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WITNESS: John Geesman

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

PREPARED TESTIMONY OF JOHN GEESMAN ON BEHALF OF THE ALLIANCE FOR NUCLEAR RESPONSIBILITY ("A4NR")

TABLE OF CONTENTS

Q01: Please state your name and business address for the record.

A01: My name is John Geesman, and my business address is: Dickson Geesman LLP, P.O. Box 177, Bodega, CA 94922.

Q02: Are your professional qualifications included in your testimony?

A02: Yes, my professional qualifications are contained in the Appendix to my testimony.

Q03: Was your testimony prepared by you or under your direction?

A03: Yes, it was.

Q04: Insofar as your testimony contains material that is factual in nature, do you believe it to be correct?

A04: Yes, I do.

Q05: Insofar as your testimony contains matters of opinion or judgment, does it represent your best judgment?

A05: Yes, it does.

Q06: Does this written submittal complete your prepared testimony and professional qualifications?

A06: Yes, it does.

Q07: What is the purpose of your testimony?

A07: The purpose of my testimony is to document a primary fallacy in the Joint Application of Southern California Edison Company ("SCE") and San Diego Gas & Electric Company ("SDG&E") for the 2024 Nuclear Decommissioning Cost Triennial Proceeding ("Joint Application"). The Joint Application relies on unfounded assumptions about the removal of spent nuclear fuel ("SNF") from the San Onofre Nuclear Generating Station ("SONGS") that render the Decommissioning Cost Estimate ("DCE") for SONGS Units 2&3 unreasonable. Based upon public reports published by SCE's retained experts in 2021 in response to a 2017 settlement of litigation,[1] a prudent utility manager would not anchor its DCE on assumptions that (1) the federal government will begin to accept SNF nationally in 2034;[2] and (2) all Unit 1 SNF will be removed from the site by 2040 and all Units 2&3 SNF will be removed by 2054.[3] The likely SNF removal timeframes identified in the SCE expert reports directly contradict the assumptions used in the SONGS DCEs, and SCE has provided no justification for altering these assumptions. The applicable expert reports are included in this testimony as Attachments A and B.

Q08: What are the implications if SCE and SDG&E have significantly underestimated the length of time that SNF will remain onsite at SONGS?

A08: The clearest implication is that the SONGS decommissioning trusts – particularly those for Units 2&3 – may prove to be insufficiently funded to complete the legally required decommissioning, necessitating additional contributions from ratepayers. SCE-04 calculates the

[1] SCE-01, p. 7, line 17 – p. 8, line 7.
[2] SCE-01, p. 4, lines 9 – 10.
[3] SCE-01, p. 13, lines 7 – 8. The DCEs assume removal of Unit 1 Greater than Class C ("GTCC") waste will be completed by 2041, and Units 2&3 GTCC by 2054. Although its storage costs are funded separately by ratepayers and not included in the DCEs, the Unit 1 SNF stored offsite in Morris, IL is assumed to be accepted by DOE in 2055. SCE-04, p. B-32.

cost of the three-year slippage in its assumed start date for DOE pickup of SNF at $82.7 million (2014$):

> The impact of the three-year delay for DOE nonperformance during the ISFSI only period is approximately $75 million for SONGS 2&3 ($25 million per year x 3 years) and $7.7 million for SONGS 1 ($2.6 million per year x 3 years) (100% share, 2014$).[4]

Applying that rate of increase for a decade (i.e., the DOE pickups start in 2044 rather than the assumed 2034) would add $276 million (2014$) to A.24-12-003's estimate of SONGS decommissioning costs. Conversely, the unexplained five-year reduction since 2014 in the assumed time to complete SNF removal from the SONGS site once DOE pickups commence, discussed further in A11 below, has effectively reduced the A.24-12-003's DCEs by $138 million.

The SNF removal timeframes identified in the SCE expert reports also significantly increase the likelihood that the California Coastal Commission will require relocation of the ISFSI when current permits expire in 2035, an unfunded expense not addressed in the DCEs. The Coastal Commission's 2015 permitting of the Holtec ISFSI was unsparing in its assessment of the consequences of continued slippage in the DOE SNF pickup assumptions:

> … there remains a significant degree of doubt as to when, or if, a permanent, off-site repository for the SONGS spent nuclear fuel will become available. It is similarly uncertain whether an off-site interim storage facility will be developed which could eventually accept SONGS spent fuel after the proposed project term of 2051. The proposed life of the ISFSI project is based on the assumption that the DOE will begin accepting spent fuel, on a nation-wide basis, beginning in 2024, with the first transport of SONGS 2 and 3 fuel beginning in 2030 … If the DOE is unable to fulfill this commitment, or if the shipment of spent fuel to an off-site location is otherwise delayed, storage in the proposed ISFSI could be required beyond 2049, and the ISFSI would not be decommissioned and removed by 2051, as proposed. In the worst case, no federal repository or other storage

[4] SCE-04, p. 6, footnote 13.

> alternative would be developed, and the proposed ISFSI would remain on the SONGS site in perpetuity.
>
> In this scenario, or any other in which the ISFSI remained in its proposed location for many decades, there would come a time when the facility would be exposed to geologic hazards, and when the proposed project configuration and design could no longer assure stability and structural integrity without requiring shoreline protection, and would thus no longer fulfill the requirements of Coastal Act Section 30253.
>
> … If, as expected, sea level continues to rise in response to global warming, higher water levels would expose the project site to ever more frequent flooding, and eventually permanent inundation. Even if the proposed ISFSI could be shown to be designed to withstand frequent flooding, inundation and exposure to ocean waves, a location within the surf zone would place major practical constraints on SCE's ability to load and unload fuel-filled MPCs, monitor and maintain the ISFSI components, and eventually decommission and remove the facility without adverse impacts to marine resources.[5]

These concerns were repeated in the Coastal Commission's 2022 extension of the permit for the NUHOMS waste storage facility to 2035, along with reiteration of the same potential remedy: relocation of the ISFSI to higher ground within the SONGS site:

> The remainder of the SONGS facilities are currently in the process of being decommissioned. Thus, beginning in the early 2030s, there will be a number of additional locations within the area covered by the SONGS NRC site license where a waste storage facility could conceivably be built but which were not available at the time SCE initially conducted its alternatives analysis. A number of these locations are at higher elevations (+30 to 80 ft MLLW) and greater distances from the shoreline (up to 900 ft) than the current NUHOMS waste storage facility site and may prove to be safe from coastal hazards over a longer period of time. If the proposed waste storage facility must remain on-site beyond 2051 for a long or an indefinite period of time, it may prove necessary to relocate the waste storage facility to another site within the SONGS site better able to minimize hazards and assure the stability of the facility over the long-term.[6]

[5] CDP 9-15-0228, pp. 33 – 34.
[6] CDP E-00-014-A2, p. 29.

Materially extending the length of time that onsite SNF storage costs will be borne by the trusts will at some point require their financial replenishment. The DCEs fail to address this risk, and even the recycling of U.S. Department of Energy ("DOE") litigation proceeds into the non-qualified trusts ordered by D.24-08-001 is a limited remedy in light of the past inability of SCE and SDG&E to recover 100% of their onsite SNF storage costs through litigation.

Q09: How does SCE explain its choice of assumptions about the timing of SNF removal?

A09: SCE acknowledges that, as with past DCEs, it has simply added three years to its previous estimates. This is the seventh time since the 2005 DCEs that SCE has made a rote adjustment, preserving assumed lead times and DOE acceptance schedules that predate DOE's 2010 abandonment of the Yucca Mountain Project. SCE has not attempted to explain the continuing applicability of these outdated timeframes in the absence of a restart or designated replacement for Yucca Mountain. Nor has it attempted to explain the continued viability of similarly outdated assumptions about the DOE queue for SNF removal in the face of a substantial increase in nationwide SNF volumes since those assumptions were made.

Q10: What did the SCE expert reports say about issues related to the DOE queue?

A10: According to the SONGS SNF Strategic Plan,

> … a key parameter in current U.S. nuclear waste policy is the existence of a queue that would govern the order in which SNF would be accepted for shipment to a 'DOE facility'— whether a federal repository for disposal or another facility (e.g., a consolidated interim storage facility) to which DOE may ship SNF prior to final disposal. [footnote omitted]
>
> … One of DOE's defined responsibilities under the Standard Contract is to issue 'an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository.' The Contract goes on to state that this priority

ranking 'shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such material from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance….' While this 'oldest fuel first' (OFF) principle is used to allocate rights to available annual acceptance capacity among contract holders based on the age of the oldest SNF in [*sic*] still in their possession, contract holders are free to use their annual acceptance rights for any SNF in their possession, at any site, that meets other acceptance criteria specified in the contract. [footnote omitted]

… SONGS has a favorable position in the queue in terms of initiating early shipments of SNF due to the early start of operation of SONGS Unit 1. The last published schedule for shipments to a repository, however, would result in only about one-third of SONGS SNF being shipped within the first decade of repository operations.

… This initial 10-year allocation totals 499 MTU. The quantity of SNF being stored at SONGS (from all three SONGS reactor units) totals approximately 1,600 MTU. Under the current ordering of the queue, completing the shipment of all SONGS SNF could take a total of two to three decades.

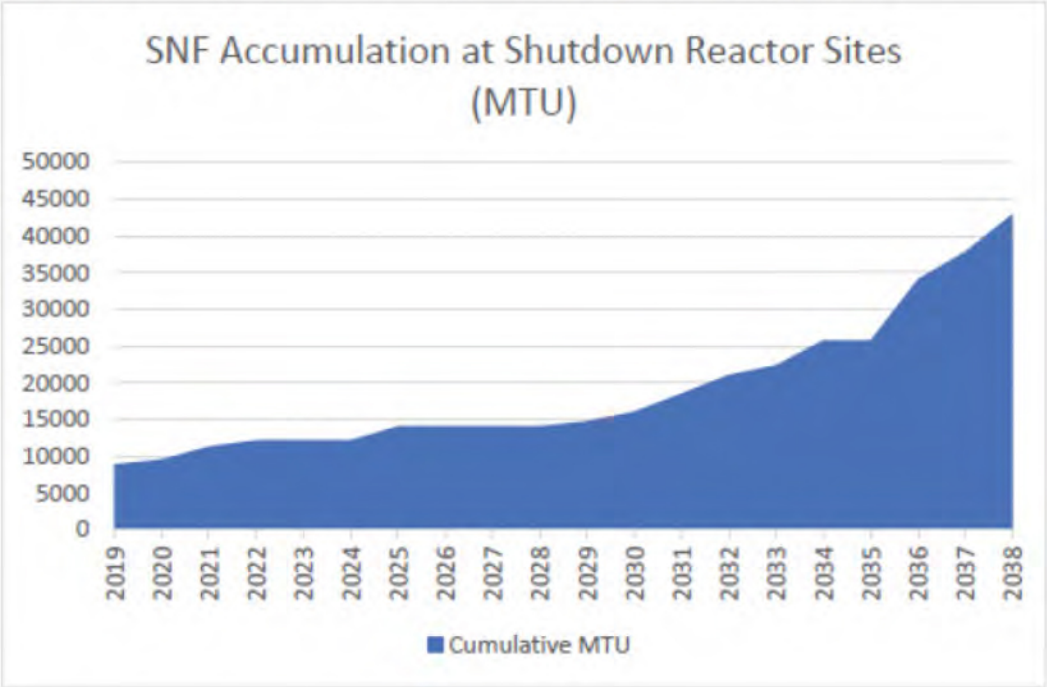
It has been suggested that positions in the Standard Contract OFF queue could be monetized—in other words, that SNF owners could pay other owners to change places for a more favorable position in the acceptance ranking. Under the Standard Contract, utilities have a contractual right to make such exchanges with other contract holders, subject to DOE's right, 'in its sole discretion,' to 'approve or disapprove…any such exchanges.' Thus, SCE could negotiate with other nuclear utilities to move SONGS's allocation forward in the queue, subject to DOE approval. In the 2008 DOE report discussed below, DOE stated that in order to avoid the equity issues that might result from using its authority to give priority to acceptance from shutdown sites, 'the government has consistently advised the parties seeking such priority treatment to avail themselves of the exchange provisions of the Standard Contract.' A legal analysis of the provisions of the Standard Contract performed for the Blue Ribbon Commission on America's Nuclear Future concluded that a market for such exchanges would likely develop. [footnote omitted] However, in order to clear the SONGS site completely in the first 10 years after the federal government starts accepting SNF, the SONGS co-owners would have to acquire acceptance rights for an additional 1,100 MTU from other utilities having those rights in that period. Since no market for rights has yet developed, the costs of acquiring the needed rights are uncertain.

A fundamental inefficiency built into the OFF queue is that it could lead to a large number of sites each shipping a relatively small amount of SNF each year. For example, in year 10 of the 2004 Acceptance Priority Ranking

report, 46 SNF owners have allocations that would allow shipping SNF from 63 different sites. One study estimated that with shipments coming from the sites having the annual allocation (i.e., the SNF owners do not use the rights to ship fuel from other reactors they own), an average of 58 sites would be shipping SNF in any given year during the period in which the total annual acceptance capacity was 3000 metric tons. While the number of shipping sites could be reduced to some extent if the eight SNF owners with more than one reactor site used their allocations to concentrate their deliveries on one site, the owners with only one reactor site would not have that option.

This potential fragmented allocation of acceptance rights among multiple sites based on an OFF-based queue increases costs to the government for the service due to system inefficiency and also substantially extends the time that it would take to remove the SNF from sites after the last reactor has shut down. Fixed costs to SNF owners for storage operations (primarily for security) do not decrease proportionally with SNF inventory reduction; rather, they cease completely only after all SNF is removed from the site. This issue has become a growing concern as the projected time for start of federal waste acceptance has slipped from 1998 in 1982 to 2010 in 2004 to an unknown date today, while the number [*sic*] sites with shutdown reactors is expected to grow rapidly starting in the next decade. As of the end of 2020, there are 19 shutdown nuclear plant sites in the United States with ISFSIs that are storing spent fuel from 22 reactors ... The owners of these plants will likely all have an interest in moving their SNF off site. These numbers are expected to increase to 25 shutdown nuclear plant sites with spent fuel from 31 reactors in 2025 and 38 sites/56 reactors in 2040. [footnote omitted] Figure 7.1 … shows the projected accumulation of SNF at shutdown plant sites over the next two decades, assuming no removal to a central storage facility or repository. [footnote omitted] This situation was not contemplated when the Nuclear Waste Policy Act was enacted in 1982 and the Standard Contracts were developed and signed pursuant to the Act shortly thereafter.

Figure 7.1 SNF Accumulation at Shutdown Reactor Sites



Source: Gutherman Technical Services, LLC

… Because the OFF framework is embodied in the Standard Contract, an effort to simply change it by legislation could trigger damage claims from affected contract holders. [footnote omitted] Section B.1(b) of Article VI of the Standard Contract gives DOE the discretion to prioritize acceptance of SNF from shutdown plant sites, independent of the order that would be dictated by the OFF queue. DOE using this discretion, therefore, requires no change to the Standard Contract language. However, DOE has been reluctant to use that discretion in the past. In a 2008 report to Congress [footnote omitted] pertaining to a program for storing SNF from decommissioned reactor sites, DOE noted that it has declined many requests to exercise its contractual discretion to prioritize acceptance of SNF from such sites on the grounds that this would delay timely removal of SNF from operating reactor sites. DOE's stated concern is that this could raise equity issues that could lead to further litigation from other contract holders. DOE concluded that legislation establishing a mandated storage program would need to 'expressly direct the Department to exercise its discretionary authority under the Standard Contract to take SNF from the decommissioned reactors on a priority basis…' [footnote omitted][7]

[7] SONGS SNF Strategic Plan, included in this testimony as Attachment A, pp. F-2 – F-10.

Q11: How do the SONGS DCEs address the uncertainties identified by the SCE expert reports about how the DOE queue will operate?

A11: SCE has kept its specific assumptions about operation of the DOE queue opaque, beyond stating (as in past DCEs) that the DCE uses "the pick-up rates published in the DOE's July 2004 'Acceptance Priority Ranking & Annual Capacity Report.'[8] In contrast to the "two to three decades" estimated by the SONGS expert reports, the A.24-12-003 DCE assumes a 21-year process identical – except for the start date – to the A.22-02-016 DCE. The A.18-03-009 DCE had assumed a 22-year process. The Preliminary Shutdown Assessment Report ("PSDAR") SCE filed with the NRC in 2014 had assumed a 26-year process. No rationale has ever been publicly provided by SCE for any of these assumed accelerations of SNF pickups from the SONGS site within the DOE queue. Whether the assumed national storage capacity has remained consistent between DCEs is unclear. There is no discussion in the current DCE of whether DOE is assumed to prioritize SNF from shutdown sites, or whether SCE is assumed to make use of the exchange provisions in the DOE contract (and no payments have been identified for any such exchanges). No mention is made of the projected increases in SNF volumes at shutdown sites since the 2004 DOE report was published. Nor is there any indication of the impacts on the assumed DOE pickup schedules if canisters with GTCC are added, from other sites as well as from SONGS, to the totals.

Q12: How did the SCE expert reports apply the requirement for commercial reasonableness to the potential use of a privately developed consolidated interim storage facility ("CISF")?

[8] SCE-04, pp. B-21, B-23 and B-67.

A12: Invoking a utility's fiduciary duty to its customers and shareholders, the "Action Plan" (which is Attachment B to this testimony) released concurrently with the SONGS SNF Strategic Plan and specifically endorsed by SCE's senior management, debunked the commercial reasonableness of reliance on any interim storage proposal – like the high-profile private projects being licensed in New Mexico and Texas – that would reduce the federal government's current responsibility for transportation, storage, and liability costs once SNF leaves the SONGS site. As the Action Plan describes the SCE experts' work product:

> These plans offer an analysis of the costs, opportunities and challenges of relocating spent nuclear fuel from a commercial utility and its customers. The evaluation found it unlikely that the SONGS co-owners and their customers would find a commercially reasonable path to move the spent nuclear fuel without federal government involvement. This is consistent with SCE's strong belief that its customers should not be exposed to additional costs or risks when it is the federal government's legal and contractual obligation to provide a solution.[9]

The Action Plan further elaborated:

> Recognizing that no offsite facility currently exists that could accept the SONGS SNF and GTCC waste, the Strategic Plan explores a range of alternative pathways for pursuing this overarching objective. Several factors were considered, most critically the ability to provide an offsite solution that (1) meets rigorous regulatory requirements for safety and protection of public health and the environment and (2) can be implemented in a commercially reasonable manner.
>
> The results of the analysis, from both the Strategic and Conceptual Transportation Plans, point to a clear distinction between pathways that rely on the federal government's longstanding contractual and statutory obligation to take title to commercial SNF and remove it from plant sites, versus pathways that do not presume a central federal role. Put simply, a

[9] Action Plan, included in this testimony as Attachment B, unnumbered first page. In addition to the SONGS SNF Strategic Plan and the Action Plan, SCE also released a "Conceptual Transportation Plan for the Relocation of SONGS Spent Nuclear Fuel to an Offsite Storage Facility or Repository" on March 15, 2021.

federal solution, or at least one that encompasses a significant degree of federal support, offers the surest and most achievable path to relocating the SONGS SNF. All other alternatives create uncertain but potentially large risks and costs and thus are far less likely to meet the test of commercial reasonableness, which encompasses critical considerations of cost, cost recovery, title and liability. The steps outlined in this Plan thus reflect an emphasis on federal action as the key to resolving the core SNF management challenges facing SONGS.[10]

Q13: What timeframes did the SONGS SNF Strategic Plan estimate for reliance on federal use of a privately developed CISF for SONGS SNF?

A13: According to the SONGS SNF Strategic Plan,

> In this scenario, the federal government takes title to the SNF, removes it from SONGS, and transports it to the private CISF where the canisters are returned to interim storage service. At that point, the private CISF owner would take possession of the material under its 10 CFR 72 license, but the federal government would retain title and pay the CISF owner for storage service until such time as the federal government ships the material to a geologic repository or other permanent disposal facility.
>
> … From the standpoint of the SONGS co-owners and customers, there is no difference between this disposition pathway and one in which the federal government removes SONGS SNF for transfer to a federal facility (whether a federal CISF or a federal repository). In both cases, the federal government assumes title to the SNF and responsibility for transport and all other offsite storage or disposal costs at the SONGS site boundary.
>
> … A non-federal CISF can be licensed and operated under current law and regulations.[11] However, this alternative would require changes to federal law to allow the federal government to transport SNF to a facility that is not

[10] Action Plan, included in this testimony as Attachment B, p. 2. As the Action Plan noted, "The criterion of commercial reasonableness is articulated in detail in the August 2017 Settlement Agreement Regarding Coastal Development Permit for Storage of San Onofre Spent Nuclear Fuel that prompted the development of these Plans; it is also a standard that any utility, given its fiduciary responsibility to customers and shareholders, would apply in making decisions that have potentially significant cost and liability implications." *Id.,* footnote 5.

[11] The NRC's authority to license a non-federal CISF was not definitively resolved by the U.S. Supreme Court in the recent *Nuclear Regulatory Commission v. Texas* (2025), where a 6-3 majority instead based its decision on a lack of standing but offered dicta that "history and precedent offer significant support for the commission's longstanding interpretation" that it can do so (slip opinion, p. 17). The Texas project sponsors have stated that, notwithstanding the Supreme Court decision, they will not proceed with any development of a CISF at the site without the consent of the State of Texas.

currently authorized under the NWPA and to allow the federal government to enter into commercial agreements with CISF owner(s)/operator(s).

… We estimate that the SONGS SNF could be completely removed within a timeframe of approximately two decades once one or more non-federal facilities that can accept all of the SNF have been fully licensed and operational and once the federal government has been authorized to contract with those facilities for storage services. However, the timing of federal authorization to enter into such contracts and the schedule for federal acceptance of SNF from different shutdown sites if such authorization is granted and contracts with the facility owners are successfully negotiated, remain key sources of uncertainty.[12]

Q14: What are the timeframes that the SCE expert reports estimate for the complete removal of SNF from SONGS under the several alternatives evaluated?

A14: All commercially reasonable alternatives to indefinite onsite storage require major changes in law by Congress as the trigger to starting the calculation of timeframes for complete removal of SNF from SONGS. This unavoidable fact means, according to the estimates of the SONGS SNF Strategic Plan, five to seven decades post-trigger for a permanent repository; three to four decades post-trigger for a federal Consolidated Interim Storage Facility ("CISF"); and, for federal use of a non-federal CISF, two decades after sufficient capacity is licensed and operational and legislation enacted authorizing such federal use. Only this third alternative could be hypothetically consistent with the current SONGS DCEs, but even it is dependent upon speculative assumptions about the content and timing of reversal of the multi-decade policy and political inertia enveloping SNF issues in Congress.

Q15: What effect on timeframes for removal of SNF from SONGS did the SCE expert reports attribute to the federal Judgment Fund?

[12] SONGS SNF Strategic Plan, included in this testimony as Attachment A, pp. 92 – 99.

A15: According to the SONGS SNF Strategic Plan,

> Since DOE has still not begun accepting commercial SNF, despite the 1998 deadline specified under the NWPA and in DOE's Standard Contract with nuclear plant operators, multiple utilities have sued for partial breach of contract. As a result of settlements or final judgments in these suits, a total of $8.6 billion had been paid out by the U.S. Treasury's Judgment Fund through the end of September 2020. [footnote omitted] As noted previously in the main text, the Judgment Fund pays out all costs incurred by the federal government as result of litigation. While 104 cases have been concluded (with 88 cases resulting in payments from the Judgment Fund), 16 cases remained pending as of the end of FY 2020. [footnote omitted] Each year without work on a permanent repository adds to the federal government's future liability under similar lawsuits: in 2017, the DOE Inspector General audit estimated this liability at $27.2 billion; in 2018, the figure was $28.1 billion; [footnote omitted] in 2019, the figure was $28.5 billion; and in 2020, the figure was $30.6 billion. [footnote omitted] However, the latest estimate assumes that work towards a DOE facility (assumed to be either Yucca Mountain or a federal CISF) resumes by FY 2023. If this does not occur, resulting delays will increase the federal government's total liability, which, according to some estimates, may eventually reach $50 billion. [footnote omitted]
>
> The fact that the NWF is subject to appropriations, but the Judgment Fund is not, creates dysfunctional incentives that tend to favor continued delay over action on nuclear waste. Doing nothing to advance a long-term solution, while simply paying utilities damages for the continued storage of spent fuel at reactor sites requires no affirmative action by either the administration or Congress (it is in effect a mandatory expenditure). By contrast, any expenditures from the NWF to implement waste disposal program activities requires annual congressional appropriations that count against appropriations caps and require the allocation of funding away from other discretionary spending priorities. This competition exists despite the fact that the NWF is self-funded, in contrast to the rest of the DOE budget...[13]

Q16: How do the timeframes identified in the SCE expert reports contrast with the dates for completion of SONGS SNF removal that the California Coastal Commission utilized in Coastal Development Permits ("CDPs") 9-15-0228 and E-00-014-A2?

[13] SONGS SNF Strategic Plan, included in this testimony as Attachment A, p. 36.

A16: The DCE assumption that SONGS SNF will remain onsite until 2054 and that decommissioning of the ISFSI will not be complete until 2056 is already five years beyond the CDP 9-15-0228 and CDP E-00-014-A2 time thresholds. The fact that the DCE assumption is implicitly dependent upon enactment of yet-to-be-introduced legislation to (1) allow federal use of a private CISF with the federal government taking title to the SNF and retaining responsibility for transport and all other offsite storage or disposal costs at the SONGS site boundary, and (2) enable a SONGS-favored pickup schedule within the DOE queue, may render even the 2054 and 2056 dates – especially if there is continued opposition from the state governments of Texas and New Mexico – sufficiently speculative to prompt the Coastal Commission to require relocation of the SONGS ISFSI. To reiterate what the Coastal Commission stated in 2022: "If the proposed waste storage facility must remain on-site beyond 2051 for a long or an indefinite period of time, it may prove necessary to relocate the waste storage facility to another site within the SONGS site better able to minimize hazards and assure the stability of the facility over the long-term."[14]

Q17: What is the relationship between a potential relocation of the ISFSI to elsewhere on the SONGS site and Special Condition 3 of CDP 9-19-0194?

A17: Special Condition 3 of CDP 9-19-0194, which authorized the first phases of the Units 2&3 onshore decommissioning work to begin, requires SCE to return within six months of completion of the permitted project (and not later than June 1, 2028) with a permit amendment application for the removal, to the extent feasible, of all remaining onshore

[14] CDP E-00-014-A2, p. 29.

structures at SONGS that may be exposed in the future due to coastal processes or that otherwise would have coastal impacts if they were to remain. As summarized by the 2019 Coastal Commission staff report prepared for the consideration of CDP 9-19-0194,

> SCE proposes to remove large portions of the above- and below-grade elements of Units 2 and 3 and associated infrastructure. However, the proposed project would leave significant amounts of foundation, footings, and other existing material in place and would cover them with backfill. Over time, coastal processes, exacerbated by sea level rise, could cause portions of remaining structures to become exposed, which would cause potential risk to public safety and marine life, as well as impacts to visual resources and public access.[15]

The current DCE "introduces a revised strategy"[16] regarding SCE's prior plan to reduce the 69-acre NRC-licensed site[17] to the 16-acre footprint of the present ISFSI after completion of decontamination and dismantlement ("D&D") of the Units 2&3 structures. Among the reasons cited in SCE-04 for abandoning the earlier two-step process: "SCE learned it must maintain the original licensed site footprint beyond the end of D&D Phase II in case the California Coastal Commission (CCC) requires the ISFSI to be relocated due to sea level rise."[18] SCE-04's description of Special Condition 3 emphasizes this potential ISFSI relocation to elsewhere on the SONGS site:

> Special Condition 3 requires SCE to provide annual reports to CCC with updates on 'opportunities for long-term storage of nuclear waste, including specific discussion of potential opportunities to relocate waste … on the SONGS site …' and requires SCE to submit a CDP amendment application by June 1, 2028, that describes, among other things, '[a]ny regulatory requirements … related to potential onsite relocation of the existing ISFSI.'[19]

[15] California Coastal Commission staff report on Application 9-19-0194, September 26, 2019.
[16] SCE-04, p. 28, line 4.
[17] This acreage calculation excludes the 15-acre switchyard portion of the SONGS Easement, which SCE and SDG&E are believed to intend to retain.
[18] SCE-04, p. 28, lines 19 – 21.
[19] SCE-04, p. 28, footnote 47.

However, none of the first five annual reports SCE has filed with the Coastal Commission includes any mention of potential onsite relocation of the existing ISFSI. During evidentiary hearings in A.22-02-016, SCE disputed a written statement from its Decommissioning General Contractor that SCE planned to relocate the ISFSI to the current Units 2&3 footprint if the SNF has not been removed by 2035.[20] SCE has not publicly identified where within the 53-acre Units 2&3 footprint the subsurface structures are located, nor the extent to which a relocated ISFSI would conflict with Special Condition 3's contemplated "removal, to the extent feasible, of all remaining onshore structures at SONGS that may be exposed in the future due to coastal processes or that otherwise would have coastal impacts if they were to remain." It is reasonable to expect that SCE's 2028 application for an amended CDP will make such an assessment of each of the potential sites within the 53-acre footprint considered for relocation of the ISFSI.

Q18: What other reasons are cited in SCE-04 for SCE's "revised strategy" for site release?

A18: SCE-04 states that the Navy, as landowner and lessor, indicated it will not identify the end state criteria[21] for termination of the SONGS Easement until the fuel is removed from the site,[22] and that the NRC informed SCE in 2023 that it will not consider an "intermediate state" License Termination Plan ("LTP").[23] SCE was asked in a data request to provide any written

[20] A.22-02-016 Transcript (SCE – Bilovsky), p. 380, line 1.
[21] These include radiological cleanup. As stated at p. 2-37 of the 2019 Final Environmental Impact Report for the Units 2&3 Decommissioning Project, "The NRC unrestricted use release limit is 25 milirem per year (mrem/yr). The SONGS Participants have contracted for a post-Proposed Project residual release criteria of 15 mrem/yr. In 2015, the DoN directed SCE to show that the Mesa lease parcels 5, 6, and 7, which contained support facilities located east of Interstate 5, would achieve a release criteria of no more than 12 mrem/yr. As the landowner, the DoN may ultimately require decontamination to a lower threshold than what is required under NRC regulations."
[22] SCE-04, p. 28, lines 21 – 22.
[23] SCE-04, p. 28, line 23 – p. 29, line 1.

communications in which the Navy specified that it will not identify such criteria until fuel is removed, and responded as follows:

> A July 17, 2019 letter from the Navy to SCE is attached. At page 3, the letter states:
>
> > At this time, the DoN cannot provide definitive terms and conditions for removal of SONGS substructures, the seawall, or other features associated with the restoration of the SONGS facility to its final end state. Those decisions will be made consistent with the terms of the existing real estate instruments, after careful evaluation, when there is sufficient information to make such evaluation.
>
> The letter then states that the Navy will continue to participate in SCE's overall progress with federal and state regulators for the investigation, cleanup and decommissioning to allow an efficient turnover of the SONGS site.[24]
>
> Nothing in the Navy letter cited by SCE ties the Navy's specification of end state criteria

for termination of the SONGS Easement to the removal of the SNF, and there is no inherent requirement for such linkage. Elsewhere, SCE-04 references "the Navy's National Environmental Policy Act (NEPA) environmental review process, associated with amending the SONGS real estate authorization to establish the site restoration or 'end state' requirements for SONGS to return the property to the Navy."[25] After a multi-year, futile attempt to negotiate a longer renewal, in 2024 SCE entered into a five-year extension of the existing SONGS Easement in 2024. Without acknowledging the expanded optionality this shorter term provides the Navy, the DCE assumes that the Navy will continue to roll over the current easement provisions in five-year increments, that each of these extensions will qualify for a categorical exemption from NEPA, and that the NEPA review that determines the final site restoration requirements will not

[24] A4NR-SCE-004 Q.05 Answer, included in this testimony as Attachment C.
[25] SCE-04, p. B-21.

be conducted until 2045-2050 for the SONGS site.[26] Even the DCEs' assumed NEPA timeframe precedes the assumed completion of SNF removal by four to nine years.

A more pertinent reading of the Navy's 2019 letter would focus on the "removal of SONGS substructures [and] the seawall." Despite SCE's recurrent and unrequited hopes that the Navy will eventually relent on its demand that all of the subsurface structures be removed, the Navy reiterated this requirement to SCE in a March 17, 2021 letter: "we continue to expect that SCE/SONGS co-owners will remove all the improvements installed or constructed on the easement site pursuant to the terms of easement."[27] SCE-04 recounts the most recent variation on SCE's relentless attempts to avoid this obligation:

> … a recent coastal processes impact study noted that some substructures could remain on the site because they are not expected to become exposed due to weather and coastal erosion. Thus, the Navy may not require 'full removal' of the substructures based on the results of the study.[28]

SCE's interpretation erroneously conflates the Navy's enforcement of the terms of the SONGS Easement with the Coastal Commission's enforcement of Special Condition 3, when they are two separate requirements by two different entities that address distinctly different concerns. SCE was asked in a data request to provide a copy of the referenced coastal processes impact study, but declined to do so, explaining:

> The draft study was completed in early 2024 and indicated that some SONGS substructures could remain on site because they are not expected to become exposed due to weather and coastal erosion. SCE cannot provide the coastal processes analysis in response to this A4NR request because it is not yet

[26] SCE-04, p. 38, lines 18 – 22.
[27] SCE-04, p. B-33.
[28] SCE-04, p. 36, lines 16 – 19. The report from HKA states at p. B-33, "Any determination in the 2024 DCE that accounts for only partial removal of substructures would be nonconservative, arbitrary and potentially inconsistent with a subsequent decision by the U.S. Navy under the terms of the easement, and without basis."

finalized. SCE will finalize the coastal processes analysis before submitting the CDP amendment application to the Coastal Commission in or about 2028.[29]

Regarding the seawall, SCE-04 makes an assertion directly contradicting the 2019 Final Environmental Impact Report ("FEIR") for the Units 2&3 Decommissioning Project when it says, "Even if the substructures are removed after the completion of Phase 2 D&D in the 2030 timeframe, one structure that cannot be removed is the SONGS 2&3 seawall. It is required to protect the ISFSI from the coastal environment."[30] As stated twice in the FEIR, citing a 2015 SCE report to the Coastal Commission, "the seawall is not needed to protect the Approved ISFSI from natural events."[31] Regarding SCE's reliance on the seawall to "function as a security barrier" for the ISFSI, the company claims no additional security costs will be incurred for the indefinite protection of a 69-acre site rather than a 16-acre ISFSI. After the spent fuel pools were emptied, SCE amended its license to reduce the Protected Area to ISFSI-only.[32] SCE was asked in a data request to identify any incremental security costs likely to result from the claimed inability to amend the 10 C.F.R. Part 50 licenses to reduce the site's footprint to ISFSI-only at the completion of D&D Phase II in 2028, and responded:

> The inability to reduce the site's footprint to ISFSI-only at the completion of D&D Phase II in 2028 is not expected to impact security costs because SCE is responsible for the whole site until it is returned to the Navy (regardless of whether the 10 C.F.R. Part 50 licenses can be amended). In addition, the majority of security costs at the site relate to protecting spent fuel in the ISFSI.[33]

[29] A4NR-SCE-004 Q.11 Answer, included in this testimony as Attachment D.
[30] SCE-04, p. 36, lines 23 – 25.
[31] FEIR, pp. 1-19 and 5-13
[32] SCE-04, p. B-20.
[33] A4NR-SCE-004 Q.08 Answer, included in this testimony as Attachment E.

SCE-04's discussion of "the NRC's decision" in 2023 that it will not consider an "intermediate state" LTP[34] begs the question of the circumstances under which an "end state" LTP for the non-ISFSI acreage would prove acceptable to the NRC. SCE-04 hints at the true prerequisite for such a submittal to the NRC by invoking the advice from its expert: "deferring submission of the LTP to when the Navy's end state criteria are known."[35] SCE was asked in a data request to provide copies of any written communications received from the NRC on this topic, and responded:

> This was a spoken statement in a meeting with SONGS staff on or about July 18, 2023. At that meeting, NRC staff said the NRC would not accept an LTP developed for an "intermediate state," given that SCE will likely remove more SONGS substructures in the future.[36]

SCE provided the NRC's written summary of the two-day site visit, during which a range of topics were addressed. The NRC summary stated:

> Regarding characterization of subsurface and Unit 1 areas, SCE stated that its characterization is an iterative process, and more data would be collected as remaining substructures are remediated, and structures are removed later in the project.
>
> NRC stated that the LTP license amendment application (LAR) addresses end state. Licensees should briefly discuss intermediate states in their LTPs, but detailed intermediate clean up criteria calculations should not be presented for approval.[37]

Missing entirely from the SCE-NRC exchange is any linkage between the removal of SNF from the SONGS site and NRC acceptance of an end-state LTP for the non-ISFSI portion of the Units 2&3 site.

[34] SCE-04, p. 28, line 23 – p. 29, line 1.
[35] SCE-04, p. 29, lines 3 – 4.
[36] A4NR-SCE-004 Q.06 Answer, included in this testimony as Attachment F.
[37] Amy M. Snyder, NRC Senior Project Manager, July 28, 2023, Summary of July 17-18, 2023, Routine Site Visit at SONGS Units 1, 2, and 3, included in this testimony as Attachment G.

Q19: What is the takeaway from the Units 2&3 DCE's analysis of the Settlement Scenario and the Operational Scenario regarding the timing of substructure removal?

A19: Without adjusting any of the assumptions SCE used to construct the two scenarios, the $12.1 million (2014$) additional cost SCE-04 attributes to the Settlement Scenario is the equivalent of a "rounding error" in the Units 2&3 DCE, less than 0.55% of the DCE's estimated remaining costs of decommissioning.[38] As a comparison, the HKA report is dismissive of an unrelated $10 million (2014$) increase since the 2020 Units 2&3 DCE because it is "less than a 1% increase" when compared to the 2020 DCE's total cost of Units 2&3 decommissioning.[39] When measured against the 2024 DCE's $4.722 billion (2014$) total cost of Units 2&3 decommissioning, the Settlement Scenario is 0.26%. Reinforcing this "rounding error" characterization of the costs attributed to the Settlement Scenario, SCE-06 identifies certain misallocations that cause the Units 2&3 DCE to be understated by some $14.9 million as of July 1, 2024.[40] A relevant benchmark for the Settlement Scenario: $12.1 million (2014$) is the cost of 5.26 months of slippage in the DCE assumed start date for DOE removal of SNF nationally.[41]

SCE-04's other disparagement of the Settlement Scenario is based on the overly simplistic logic (a) that any work deferral is financially beneficial to the trusts when the assumed long-term investment return exceeds the assumed long-term cost escalation rate, without addressing the volatility associated with either escalation rate; (b) that it is environmentally preferable to conduct a single dewatering after all SNF has been removed from the ISFSI,

[38] SCE-04, pp. B-82 – B.83, identifying the remaining costs of Units 2&3 decommissioning at $2,939,858,000 in 2023$, and the difference between the two scenarios at $16 million in 2023$, or 0.54%.
[39] SCE-04, p. B-8.
[40] SCE-06, p. 18, footnote 41.
[41] *See* SCE-04, p. 6, footnote 13.

although no discussion of environmental impacts or their significance is offered; (c) that early return to the Navy of the non-ISFSI acreage would not be facilitated by the Settlement Scenario because of the new assumption, discussed in A18 above, that removal of all SNF from the ISFSI must occur first; and, implicitly, (d) that restoration of the public's long-impaired coastal access rights to the non-ISFSI acreage under the Public Trust Doctrine, the California Constitution, and the Coastal Act must be conditioned on removal of all SNF from the ISFSI. SCE-04 does make the self-evident point that a potential relocation of the ISFSI is an unavoidable factor in the scope and timing of any removal of Units 2&3 subsurface structures, as well as the scope and timing of the return of non-ISFSI acreage to the Navy. But these are determinations to be made in the future by the Coastal Commission and the Navy, respectively, and are outside the jurisdiction of the Public Utilities Commission. The DCEs should adhere to SCE-04's renunciation of assumptions that are "nonconservative, arbitrary and potentially inconsistent with a subsequent decision by the [Coastal Commission] and U.S. Navy under the terms of the [CDP and] easement, and without basis."[42]

Q20: What are the ramifications for the funding sufficiency of the SONGS decommissioning trusts of the ongoing DOE breach of contract?

A20: Depending on the actual timeframes for complete removal of SNF and GTCC from SONGS 1 and SONGS 2&3, the past inability of SCE and SDG&E to recover more than about 80% of the associated costs through litigation or settlement could compel future contributions to the trusts from ratepayers. It is premature to revisit D.24-08-001's Ordering Paragraph 3

[42] *See* footnote 28.

without a clearer understanding of the likely timeframes for complete removal of SNF and GTCC from SONGS 1 and SONGS 2&3.

Q21: What do you recommend the Commission do in this proceeding?

A21: Unless SCE and SDG&E can provide credible evidence in their rebuttal testimony of the financial resilience of the SONGS Units 2&3 decommissioning trusts[43] to a 10-year delay in the assumed 2034 start date for DOE pickups of SNF, the Units 2&3 DCEs should be rejected as unreasonable. As the SCE expert reports observed in early 2021, "Whether the current schedule [i.e., which then contemplated completion of SONGS decommissioning by year-end 2051, now relaxed to year-end 2054 in A.24-12-003] can be met depends to a significant extent on whether an offsite consolidated interim storage facility is available … in the 2035–2045 timeframe."[44] Adjusted to reflect the passage of time, this timeframe would be 2039—2049, with a median of 2044. Using SCE-04's methodology, this 10-year delay would add $250 million (2014$) to the Units 2&3 DCE,[45] and perhaps more depending upon the underlying assumptions about the operation of the DOE queue.

In addition, the Commission should order that the Unit 1 and Units 2&3 DCEs submitted in SCE's and SDG&E's next NDCTP applications include analyses of:

- the 60-year post-shutdown period identified in the NRC's Generic Environmental Impact Statement for Continued Storage of Nuclear Fuel, NUREG-2157 ("GEIS"), as the end of onsite "Short-Term Storage" at SONGS;

[43] SCE-06 indicates a substantial surplus in the Unit 1 trusts when compared to future decommissioning costs.
[44] SONGS SNF Strategic Plan, included in this testimony as Attachment A, p. 4.
[45] SCE-04, p. 6, footnote 13.

- the 110-year post-shutdown period identified in the GEIS as the median point for onsite "Long-Term Storage" at SONGS;
- the 160-year post-shutdown period identified in the GEIS as the end point for onsite "Long-Term Storage" at SONGS;
- the specific assumptions made about the operation of the DOE queue – including the national volume of SNF, available storage capacity, and whether shutdown sites are prioritized for SNF removal – in any assessment of the length of time SNF will remain onsite at SONGS, including the three GEIS-based scenarios identified above;
- whether the assumptions made about the operation of the DOE queue include monetized exchanges with other contract holders and, if so, what amounts have been included in the DCEs to pay for such exchanges; and
- continued inclusion in the DCEs of the Settlement Scenario that was required to be considered in this proceeding.

APPENDIX: QUALIFICATIONS OF JOHN GEESMAN

John L. Geesman is an attorney with the law firm, Dickson Geesman LLP, and a member in good standing of the California State Bar.

Mr. Geesman served as a member of the California Energy Commission from 2002 to 2008, and was the agency's Executive Director from 1979 to 1983. While a Commissioner, he chaired the Commission's Facilities Siting Committee during a period when nearly two dozen new power plants were approved for construction. Between his two tours at the Energy Commission, Mr. Geesman spent nineteen years as an investment banker focused on the U.S. bond markets and served as a financial advisor to municipal electric utilities throughout the western states.

Mr. Geesman has a long history of engagement with issues related to regulatory compliance, resource planning, environmental policy, financial management, and risk practices. This is demonstrated by his service in numerous leadership capacities, including stints as:

- Co-Chair of the American Council on Renewable Energy;
- Chairman of the California Power Exchange;
- President of the Board of Directors of The Utility Reform Network (nee Toward Utility Rate Normalization);
- Member of the Governing Board of the California Independent System Operator; and,
- Chairman of the California Managed Risk Medical Insurance Board.

Mr. Geesman has testified as an expert witness before the California Public Utilities Commission on many occasions. He is a graduate of Yale College and the University of California Berkeley School of Law.

ATTACHMENT A:

SCE Strategic Plan for the Relocation of SONGS Spent Nuclear Fuel to an Offsite Storage Facility or a Repository

March 15, 2021

VOLUME II

STRATEGIC PLAN FOR THE RELOCATION OF SONGS SPENT NUCLEAR FUEL TO AN OFFSITE STORAGE FACILITY OR A REPOSITORY

March 15, 2021

NORTHWIND
A CIRI COMPANY

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

SUMMARY

The **San Onofre Nuclear Generating Station (SONGS)** is a former three-unit commercial nuclear power plant site located on the southern coast of California, near the city of San Clemente and between the major metropolitan areas of Los Angeles and San Diego. SONGS operated for 44 years, from 1968 to 2012. The SONGS Unit 1 reactor was decommissioned and largely dismantled in the 1990s. Activities to fully decommission Units 2 and 3 have been underway since 2013, when Southern California Edison (SCE), the majority owner and decommissioning agent,[1] announced SONGS's permanent retirement. These activities have included moving spent nuclear fuel (SNF) from storage in water pools at the reactors to dry storage on site and preparing for the eventual dismantlement and removal of the two reactor units' structures, systems, and components.

Completion of the decommissioning process requires removal from the site of the SNF now in dry storage at SONGS. However, no offsite facility currently exists that can accept the SONGS SNF. This fact is the result of a failure by the federal government to implement an effective national strategy for the management and permanent disposition of SNF. Since the passage of the Nuclear Waste Policy Act of 1982 (NWPA), responsibility for implementing a disposal solution for SNF has rested with the federal government. Well before 1982, as early as the 1950s, there was a general understanding that the federal government would ensure the high-level wastes produced by the nuclear fuel cycle would not be the responsibility of the utilities. This was an important enabling factor in the development of America's commercial nuclear energy industry.

The 1982 NWPA established a schedule and program for the U.S. Department of Energy (DOE) to develop geologic repositories for the disposal of SNF and other highly radioactive waste. It also required utilities to sign contracts with the federal government to pay the full costs of SNF removal, transportation, and disposal in advance, through a customer fee, in exchange for a commitment to begin removing commercial SNF from nuclear plant sites no later than 1998. This "Standard Contract" is identical for all nuclear utilities. SONGS customers have paid $988.7 million (including accrued interest) into the Nuclear Waste Fund (NWF) in complete fulfillment of their financial obligations under the NWPA and the related contract.

Unfortunately, the federal government has failed to perform on its statutory and contractual obligations and is paying damages to utilities for the cost of on-site, at-reactor storage of SNF. These payments are the result of a series of lawsuits brought by utility companies against DOE for its partial breach of the Standard Contract, which required DOE to begin removing SNF from reactor sites by 1998. The payments come from the Judgment Fund of the Department of Justice, which pays out all costs incurred by the federal government as a result of litigation.

There is no active federal program for the management of commercial SNF at this time. The Yucca Mountain project in Nevada, which Congress made the sole focus of the U.S. repository effort in 1987, was halted in 2010 and the DOE waste management program was defunded and dismantled. It has made little progress since then because of a continued political impasse over whether to restart the

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[1] Edison International, Southern California Edison's parent company, holds 78.2 percent ownership in the plant; the other owners are San Diego Gas & Electric Company (20 percent) and the City of Riverside Utilities Department (1.8 percent). The City of Anaheim, a former SONGS owner, remains a co-participant in the decommissioning process and shares the co-owners' interest in finding an offsite solution for SONGS SNF. Because SCE is the sole named defendant in the lawsuit and associated settlement that gave rise to this Strategic Plan (as described later in the main text), this report generally refers to "SCE" or "SONGS co-owners" throughout.

Yucca Mountain project or pursue another avenue. Leaders of both parties have pledged that they will not continue to pursue a repository at Yucca Mountain over the objections of the state of Nevada, and Congress has been unable to agree on a new path forward.

Overview of the Strategic Plan: Objectives, Framework, and Approach

The effort to develop a strategy for moving SONGS SNF off site, including both this Strategic Plan and the accompanying Conceptual Transportation Plan, followed from the terms of a Settlement Agreement reached in 2017 between SCE and a group called Citizens' Oversight.[2] The removal of all SNF so as to allow for the full decommissioning and restoration of the SONGS site, as soon as legally and practically possible, is the overarching and shared objective of the SONGS co-owners; communities around SONGS; the U.S. Navy, which owns the site; and a wide array of stakeholders.

The goal of this Strategic Plan was to develop insights and information concerning commercially reasonable pathways for moving SNF off site and, if such pathways currently do not exist, to identify efforts that might be taken, through coalitions and partnerships, to help catalyze action and ensure that the SONGS co-owners are ready to act as circumstances warrant. In contrast to most prior studies that have analyzed the issue of SNF management and disposition from a national perspective, this Strategic Plan offers a perspective on the challenges created by the breakdown of the federal program from the vantage point of the utility owner of SNF seeking a safe, commercially reasonable, and prudent path forward in the face of long planning timeframes and large uncertainties that are beyond the utility owner's control.

In 2018, SCE assembled a team composed of six nationally recognized experts in nuclear waste management (the "Experts Team") to provide independent review and advice for the development of this Plan.[3] Subsequently, SCE enlisted the help of North Wind, Inc., which organized a team of subject matter experts to identify and assess potential options for relocating the SONGS SNF consistent with the Plan's objectives.[5]

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[2] At the end of 2015, a group called Citizens' Oversight and an individual, Patricia Borchmann, filed a lawsuit against the California Coastal Commission's decision to grant a permit for the expansion of SNF dry storage capacity at SONGS. The filing led to a settlement agreement between the parties that requires SCE "to assess the feasibility of relocating SONGS Spent Fuel to an Offsite Storage Facility." The text of the Agreement may be accessed at: https://www.courthousenews.com/wp-content/uploads/2017/08/San-Onofre-Settlement.pdf. Further details are provided in the main report. Note that the information presented in this document is current up to December 31, 2020.

[3] The Experts Team included six individuals with extensive, high-level experience in the fields of SNF facility siting and licensing, regulation, radiation science, SNF transportation, and nuclear engineering. They are Thomas Isaacs (Chair), Kristopher Cummings, Dr. Allison Macfarlane, J. Gary Lanthrum, Richard Moore, and Dr. Josephine Piccone.

[4] Technically, the Strategic Plan encompasses the removal of two types of high-level radioactive waste at SONGS: SNF and greater than Class C (GTCC) waste, which is a different type of waste (with a lower concentration of radioactivity) generated by the decommissioning process. References to SONGS SNF in this summary should be understood to include SONGS GTCC waste in most cases.

[5] North Wind was retained by SCE in 2019 following a competitive procurement process. Individual members of the North Wind team are listed in Appendix A of this report.

The Larger Context

Although this Plan focuses on SONGS SNF, the options available for achieving its objectives are shaped (and in many ways constrained) by the national landscape for nuclear waste management policy. Several considerations and factors are worth highlighting as they provide crucial context and framing for the Strategic Plan.

Need for a safe, permanent disposal solution for all SNF: While current storage arrangements for SNF at SONGS and other nuclear plant sites can be maintained in a safe and secure configuration, now and for decades to come, these storage arrangements were not intended to serve for very long (century-scale) or indefinite timeframes. A permanent national solution for isolating this material from the biosphere is needed and is required by law.

Breakdown of the national program for commercial SNF management: As we have already noted, the federal program has made little progress for more than a decade because of the political impasse over building a repository at Yucca Mountain and the decision in 2010 to dismantle the DOE office responsible for managing the waste program. The development of this Strategic Plan started with the recognition that the federal government retains ultimate responsibility for disposing of the SONGS SNF and that SONGS customers have already paid the federal government in full to meet that obligation. Thus, much of the focus in this document is on the actions that would be needed at the national level to facilitate efforts by the SONGS co-owners to move the SNF off site.

Current lack of offsite consolidated interim storage options: Consolidated interim storage options for SNF do not exist today. Proposals for commercial facilities are currently advancing through the licensing process but success in developing viable and commercially reasonable offsite storage capability has thus far proved elusive. Access to such options is particularly important for SNF being stored at shutdown nuclear plant sites like SONGS, which cannot be fully decommissioned until all the SNF is removed. This Strategic Plan focuses on implementation issues, such as business arrangements, that would need to be addressed to utilize centralized interim storage for SONGS SNF should one or more commercial facilities receive a license and proceed to construction and operation.

SONGS is not unique: By 2040, the number of shutdown nuclear plant sites with SNF inventories is projected to grow to at least 38 nationwide.[6] None of these sites can be fully decommissioned and restored to use for other purposes until there is another storage or disposal option for SNF. Not all pathways to developing this capacity require congressional action, but all involve federal agencies and policies, and all would be likelier to succeed in the context of a well-functioning national-level nuclear waste management program. Conversely, progress toward a solution for SONGS SNF would also deliver broader benefits—both in terms of specific learning that could benefit other companies and communities, and by providing "existence proof" that progress is possible. In short, neither the challenges nor the benefits of finding a solution for SONGS SNF can be fully divorced from the broader picture for nuclear waste management. The implementation strategies in this plan need to be considered within the context of acceptability and precedent for the nuclear power sector on a national basis.

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[6] Appendix D explains this projection based on current decommissioned plants and both announced shutdowns and license expiration dates.

The challenge: The combination of all of the above factors creates large uncertainties for any effort to develop a plan for relocating SONGS SNF. Consequently, it was important to consider strategies that were (1) not limited to a single preferred offsite disposition alternative and (2) offered flexibility to adapt to uncertain timeframes for the availability of one or more viable solutions. The Strategic Plan needed to chart a path forward that could be robust, flexible, and durable. For the SONGS co-owners, the challenge will be to sustain a corporate focus on achieving the Strategic Plan's objectives over time, while also adapting to changing circumstances, identifying and pursuing new opportunities, and maintaining the relationships and broader socio-political engagement on these issues that will be necessary to make progress.

Assessment Factors

The Settlement Agreement that triggered the development of this Strategic Plan recognizes that DOE has the responsibility and authority, under the terms of the Standard Contract, to accept SNF and greater-than-Class-C (GTCC) waste at the boundary of the SONGS site and transport this material to an offsite facility (either a geologic repository or interim storage facility). Upon transfer of title and possession to DOE, the SONGS licensees are no longer legally responsible for the transportation and disposition of this material. The SONGS co-owners and their customers would incur no costs (other than the cost to prepare SNF for shipment and deliver it to the site boundary) beyond the pre-payments for SNF management and disposal that utility customers have already made to the federal government via the Nuclear Waste Fund.

The Settlement Agreement also recognizes, however, that progress in the federal repository program has stalled. Thus, pending the development of a federal repository ("Permanent DOE Facility"), SCE has agreed to use "commercially reasonable" efforts to relocate the SONGS SNF to an offsite facility that would be licensed by the Nuclear Regulatory Commission (NRC) and constructed and operated by either the federal government or a third party (an "Offsite Storage Facility"). Until title to (and liability for) the SONGS SNF is transferred to the federal government or a third party, the co-owners will continue to own and be responsible for this material.

The assessment factors used to evaluate potential disposition pathways for the SONGS SNF in this Strategic Plan derive from the terms of the Settlement Agreement but were expanded to include additional considerations that would affect implementation feasibility. A short discussion of each assessment factor follows the summary list below.

Assessment Factors that Guided the Analysis

- ✓ **Safety, scientific and technical issues, and regulatory feasibility**
- ✓ **Commercial reasonableness**
  - *Cost*, including costs to develop different types of facilities, taking into account capital and operating requirements (transportation costs are discussed in qualitative terms in this plan and in more detail in the Conceptual Transportation Plan, Vol. III).
  - *Ability to recover costs* from prior fees paid into the Nuclear Waste Fund, the Judgment Fund, or allowable uses of decommissioning funds.
  - *Commercially reasonable protection against liability* and other financial risks and uncertainties associated with moving SNF off site if the SONGS co-owners retain title to the SNF after it leaves SONGS.

- ✓ **Timeliness of offsite storage or disposal**
  - Implementation schedule
- ✓ **Other implementation considerations (in addition to commercial reasonableness)**
  - Need for statutory change
  - Potential socio-economic-political barriers
  - Degree to which SONGS co-owners have control over implementation

Safety, Scientific and Technical Issues, and Regulatory Feasibility: All of the alternatives evaluated in detail in the Strategic Plan can meet or exceed applicable licensing requirements. These licensing requirements would, in all cases, entail rigorous technical and engineering analyses as well as detailed demonstrations of site suitability and safety protections. More exotic disposition pathways that clearly fail this stipulation were excluded from detailed consideration at the outset.

Commercial Reasonableness: Considerations of commercial reasonableness, it must be stressed, are not unique to SONGS or to the SONGS co-owners. On the contrary, every utility company has a core responsibility, to its customers and shareholders, to make decisions and take actions that are prudent with respect to risk, liability, and cost. Pathways to relocating the SONGS SNF that cannot be considered commercially reasonable would thus be disqualified not only by the SONGS co-owners, but by any similarly situated utility.[7] The Strategic Plan considers three discrete elements of commercial reasonableness:

- Cost to implement, including both facility costs and costs from the perspective of the SONGS co-owners and their customers. Transportation costs are another significant consideration for some alternatives; they are discussed in general, order-of magnitude terms in this document and explored in more detail in the Conceptual Transportation Plan (Volume III of this compendium).

- Ability to recover costs. This element focuses on the question of "Who pays?" The burden of costs for SNF management can vary significantly among the federal government (and ultimately federal taxpayers) and nuclear electricity customers. Cost burden was also considered in the context of whether costs were in fact pre-paid through fees paid into the federal Nuclear Waste Fund or customer contributions to SONGS decommissioning funds, versus costs that would have to be paid through new charges. The Settlement Agreement stipulates that any plan for the offsite disposition of SONGS SNF must avoid imposing unrecoverable costs on SONGS co-owners' customers.

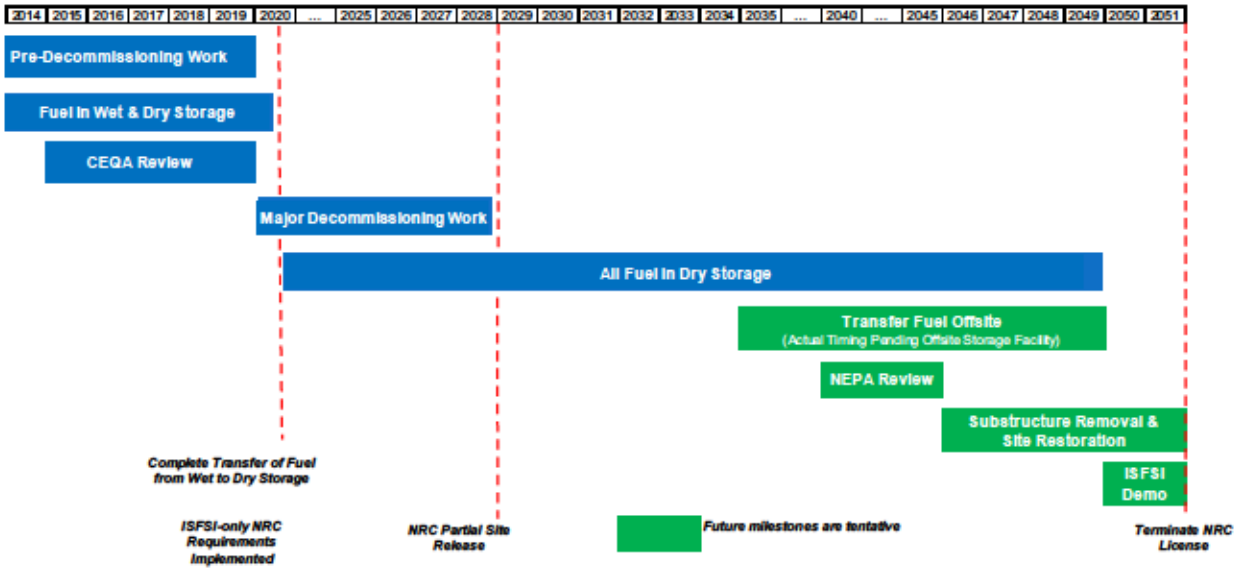
- Reasonable protection against liability and other financial risks and uncertainties associated with moving SNF off site. The issue of liability derives from the question of who holds title to the SNF once it leaves SONGS. The current contract between SONGS co-owners and the federal government requires the government to take title to and assume full liability for the SNF at the SONGS site boundary. Alternatives that involve storing SONGS SNF in a non-federal offsite

[7] This point is explicit in the Settlement Agreement between SCE and Citizens' Oversight, which defines "commercial reasonableness" as "such actions a prudent utility would undertake or decisions it would make under similar circumstances based on the information reasonably available to it at that time." See: https://www.courthousenews.com/wp-content/uploads/2017/08/San-Onofre-Settlement.pdf.

consolidated storage facility could leave the SONGS co-owners and their customers liable for certain risks arising from transportation and storage. To address this concern, the Settlement Agreement requires that any relocation of SONGS SNF to an offsite facility must result in the transfer of title and liability for this material to a third party unless SCE can obtain contract terms from the third party, such as (but not limited to) indemnities and insurance provisions, that offer commercially reasonable protection from liabilities and risks that may arise from the co-owners' retention of title to the SONGS SNF.

Timeliness of Offsite Storage or Disposal: This assessment factor considers the overall implementation schedule for different alternatives and the time required to clear the SONGS site once an offsite facility is available (issues related to the readiness of on-site infrastructure at SONGS to support preparing and loading SNF for offsite shipment are discussed in the Conceptual Transportation Plan, Vol. III). As a starting point for this assessment, the Strategic Plan assumes that SONGS SNF will be ready for offsite disposition in accordance with the current schedule for site decommissioning. The most recent SONGS Decommissioning Plan assumes that the current phase of decommissioning will be complete in 2028 and that the transfer of SNF off site could begin after 2030 or once necessary on-site preparations have been made to support the loading of SNF packages for shipment (Figure 1).

Figure 1. Current Songs Decommissioning Plan Timeline



Other Implementation Considerations: This assessment factor encompasses three elements that—in addition to commercial reasonableness—go to the practical viability of different alternatives:

- The need for, and nature of, changes to federal law as well as the need for federal appropriations to implement existing statutory authorities and obligations.
- Potential socio-economic-political considerations that could either facilitate or impede implementation. Public and stakeholder acceptance, for example, is a crucial factor and one that has emerged as a consistent and often intractable challenge in past efforts to site SNF storage or disposal facilities.
- Degree to which SONGS co-owners have control over implementation. This is important because many of the alternatives would require actions by Congress, federal executive-branch agencies, and various state-level agencies. Actions by federal or state governments also may be subject to judicial review. Where an alternative requires actions by entities outside the co-owners' control, the Plan identifies possible strategies, such as coalition building, that could facilitate progress.

Alternatives Included in the Assessment

The North Wind team drew from the Settlement Agreement, stakeholder input, previous studies, and its own expert judgment to identify a number of possible disposition pathways that would allow for the complete removal of SNF from SONGS and the full decommissioning of the SONGS site. These pathways are not mutually exclusive, and it would be logically consistent to concurrently support more than one pathway at a time depending on their relative prospects for success in light of the assessment factors described in the previous section. For the sake of completeness, we also considered a category of "other" pathways for the permanent disposition of SNF that are currently less well-developed or implementable—these pathways did not receive a detailed assessment but are noted to make the broader point that changing circumstances and new technological or policy developments could open the door to further possibilities in the future.

The specific disposition alternatives North Wind assessed include:

1. Federal permanent geologic repository. This would require resumption of the licensing process for the proposed Yucca Mountain repository[8] or revisions to the NWPA to authorize the identification of a new site.
2. Federal consolidated interim storage facility (CISF). This alternative contemplates federal development of a CISF, either under new legislation or under the existing (and highly constrained) interim storage provisions of the Nuclear Waste Policy Act (note that further congressional action would still be required to allow a federal storage facility to go into operation).
3. Federal use of a non-federal CISF. This could include, for example, a federal government contract to store SNF at one or both of the two private SNF storage facilities that have been proposed in Texas and New Mexico, pursuant to the Standard Contracts currently in effect

[8] To be clear, neither the North Wind team nor the SONGS co-owners take any position with respect to the suitability of the Yucca Mountain site or with respect to any decision that might be taken regarding whether to continue the licensing process for Yucca Mountain and/or pursue another repository site.

between the federal government and nuclear utilities. As a variant of this alternative, we also discuss public–private arrangements in which ownership, financing, management and operational responsibilities for a CISF might be apportioned among the federal government and other participants, including potentially states and private-sector entities.

4 Non-federal CISF where the SONGS co-owners make direct arrangements with the owners of a non-federal storage facility to store SONGS SNF without the involvement of the federal government. This could include arrangements with the private SNF storage facilities currently being proposed in Texas and New Mexico.

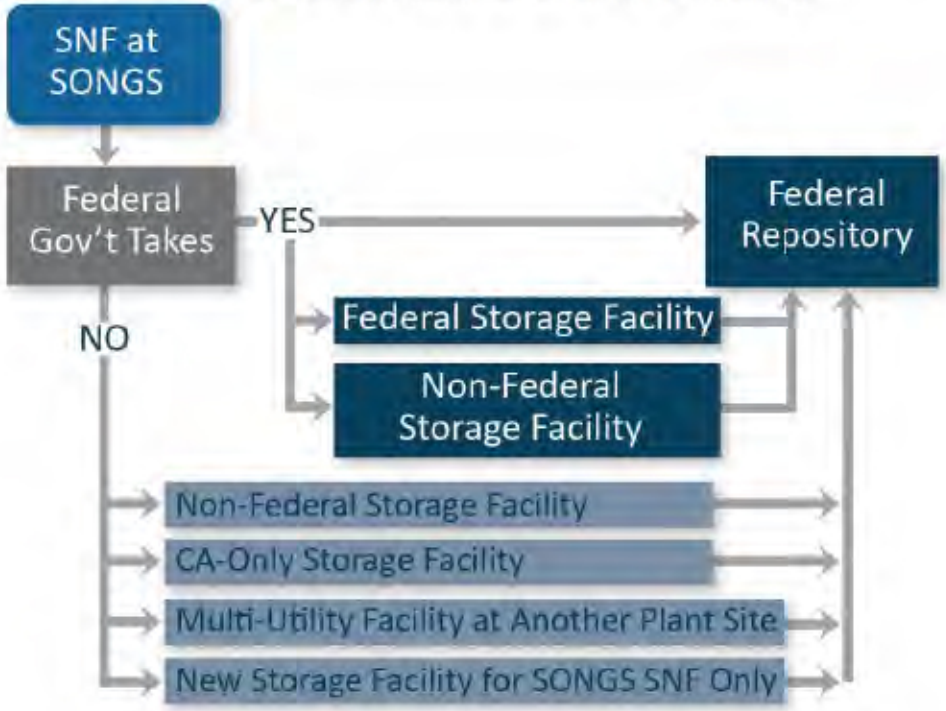
5. Non-federal CISF for California SNF only.

6. Non-federal CISF that involves two or more utilities jointly developing a facility to store SNF The Settlement Agreement specifically directed SCE to inquire with the owners of the Palo Verde Generating Station in Arizona about their potential interest in pursuing this approach. The Palo Verde owners responded that they are not interested. This concept, however, could still be explored with other potential utility partners.

7. A new independent spent fuel storage installation (ISFSI) for SONGS SNF only at a different location—e.g., moving the ISFSI to higher ground within the existing SONGS site, elsewhere on Camp Pendleton, or to another location. It should be noted that the Navy is strongly opposed to keeping any SNF at any location within Camp Pendleton.

8. Other disposition concepts beyond current policy and regulatory frameworks. These included deep borehole technology and other alternatives that are unlikely to have a timely path forward as of the writing of this Strategic Plan.

Figure 2. Alternatives Included for Detailed Assessment



Findings from the Alternatives Assessment

This section highlights a selection of key findings regarding potential disposition pathways for SONGS SNF. More detailed findings are provided in Chapter 7 of the full report.

Overarching Findings

North Wind's assessment reaffirms the fact that ***the current absence of a national nuclear waste management program poses a significant challenge for any alternative*** that the SONGS co-owners might consider for the offsite disposition of SONGS SNF. All of the alternatives assessed in the plan require some form of action by the federal government—either by Congress or by one or more executive branch agencies, including the Department of Energy, the Nuclear Regulatory Commission, and the Department of Justice. The nature and timing of these essential actions is highly uncertain, and the SONGS co-owners' ability to influence them is limited. Motivating stronger efforts by other utilities nationwide may be challenging so long as utilities do not need to modify current at-reactor storage arrangements for which they receive legally required cost reimbursement from the Judgment Fund.

Our assessment also finds that ***the time needed to implement a disposition pathway for SONGS SNF is on the order of decades, not years.*** Thus, removing this material and fully decommissioning the current site will almost certainly take longer than many stakeholders and the SONGS co-owners would prefer. Past delays and the on-going impasse over the federal repository program mean that any schedule for the permanent disposal of SONGS SNF is likely to extend well beyond the current SONGS Decommissioning Plan timeline. Offsite consolidated interim storage could be available within a timeframe that is more consistent with the current Plan, but federal action remains critical to advancing this capability and delivering a timely solution (note that the Plan timeline is updated on a regular basis).

The time required to completely remove SNF from the SONGS site once acceptance at an offsite facility becomes available presents additional schedule uncertainty. The Standard Contract between DOE and SNF owners specifies criteria for allocating rights to federal acceptance of SNF (once a federal facility is available to receive the SNF) based on the age of the SNF in the contract holder's possession. This is often referred to as the oldest-fuel-first or OFF "queue." If all contract holders used their annual allocation to ship the oldest SNF in their possession each year, completing the shipment of all SONGS SNF to a federal facility could take as long as two to three decades. Importantly, however, the Standard Contract also provides latitude for SNF owners to exchange OFF acceptance rights and for DOE to prioritize shutdown plant sites independent of the OFF allocation. (Options for a more efficient approach to removing SNF from reactor sites are discussed later in this summary and in the full report.) Uncertainty about how contract holders' rights and DOE's authority to prioritize shutdown sites might be exercised makes it difficult to predict how quickly the SONGS site might be cleared once a federal facility begins accepting SNF.

North Wind's assessment is also sensitive to the fact that ***approval by impacted state and tribal governments has emerged as a central and consistent challenge*** to the successful siting of repositories or interim storage facilities. There are multiple examples in the United States where siting efforts, for both repository and storage facilities, were successfully blocked by state opposition. While states cannot block the NRC licensing process, they can impose other impediments. Recognizing this problem, some bills that have been introduced in Congress to authorize new waste facility siting efforts require evidence of approval from state and tribal governments and, in most cases, from affected local governments as well.

Cost considerations and, more specifically, the question of "who pays?" could become a significant impediment to any alternative that does not include the federal government in a central role. Simply put, any path in which the federal government fails to uphold its core obligations with respect to SNF management will saddle nuclear utilities and their customers with uncertain (but potentially large) costs and liabilities.

In the case of private offsite storage options, for example, any economies of scale achieved by consolidating SNF storage could be more than offset by one-time transportation costs and by the storage fees needed to cover financing costs, return on equity, federal taxes, state and local benefit payments, and insurance. In fact, transportation costs alone could be disqualifying from a commercial reasonableness standpoint in any of the non-federal pathways we considered. These costs will depend on a host of factors and cannot be fully analyzed without knowing the specific parameters involved. But to provide some sense of magnitude, we estimate that shipping all the SONGS SNF off site—absent significant federal support and/or cost-sharing opportunities with other entities—could cost well over $100 million in a scenario where requisite equipment, such as specialized rail cars and casks, must be procured just to transport SONGS SNF.

Meanwhile, prospects for using Judgment Fund payments to offset the costs of non-federal consolidated interim storage are uncertain at this time and may be challenging to resolve in the context of a single utility, since this could set precedents for the use of the Judgment Fund across all nuclear utilities.

The issue of ***apportionment of liability for SONGS SNF once it leaves the site also has significant bearing on the cost burden to SONGS co-owners and customers***. Whether third-party protection from risks and liabilities could be obtained on commercially reasonable terms is, at best, uncertain in any scenario where the SONGS co-owners retain title to the SNF after it leaves the SONGS site. Thus, any alternative for relocating the fuel that does not also involve transferring title and liability for the fuel could face a substantial hurdle with respect to this key aspect of commercial reasonableness.

The above findings lead to an overall conclusion that ***any pathway for relocating the SONGS SNF that does not involve the federal government in a significant way—both to take title or otherwise address the need for liability protection and to assume cost—is highly unlikely, under present circumstances, to meet the test of the commercial reasonableness from the standpoint of SONGS co-owners and customers***.

More detailed findings for the individual alternatives are provided below and in Table 1 at the end of this Summary. It is important to note that these findings reflect current information and circumstances. North Wind recognizes that new developments may shift the relative advantages and disadvantages of different pathways and warrant reconsideration of aspects of our assessment.

Key findings for federal repository

- Resolution of a path forward on Yucca Mountain and/or another repository site is imperative because the necessary disposition endpoint for all SNF is deep geologic disposal in a manner that isolates this radioactive material from the biosphere over very long timescales. Permanent disposal in a deep geologic repository remains the preferred pathway for ultimate disposition of SNF based on long-standing scientific and policy consensus, in the United States and internationally. In addition, progress on a credible federal repository program is needed to provide assurance to hosts of interim SNF storage facilities that these interim facilities will not become *de facto* permanent.

- The main schedule uncertainty for this alternative concerns the time to resolve the current political impasse and reach a decision to move forward, either with Yucca Mountain or a new site. Once a decision is made, the time needed to reconstitute the federal program, find a new site (if necessary), and license and construct the facility adds further schedule uncertainty. Finally, once a repository is available, the timeframe for removing SNF from the SONGS site will depend on the rate at which SNF is accepted by DOE for disposal, which in turn will depend on whether and how the federal government exercises its authority to prioritize the acceptance of SNF from shutdown reactors. Overall, we estimate that the time needed to complete the removal of all SONGS SNF in this alternative could be as long as five to seven decades after congressional action to restart the federal program, if the government fails to implement an efficient approach.

Key findings for federal consolidated interim storage facility (CISF)

- A federal monitored retrievable storage (MRS) program could be initiated under existing statutory authority now and carried to the point of siting and licensing a storage facility, if Congress provides direction and appropriates the necessary funds (in fact, funding for this purpose was included in the House Energy and Water Projects appropriations bill for FY2021).

- To move forward with construction of a federal MRS facility after siting and licensing, legislation would be needed to relax the link that exists in current law between storage facility construction and construction authorization for a permanent repository.

- Alternatively, a new federal CISF development process could be authorized as part of more comprehensive legislation to restart the federal repository program. In addition, legislation enabling DOE or another federal waste management entity to enter into interim storage arrangements with private entities or utilities would give the federal government greater flexibility to meet its SNF management obligations.

- The linkage between a federal CISF and permanent disposal capability has been a longstanding issue in U.S. nuclear waste management policy. Host communities and states will want to have confidence that their interests are protected and that storage sites will indeed be "interim" in the sense that a permanent solution will be forthcoming.

- The timeframe associated with this alternative depends on congressional action to fund the start of a storage program, siting challenges, and the rate at which SONGS SNF is accepted for storage at a federal CISF. We estimate that the complete removal of SONGS SNF could take three to four decades following initiation of a federal CISF project, although this could be reduced substantially if the federal government exercises its contractual authority to prioritize acceptance of fuel from shutdown reactors. There are also many factors that could extend this timeframe.

Key findings for federal use of a non-federal CISF

- Two private companies, Holtec and ISP, have applied for licenses to construct CISF facilities (in New Mexico and Texas, respectively); both are seeking license approval in 2021. If these projects go forward, they could potentially offer an offsite storage option for SONGS SNF sooner than a federal facility. Other non-federal initiatives could emerge in the future.

- The private initiatives have stimulated strong interest in Congress in the possibility that the federal government could contract with a private or non-federal facility to store SNF accepted from utilities in lieu of developing a federal facility for that purpose. Statutory authorization for such contractual arrangements would be required.

- Both the Holtec and ISP projects still face formidable challenges in terms of resolving issues of financing and political acceptance. In addition, neither facility, based on the current license applications, could accept all of the SONGS SNF canisters.

Key findings for other forms of public/private arrangements

- A number of models could provide the basis for a partnership among the federal government, nuclear utilities holding SNF, other private-sector vendors, and state and local government entities. DOE has for example, entered into several contractual arrangements in the past for SNF management services. Also, the proposed private CISF facility in New Mexico represents a partnership between a private sector entity (Holtec) and local governments that hold title to the proposed site. Finally, there may be opportunities for a state government to assist the formation of a statewide SNF storage initiative, such as for the California-only CISF concept discussed in the "Path Forward" section below.

- Nuclear waste bills introduced in both the House and Senate during the 116th Congress provide flexibility for various types of arrangements between the federal government and non-federal entities to implement federal storage of SNF accepted from utilities.

- Because these partnerships could take many forms, it is not possible to draw general conclusions as to how any variation might comport with the assessment factors in the Strategic Plan. The assessment would need to be case-specific.

Key findings for SONGS co-owners' use of a non-federal or private CISF

- As already noted, the storage facilities being advanced by Holtec and ISP could potentially offer an offsite storage option sooner than a federal facility; both are far along in the licensing process but also face significant uncertainties and challenges. New private or other non-federal initiatives could emerge in the future.

- The costs and risks of contracting directly with a non-federal entity for offsite SNF storage would depend on the specific terms and conditions that could be negotiated with the storage provider, not only with respect to ongoing storage fees but also with respect to title and liability. Costs and risks to transport the SNF are another key consideration.

- It is difficult to speculate but based on the information that is currently available for the Holtec and ISP projects, significant issues would have to be resolved to make use of these facilities commercially reasonable from the standpoint of the SONGS co-owners and their customers. For example, the current business models and draft licenses for these facilities would require the SONGS co-owners to retain title to the SNF while it is in storage off site (liability would be shared). There is also uncertainty around whether storage fees and transportation costs could be reimbursed from the Judgment Fund.

- North Wind estimates that it could take approximately a decade, once a license is issued, for a private or other non-federal CISF to be constructed and begin accepting SNF. Once a private CISF is operational (and assuming commercially reasonable terms for using the facility can be

negotiated), the time required to remove all SNF from the SONGS site would depend on the specific arrangement that is struck with the storage provider, which may be affected by a number of factors, including transportation logistics and competition for acceptance capacity at the storage facility from other SNF owners.

Key findings for a CISF developed by one or more utilities (potentially at another nuclear power plant site)

- Expanding an existing ISFSI at another plant site to host SONGS SNF could have siting and licensing advantages while also offering economies of scale and cost-sharing opportunities. Detailed feasibility studies would be needed to analyze the potential benefits to participants, including benefits to the host utility and community.

- Key challenges for this alternative are finding a willing utility partner (or partners) and securing the support of the host state and local communities. In 2018, as directed by the Settlement Agreement, SCE approached the owners of the Palo Verde Generating Station (PVGS) in Arizona about pursuing this approach at the PVGS site. In a written response, the PVGS owners indicated they were not interested. Possible interest among other utilities in the western states region is currently unknown.

- Consolidated storage at an existing licensed ISFSI could offer economies of scale. As with other private CISF alternatives, however, there is significant uncertainty around whether the SONGS co-owners could protect the interests of customers and shareholders and meet their fiduciary obligations—both in terms of fully recovering SNF transportation and storage costs associated with use of a private facility from the Judgment Fund *and* in terms of obtaining, on commercially reasonable terms, third-party protection against financial and other risks if they retain title and liability for SNF stored at another site.

Key findings for relocation of SONGS SNF to a new storage facility, on or off site

- This alternative has the highest cost because it requires starting from scratch without the benefit of any previously incurred investments. It is also the least cost-effective alternative because it does not benefit from the economies of scale of consolidated storage. Finally, this alternative would likely entail the greatest cost burden to SONGS co-owners and customers because the costs to site, license, and construct a new ISFSI, and the cost to move SONGS SNF to the new location likely would *not* be recoverable from the Judgment Fund if moving the ISFSI is not required to meet regulatory requirements or for some other compelling reason. Therefore, North Wind concludes that this alternative is not commercially reasonable for the SONGS co-owners and their customers.

- The Navy has indicated, both in writing and at public meetings, that it opposes relocating the ISFSI to another site within Camp Pendleton. Without the Navy's support, relocating the SONGS ISFSI anywhere on the Camp Pendleton site is not feasible.

- The SONGS co-owners will be required to periodically review the technical basis for their coastal development permit. If there is any change to the safety basis, the SONGS co-owners could revisit their options for moving the SNF. Specifically, applications for renewal of the coastal development permits for the TN and Holtec ISFSIs at SONGS are due to the California Coastal Commission in 2022 and 2035, respectively. In applying for each renewal, the co-owners will be required to

review the technical basis for the permit and provide any updated information pertaining to continued operation of the ISFSI at the existing location for the period of extended operation.

Key findings for other concepts for permanent SNF disposition

- Many concepts for permanent SNF disposition were investigated by DOE in the 1970s, leading to a conclusion that the mined geological repository concept offered the preferred path forward. This position was subsequently adopted in the Nuclear Waste Policy Act of 1982. Consequently, a mined geological repository is the disposal concept that became the basis for the current regulatory framework in the United States. (Note that SNF disposal programs in all other countries are also built around mined geologic repositories, further reinforcing this approach.)

- At the same time, the NWPA called for continued research and development related to alternatives for permanent disposition, and concepts such as disposal in deep boreholes have continued to be investigated. For example, a private company has put forward a commercial proposal for SNF disposition in boreholes formed by commercial horizontal drilling technologies that are in widespread use in the oil and gas industry. New approaches could emerge as worthy of consideration in the future.

- Implementing new concepts could require new regulatory frameworks (as in the case of borehole disposal) or changes in national or international law and policy in some cases. This could substantially increase the uncertainty and timeframe associated with these pathways. For these reasons none of the specific concepts noted by way of example in this Plan are likely to be relevant for the disposition of SONGS SNF in a timeframe comparable to the more mature concepts North Wind considered.

Themes from Engagement with SONGS Stakeholders

To inform the Strategic Plan and better understand the expectations and priorities of SONGS stakeholders, the North Wind team conducted 68 one-on-one interviews with activists, community members, and local public officials, predominantly from the Southern California area, between July 2019 and May 2020. The public was also invited to provide input through the SONGS website (www.SONGScommunity.com).

Four themes from the one-on-one interviews are summarized below:

- Most local stakeholders want to see the SNF removed from SONGS as soon as possible but are also aware that no immediate option exists to make this possible. Some view the current site as vulnerable to various risks that could increase over time and point to its proximity to major population centers.

- Local public officials want to be kept informed about efforts to find an offsite solution for SONGS SNF and about emergency-response measures and other ongoing planning and coordination issues as long as the SNF remains on site. The existing Community Engagement Panel has been an important conduit for providing information and airing issues, but consistent communication with SCE remains a concern for some stakeholders.

- There is broad appreciation for the difficulty of siting nuclear waste facilities. Several people interviewed expressed the view that they would not want a new facility imposed on another community if that community were unwilling to accept it.

- The interviews generally did not elicit strong preferences between different offsite interim storage alternatives for the SONGS SNF, though a few interviewees were intrigued by the idea of a California solution, including the potential use of former military installations within the state. Those who have followed nuclear waste issues understand that the federal program has stalled over the Yucca Mountain controversy.

A Path Forward

North Wind's assessment identified potential opportunities as well as major uncertainties for each of several alternative disposition pathways that could achieve the safe removal of SNF from the SONGS site. An overarching conclusion from our assessment is that action is needed to reset the national nuclear waste management program and to advance commercially reasonable offsite consolidated interim storage options that could be available sooner than a federal repository.

Re-establishing federal leadership, in particular, is essential. All commercially reasonable pathways for removing the SONGS SNF require the restart of an effective national repository and consolidated storage program. Members of the California congressional delegation advanced a range of alternative approaches that broadened the legislative options under consideration in the 116th Congress, but consensus about how to proceed remains lacking. SCE can be a catalyst for organizing diverse coalitions —including utilities, governments, the private sector, and environmental groups—to develop a consensus approach and encourage congressional and administration action.

While federal action is needed, the prospects and timing for such action are uncertain. SCE will need to maintain optionality and flexibility to take advantage of opportunities as they arise by monitoring and assessing potential offsite CISF alternatives and being prepared to engage as future circumstances warrant. This includes implementing the current Decommissioning Plan safely and effectively, including the inspection and monitoring program and planning for the transportation loading infrastructure improvements that will be needed to enable offsite transfer of the SONGS SNF.

Pursuing opportunities for coalition building can create forward momentum. While SCE alone cannot control outcomes, it can help to catalyze coalition actions to support reestablishment of an active federal waste management program.

A commonality of interests exists at the local and state Levels. Local and regional stakeholder engagement identified a strongly shared desire for the safe and cost-effective movement of SONGS SNF to an acceptable offsite location. Most stakeholders interviewed by North Wind realize that responsibility for the current impasse in finding a permanent disposal solution for SNF lies not with SCE, but with the federal government's failure to begin taking spent fuel for final disposition as required by current law. Greater state interest could be prompted by wider recognition that the SONGS situation is not unique: There are two other shutdown nuclear plant sites with "stranded" SNF in California—one (Humboldt Bay Nuclear Power Plant) is likewise on the coast.[9] California utilities and their customers have already paid about $2 billion in cash and accrued interest for the federal government to accept and

[9] The other California site with stranded SNF is Rancho Seco Nuclear Generating Station. Another plant site in the state, Diablo Canyon Power Plant, is still operating but is expected to shut down in 2025; it too is located on the coast. See Chapter 3.

remove this SNF. California's congressional delegation, led by Senator Feinstein and by local leaders such as Representatives Levin and Peters, is working to advance federal legislative solutions.

There is growing motivation for action nationwide. Twenty-two sites in 16 states over the next five years—and substantially more over the next decade—present the same challenge in terms of lacking options for the offsite disposition of SNF from shut-down reactors. Nuclear utility customers have pre-paid about $44 billion in cash and accrued interest for nuclear waste disposal by the federal government and should not be burdened with further costs due to continued inaction. At the same time, all federal taxpayers are currently paying for continued on-site SNF storage via Judgment Fund reimbursements for the cost of federal inaction. But this mechanism cannot serve as a blank check indefinitely. The most recent DOE estimate of remaining liabilities for contract non-performance, reflecting continued delays in restarting a waste program, is approximately $30.6 billion—according to some industry estimates, this liability may eventually reach $50 billion if delays continue.[10] Finally, proponents of nuclear energy as a reliable source of clean electricity recognize and support the need for progress on federal SNF management.

A national legislative agenda to restart the federal waste management program must include several critical elements. A key to effective coalition building is to establish a common set of policy and legislative objectives, building from widely shared principles. Absent this foundation, success in achieving and sustaining the administrative and congressional actions that are needed will continue to be elusive. North Wind's analysis points to several programmatic objectives and enabling actions that could provide the core of a broad agreement about what needs to be done.

Four Strategic Programmatic Objectives:

- Provide direction, obtain appropriations, and take other necessary steps to restart the national program.
- Establish and implement a national consolidated interim storage program with broad authority to enable multiple forms of business models (including contracting for private storage, implementing a federal CISF, or forming a public-private partnership with a non-federal public or private entity).
- Re-establish a program for a permanent geologic repository that addresses the need for stakeholder engagement and the consent of involved state, local, and tribal governments.
- Pursue opportunities for the industry to work together, perhaps via the Nuclear Energy Institute and/or the Decommissioning Plants Coalition, to create a consensus-driven prioritization scheme for removing SNF from shutdown sites and recommend that that scheme be adopted by the federal government. Adopting a more efficient approach for removing SNF from shutdown sites could save up to $10 billion in Judgment Fund payments (see Appendix F).

[10] For the current DOE estimate, see: https://www.energy.gov/sites/prod/files/2020/11/f80/DOE-OIG-21-02.pdf. For the industry estimate, see: https://www.powermag.com/a-break-in-the-nuclear-waste-impasse.

Two Critical Enabling Actions:

- Establish and staff a new SNF management organization with adequate authority, expertise, and autonomy, preferably as an independent entity outside of DOE.
- Establish assured funding from the Nuclear Waste Fund.

Conclusion

This Strategic Plan is focused on achieving the safe and commercially reasonable relocation of SONGS SNF to a different site so as to enable the full decommissioning and restoration of the plant site and the return of the land currently occupied by the site to the Navy as soon as possible. Achieving this objective will not be straightforward or quick, but the Chinese proverb, "A journey of a thousand miles begins with a single step," is certainly apropos. The SONGS co-owners will have to pursue multiple pathways, work hard to engage stakeholders and potential partners, and remain flexible and open to new opportunities, while also taking concrete steps to make progress in the near and medium term. All of this requires the SONGS co-owners to sustain their commitment to finding an offsite disposition solution for SONGS SNF over years and probably decades.

While the challenges should not be underestimated, the benefits of success must also be kept clearly in view. Until a facility exists that can receive the SNF, the SONGS co-owners will have no choice but to remain in the nuclear waste management business, communities around SONGS will have no choice but to continue to host a nuclear waste facility, and the Navy won't be able to reclaim its land for more productive uses. At the national level, meanwhile, storing SNF at dozens of sites like SONGS for the indefinite future is inefficient, will become increasingly costly over time to U.S. taxpayers, and continues to fuel the argument that a lasting solution for long-lived radioactive wastes is not achievable.

The current impasse has persisted not because a solution for responsibly managing and disposing of nuclear waste is out of reach scientifically, technically, or even economically. Rather it has persisted for a set of reasons that are primarily socio-political in nature and because it has been easier to ignore and defer the problem than to solve it. As the number of shutdown nuclear plant sites with "stranded" SNF grows, however, and as payouts from the Judgment Fund result in a mounting burden for U.S. taxpayers, interest in finding solutions can be expected to increase. Indeed, efforts to introduce new national-level legislation on the nuclear waste issue over the last few years—including several bills in the 116th Congress that were sponsored or cosponsored by members[11] whose congressional districts include SONGS or the nearby area—signal that the political dynamics may already be shifting. Against this backdrop, the SONGS co-owners can help build support and momentum for breaking through the current stalemate. In urging action, the co-owners can draw on a diverse and broad group of allies and on decades of expert opinion that have consistently called for an effective national program to manage SNF that includes both consolidated storage and geologic disposal capability. For some time now, a lack of focus and political will have been the most important impediments to progress. Working with allies and partners, the SONGS co-owners have an opportunity to influence both.

[11] Including Representatives Mike Levin, Scott Peters, and Katie Porter.

Table 1 Summary of Assessment Results for Alternative SONGS SNF Disposition Pathways

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
Offsite Disposal Alternative				
Federal Repository Baseline: Yucca Mountain Variant: • Another location.	• YM program has been defunded and therefore suspended for more than a decade. • Though major licensing milestones have been passed, contentions remain and project infrastructure and technical staff have been dismantled. • While Yucca Mountain has had support at the county level, the state of Nevada has strongly opposed the project. • Leaders of both political parties are on record as opposing restart of project over Nevada's objections. • Starting over at another site will require congressional action, siting process, lengthy characterization studies.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport and disposal from that point. • Costs to transport and dispose of SONGS SNF would be covered by the federal government out of the NWF using funds already collected from nuclear utility customers. • Until repository is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	• Depends on congressional action to restart and potentially restructure the federal repository program. • Opening YM likely to take additional decades even after decision to restart. • Schedule for shipping SONGS SNF to a repository would depend on whether and how the federal government prioritizes acceptance of SNF from shutdown reactors. • Full removal of SONGS SNF could take five to seven decades after congressional action if the federal government fails to implement an efficient approach. • Pursuing another site could take as long or longer.	• Difficult to predict an end to the current political impasse. • Program management organization needs to be rebuilt and changes to budgetary treatment of NWF are needed to provide assured funding. • Siting will continue to be a challenge if decision is to pursue a new location. • SCE has limited leverage to influence progress.
Federal Offsite Storage Alternatives				
Federal CISF	• Existing statutory authority for Federal consolidated interim storage is limited and heavily constrained. It is also linked to construction authorization for a repository.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport, storage, and eventual disposal at that point.	• Requires appropriations and eventual legislative action, including resolution of linkage to repository. • Acceptance schedule would likely be affected by whether	• Significant public and political resistance to initiating a storage facility program absent linkage to a permanent repository.

Table 1 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
	• With appropriate direction and funding, initial steps to design and site a facility could be taken before the NRC authorizes repository construction under existing authority. However, new legislation would be needed for construction and operation.	• Costs for a federal CISF and to transport and store SNF would be covered by the federal government out of the NWF, once the necessary legislative changes were in place. • Until CISF is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	and how the federal government prioritizes acceptance of SNF from shutdown reactors. • Full removal of SONGS SNF could take three to four decades after congressional authorization, assuming no priority given to shutdown reactors.	• Siting a facility could be challenging. • SCE has limited leverage to influence progress.
Federal Use of a Non-Federal CISF Baseline: Federal government contracts for use of one or both of the proposed Holtec and ISP facilities Variants: • Federal government contracts for use of another as-yet-unidentified non-federal facility. • Other public–private partnership arrangements.	• NRC is currently reviewing Holtec and ISP license applications. Barring delays due to opposition or other factors, license approval is expected in 2021. • Vendors express confidence that projects will move forward, but a number of hurdles remain. • Federal government would need new legislative authority to contract with a non-federal entity for storage services.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport and storage fees at that point. • Depending on storage fees and other contract terms, this option might be more or less attractive to the federal government than a federal CISF. • Until CISF is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	• Timeframe to either facility being available depends on issuance of license, completion of funding and pre-construction requirements and finalization of contractual arrangements between CISF and possible clients, including (in this case) federal government. • Depends on action by Congress to authorize and fund federal contract for storage at a non-federal facility. • Schedule for SNF transportation and acceptance would also be influenced by whether and how the federal government prioritizes acceptance of SNF from shutdown reactors.	• Private storage facilities face challenges in terms of public and host-state acceptance. • From federal government standpoint, use of a non-federal facility may face additional political and budgetary hurdles. • SCE has limited ability to influence successful completion of non-federal facilities or federal government decision to use such facilities. • More flexible authorization for federal storage program could open the door to a variety of arrangements.

Table 1 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
			• Full removal of SONGS SNF could require two to three decades after facilities become available and Congress authorizes use, assuming no priority given to shutdown reactors.	
Non-Federal Offsite Storage Alternatives				
Non-Federal CISF Baseline: SONGS co-owners contract directly for storage services at proposed Holtec and/or ISP facilities and are responsible for SNF transport to storage facility Variants: • SONGS co-owners sell SONGS assets and transfer title to another private entity affiliated with private storage provider. • Non-federal CISF owner/operator takes possession of SNF at SONGS boundary and provides transport services.	• NRC currently reviewing Holtec and ISP license applications. Barring delays due to opposition or other factors, license approval expected in 2021. • Vendors express confidence that projects will move forward, but a number of hurdles remain.	• Storage fees for a private facility are not yet known, but will depend on financing arrangements, insurance requirements, benefits payments, and other factors. • Current draft licenses for both the Holtec and ISP facilities require the client (in this case, the SONGS co-owners) to retain title to SNF. This means SONGS co-owners and customers would have to seek protection for risks and liabilities of retaining title from a third-party entity on commercially reasonable terms. • Neither Holtec nor ISP is currently proposing to provide SNF transport. Rather, both applicants have indicated that SNF owners would be responsible for acquiring transportation assets and covering operational costs to ship SNF to their facilities.**	• Depends upon issuance of license, completion of funding and pre-construction requirements and finalization of contractual arrangements between CISF and SNF owners. • Full removal of SONGS SNF could be completed two decades after licensing and financing complete and commercially reasonable contract terms are reached. Transportation arrangements, including schedule, are uncertain and subject to negotiation.	• Private storage facilities face challenges of public and host-state acceptance. • Resolution of contract terms and conditions that are commercially reasonable, including cost, cost reimbursement, and title/liability protection would be required. • SCE has limited ability to improve private vendors' ability to obtain licenses or to address host-state concerns.

Table 1 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
• Another private or non-federal vendor.		• Availability of Judgment Fund reimbursements to pay for transportation and private storage costs – in all non-federal offsite storage scenarios – is uncertain.		
CA-only CISF Baseline: All CA utilities form cooperative agreement to consolidate SNF storage within the state, with some form of sanction/support from state government. Variants: • CA utilities form a NEWCO to take title to SNF at CA CISF. • NEWCO takes title to SNF at plant sites and is responsible for transport to CA CISF. • CA state gov't and CA utilities partner to share responsibilities for SNF storage, with division of roles and responsibilities to be negotiated.	• Idea has not been explored but would require engagement with other CA utilities and state officials to assess interest. • Could avoid the problem of seeking host-state support for a storage facility elsewhere in the U.S. that is being asked to take SNF from California and other states.	• SONGS co-owners would retain title to the SNF, creating need to obtain third-party protection for co-owners and customers from financial and other risks on commercially reasonable terms. • Costs to site, design, and license a new CISF could be substantial; consolidation of SNF, however, could provide some economies of scale and cost-sharing opportunities because costs to build facility and some transport costs would be shared with other utility partners. • Availability of Judgment Fund reimbursements to pay for transportation** and other costs associated with developing a new facility is uncertain. • Storage O&M cost savings, if any, would accrue to both the utilities and to the Judgment Fund. • Could potentially benefit from state support or as a federally supported demonstration project.	• Depends on time needed to enlist partners, find acceptable site, and characterize, license, and construct facility. • Full removal of SONGS SNF could take two decades after siting agreement reached.	• Interest among other CA utilities or within state government is currently unknown; continued impasse on federal program and impediments to CISF implementation could prompt interest. • Siting remains a key challenge, even if presented as a California solution to a California problem.

Table 1 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
• Other non-utility NRC licensees in the state join the effort.				
Multi-utility CISF At Another Plant Site Baseline: SONGS co-owners partner with one or more other nuclear utilities to consolidate SNF storage at another site. Note that an expanded or new storage facility at Palo Verde Generating Station (PVGS) was used to generate rough cost estimates, but the Palo Verde owners have rejected the idea of storing SONGS SNF at this site. Variants: • Utility participants form a NEWCO to own and operate private storage facility at an existing plant site.	• PVGS co-owners have been approached and have indicated (by letter) that they are not interested. • Other partners and sites have not been explored. • Use of an existing plant site could offer siting and licensing advantages.	• Expansion of an existing ISFSI to host SONGS SNF may offer economies of scale and cost-sharing opportunities. • SONGS co-owners would retain title to the SNF, creating need to obtain protection from financial and other risks from a third-party entity on commercially reasonable terms. • Availability of Judgment Fund reimbursements to pay for transportation** and other costs of developing and using a new facility is uncertain. • Storage O&M cost savings, if any, would accrue to both the utilities and to the Judgment Fund. • Could potentially benefit from federal support, perhaps as a demonstration project or regional CISF.	• Depends on time needed to enlist partners, find acceptable site, and characterize, license, and construct facility. • Full removal of SONGS SNF could take two decades after siting agreement reached.	• Possible interest among other utilities in the Western states region is currently unknown. • Socio-political acceptance could be a major challenge since the host state and community would have to be willing to accept SNF from out of state.

Table 1 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
Relocation of SONGS SNF to a New ISFSI Baseline: Another location at the SONGS site at higher elevation. Variants: • A new site in California. • Another location at Camp Pendleton.	• The current on-site ISFSI has been completed and is operating under NRC and state regulation and oversight. • SCE is required to update its assessment of coastal hazards and examine options for moving the ISFSI within the current licensed plant site when it applies for renewal of the coastal development permit for the SONGS ISFSI in 2035. • Navy wants all SNF off Camp Pendleton. • Other possible sites for relocating the current ISFSI have not been explored.	• Developing a new offsite ISFSI would entail substantial cost and time to complete site identification, licensing, construction, and operation. • SONGS co-owners would retain title to the SNF, potentially creating need to protect co-owners and customers from liability issues and additional insurance costs if SNF is moved to a new offsite location. • SCE-only approach does not meet test of commercial reasonableness because of the cost of relocation and because it provides no economies of scale and little opportunity for cost sharing. • Availability of Judgment Fund reimbursements to pay for costs to move the SNF to another ISFSI location is uncertain.**	• For an offsite location, depends on siting difficulty and time to characterize and license site. • The same challenges don't apply if the ISFSI is moved within the existing plant site, but that option also doesn't achieve the objective of clearing the site. • Full removal of SONGS SNF if the new location is off site could be completed two decades after initiation of development.	• Navy is opposed to continued SNF storage anywhere on Camp Pendleton. • Moving SONGS SNF to a new site in CA would present major challenges in terms of public and host location acceptance. • Coastal development permit renewal in 2035 will require assessment of new information.

* Where a timeframe is given, it represents the North Wind team's expert judgment using reasonable estimates of the time required for discrete steps to implementation. In all cases, delay or opposition could extend these timeframes. See Chapter 7 for the full report for more detail.

** SNF transportation costs for all non-federal disposition pathways could be substantial and would likely fail the test of commercial reasonableness absent significant federal support and/or cost sharing with other entities. North Wind estimates that costs to ship all the SONGS SNF, if the necessary equipment had to be procured for SONGS alone, would be well over $100 million for a private (non-federal) shipper. More precise estimates cannot be generated without knowing the specific parameters of a future shipping campaign. See further discussion in Section 6.5 of the full report and in the Conceptual Transportation Plan (Vol. III).

ACKNOWLEDGEMENTS

The North Wind team is indebted to members of the Experts Team—Thomas Isaacs (Chair), Kristopher Cummings, Dr. Allison Macfarlane, J. Gary Lanthrum, Richard Moore, and Dr. Josephine Piccone—for their many contributions to the development of this Strategic Plan. We also thank former Secretary of Energy Ernest Moniz for providing guidance and critical insights at multiple points in the Plan development process. Finally, we are grateful to senior members of the SCE and SONGS management teams, including Christopher Abel, Douglas Bauder, Manuel Camargo, Ian Forrest, Julie Holt, Amy Pressler, and Edgar Yep for a candid and constructive working relationship throughout the course of this effort. This Plan was immeasurably strengthened by the collective and individual wisdom of all these participants.

1. INTRODUCTION

This Strategic Plan explores potential pathways for relocating spent nuclear fuel (SNF) at the San Onofre Nuclear Generating Station (SONGS) to an offsite facility and develops findings with respect to commercially reasonable approaches to achieve that objective. It was prepared for Southern California Edison (SCE), the decommissioning agent for SONGS,[12] consistent with the SONGS co-owners' commitment to pursuing solutions for removing SNF from the plant site. A companion volume to this Strategic Plan, the *Conceptual Transportation Plan for Relocating SONGS Spent Nuclear Fuel to an Offsite Storage Facility or Repository*, focuses on the specific steps involved in planning for and executing shipments of SONGS SNF, once an offsite facility is available. These two documents (Volumes II and III of this compendium, respectively), inform the *Action Plan for Relocating SONGS Spent Nuclear Fuel to an Offsite Storage Facility or Repository (Volume I),* which details the actions the SONGS co-owners intend to take to achieve the overarching objective of relocating SONGS SNF off site.

Planning to fully decommission SONGS has been underway since 2013, when SCE announced the plant site's permanent retirement. Since that time, activities at the site have included commencing the years-long process of dismantling and removing reactor unit structures, systems, and components and completing the movement of SONGS SNF to safe, secure dry storage on site.

The effort to develop a strategy for moving SONGS SNF off site, including both this Strategic Plan and the accompanying Conceptual Transportation Plan, followed from the terms of a Settlement Agreement reached in 2017 between SCE and a group called Citizens' Oversight.[13] All parties involved in this effort place a high priority on finding offsite storage or disposal solutions that would allow for the removal of SONGS SNF and the full restoration of the plant site for other uses.

This Strategic Plan focuses on the challenge of identifying and pursuing a set of actions that has the best chance of achieving that objective, which is shared by the SONGS co-owners and a wide range of stakeholders. As with most complex problems that entail large uncertainties and involve multiple decision-makers, no single action will suffice, and no one pathway is guaranteed to lead to success. In addition, given the large uncertainties and multi-decade timeframes involved, there will be surprises.

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[12] Edison International, Southern California Edison's parent company, holds 78.2 percent ownership in the plant; the other owners are San Diego Gas & Electric Company (20 percent) and the City of Riverside Utilities Department (1.8 percent). The City of Anaheim, a former SONGS owner, remains a co-participant in the decommissioning process. Because SCE is the sole named defendant in the lawsuit and associated settlement that gave rise to this Strategic Plan (as described later in the main text), this report generally refers to "SCE" or "SONGS co-owners" throughout.

[13] At the end of 2015, a group called Citizens' Oversight and an individual, Patricia Borchmann, filed a lawsuit against the California Coastal Commission's decision to grant a permit for the expansion of SNF dry storage capacity at SONGS. The filing led to a settlement agreement between the parties. Under the terms of the agreement, "to assess the feasibility of relocating SONGS Spent Fuel to an Offsite Storage Facility, SCE shall: (1) develop a conceptual plan for the transportation of the SONGS Spent Fuel to an Offsite Storage Facility assumed to be located in the southwestern region of the United States ('Transportation Plan'), and (2) develop a strategic plan for supporting the development of a Commercially Reasonable Offsite Storage Facility ('Strategic Plan')."Consideration of such a facility was to include, but not be limited to: "(1) a consolidated interim storage … facility to be developed and operated by a third party…; or (2) an expanded ISFSI at the Palo Verde Nuclear Generating Station … located near Tonopah, Arizona." For an example of local media coverage of the Settlement Agreement, see: https://www.thecapistranodispatch.com/citizens-oversight-projects-coastal-commission-reach-settlement-agreement-songs-lawsuit/.

This means that flexibility, adaptability, preparedness, and a willingness to catalyze change and leverage new opportunities are needed.

The challenge is to identify and pursue a set of actions that has the best chance of achieving the objective, shared by the SONGS co-owners and a wide range of stakeholders, to remove SNF from the SONGS site.

In 2018, SCE assembled a team of six nationally recognized experts with decades of collective experience in nuclear waste policy, regulation, and program implementation to guide the development of the Strategic Plan.[1] With assistance from this "Experts Team" SCE subsequently retained North Wind Inc. in June 2019, following a competitive procurement process, to help assess alternatives for achieving the Plan's objectives. North Wind brought together a group of professionals with expertise in the technical, legal, regulatory, economic, political, and stakeholder engagement aspects of SNF management and disposition (Appendix A). The North Wind team (NWT) also sought input from an extensive array of stakeholders, including numerous knowledgeable individuals at all levels of government, within industry and nongovernmental organizations, and among local community leaders and advocates. Throughout, NWT benefited from the insights of the SONGS Experts Team, and from an open and constructive working relationship with management and staff at SONGS and at SCE.

The remainder of this document is organized as follows: Chapter 2 begins with an introduction to SONGS and goes on to highlight key aspects of the Strategic Plan, including objectives, overall approach, and main alternatives considered for relocating SONGS SNF. Chapter 3 describes the nature of the nuclear materials present at the SONGS site, current storage arrangements for these materials, and the decommissioning process at the site. Chapter 4 discusses key stakeholder relationships and perspectives and describes NWT's engagement with stakeholders in the course of developing this Plan. Chapter 5 reviews the history of nuclear waste management in the United States and identifies the legal and regulatory parameters—and socio-political challenges—that have emerged over the course of that history. Chapter 6 addresses several cross-cutting issues and considerations that apply to all pathways for removing SNF from the SONGS site. Chapter 7 describes the results of NWT's assessment of SNF disposal and storage alternatives that would achieve the Plan's objectives. Chapter 8 summarizes overall findings, recommends a few high-level strategic priorities, and offers concluding remarks.

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[1] The following individuals served on the Experts Team; areas of specific expertise are indicated in parentheses after each name:

Thomas Isaacs, Chair (Siting and Licensing)
Independent Strategic Advisor to SCE for Nuclear Waste Management
Former Director, Office of Policy within the U.S. DOE
Dr. Allison Macfarlane (Siting and Licensing)
Former Chairman of the U.S. Nuclear Regulatory Commission
Dr. Josephine Piccone (Radiation Detection & Monitoring)
Former Certified U.S. Nuclear Regulatory Commission Reviewer / Inspector and Senior Manager. Former U.S. government representative to the IAEA Radiation Safety Standards Advisory Committee (RASSC)
Richard C. Moore (Spent Fuel Transportation)
Western Interstate Energy Board Consultant supporting High Level Nuclear Waste Committee
J. Gary Lanthrum (Spent Fuel Transportation)
Principal Engineer with Radiation Material Transportation and Storage Consulting (RAMTASC)
Kristopher W. Cummings, M.S. (Nuclear Engineering)
Principal Engineer with Curtiss-Wright Nuclear Division-NETCO

2. OVERVIEW OF STRATEGIC PLAN OBJECTIVES AND APPROACH

This chapter sets the stage for the Strategic Plan by introducing the reader to SONGS and reviewing the Plan's near- and long-term objectives. The chapter also discusses the role of SCE and the Experts Team in shaping this Plan and outlines the approach taken to select alternatives for assessment. It ends by identifying the eight main pathways we examined for moving spent nuclear fuel off the SONGS site.

2.1 An Introduction to SONGS

SONGS is a former three-unit nuclear generating site located on the southern coast of California, near the city of San Clemente and between the major metropolitan areas of Los Angeles (about 70 miles to the north) and San Diego (approximately 60 miles to the south). SONGS is mostly owned by Southern California Edison (SCE), a subsidiary of Edison International. It operated between 1968 and 2012.

At its peak output in the 1980s, SONGS generated approximately 1.3 million gigawatt-hours of electricity per year—supplying as much as 20 percent of the electricity needs of large portions of Southern California—and employing as many as 2,200 people. The plant site, which takes up an area of 84 acres, includes an energized switchyard that remains as a major interconnect between Orange and San Diego Counties. SONGS itself is situated in close proximity to the shoreline of the Pacific Ocean (Figure 2.1) on land owned by the U.S. Navy (the entire site is within the boundaries of an active military base, Marine Corps Base Camp Pendleton). A major north-south highway, Interstate 5, runs close to the plant site along its eastern boundary. The plant site's distinctive twin hemispherical containment structures are a widely recognized feature of the local landscape.

Three reactor units were active at SONGS over the course of the plant's 44-year operating history. Construction on Unit 1, a first-generation, Westinghouse pressurized water reactor with a rated electricity generating capacity of 436 megawatts (MW_e), began in 1964. Unit 1 commenced commercial operations in 1968; it was permanently shut down 24 years later, in 1992, and subsequently largely dismantled. The area once occupied by Unit 1 has since been used to store SNF.

Construction of two additional and much larger pressurized water reactors at SONGS—Unit 2, at 1,070 MW_e, and Unit 3, at 1,080 MW_e—was completed in 1982 and 1983, respectively. Both units operated until January 2012 when premature wear was found on tubes in replacement steam generators that had been installed as part of substantial plant upgrades completed in 2010 and 2011. Though these upgrades had been undertaken in expectation that the two units would operate to the end of their licenses in 2022 (and perhaps longer, if the licenses were renewed), SCE announced that it would permanently retire Units 2 and 3 in June 2013, citing "continuing uncertainty about when or if SONGS might return to service." In September 2014 SCE submitted to the U.S. Nuclear Regulatory Commission (NRC) its SONGS Post-Shutdown Decommissioning Activities Report (PSDAR), which included an estimate of decommissioning costs and a management plan for the SNF at the site.[15]

[15] See: https://www.nrc.gov/info-finder/decommissioning/power-reactor/songs/decommissioning-plans.html.

Figure 2.1. San Onofre Nuclear Generating Station (SONGS) Site

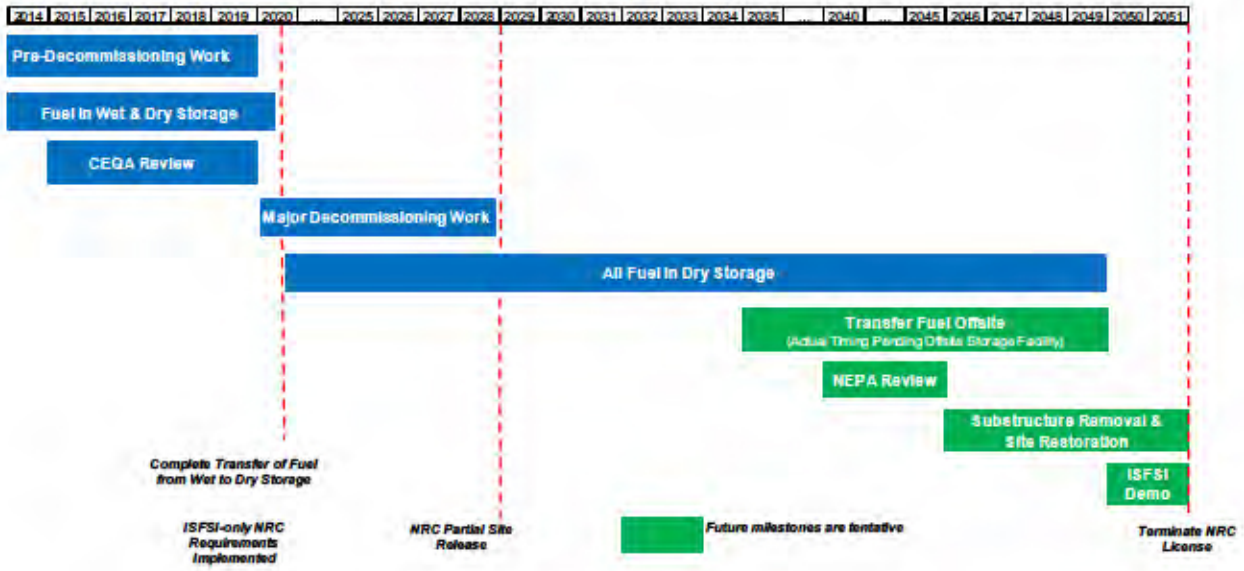
By formally notifying the NRC in July 2013 that it was permanently ceasing operation of Units 2 and 3, SCE set the stage to begin preparations for decommissioning SONGS.[16] The decommissioning process, which is well defined by the NRC, requires transferring all the SNF in the reactors to wet storage in the spent fuel pools and/or into dry storage, depending on the schedule for dismantling plant structures. (Additional details about SONGS decommissioning are provided in Chapter 3.) Longer term, the goal of the decommissioning process is to remove all SNF from the site and restore the site to a level that supports termination of the facility's NRC licenses.

SCE anticipates that the current phase of SONGS decommissioning will be complete in 2028. At that point, the only remaining visible structures at the site will be the switchyard, the seawall/walkway/rip-rap, and the independent spent fuel storage installation (ISFSI). The ISFSI stores SONGS SNF and other radioactive materials (known as "greater than Class C waste") from the decommissioning process. (Additional details are provided in Chapter 3.) These materials cannot be removed until a licensed disposal or storage facility exists that can accept them.

Figure 2.2 shows the schedule in the current SONGS Decommissioning Plan. As noted in the figure, future milestones are tentative and the plan is periodically updated. Whether the current schedule can be met depends to a significant extent on whether an offsite consolidated interim storage facility is available to in the 2035–2045 timeframe shown in the figure.

[16] The units were permanently shut down on June 7, 2013. Formal notification, in the form of a "Certification of Permanent Cessation of Power Operations," was transmitted to the NRC on June 12, 2013.

Figure 2.2. Current SONGS Decommissioning Plan Timeline



2.2 Strategic Plan Objectives

The overarching objective of this Strategic Plan, and of SCE, other SONGS co-owners, and the SONGS community, is the safe and commercially reasonable relocation of SONGS SNF to another facility as soon as practical. Relocating the SNF is a necessary final step in decommissioning all facilities at SONGS so as to enable the restoration of the site and the return of the land to the U.S. Navy. Nearer term objectives are to (1) accelerate progress toward developing one or more viable disposition options for SONGS SNF and (2) prepare for and support the eventual transfer of these materials to another facility for storage or disposal. As long as SNF remains at SONGS, taking all measures necessary to ensure the safety and security of on-site storage arrangements will remain a central focus, along with sustaining engagement and a strong trust relationship with local communities and stakeholders.

The alternatives available for relocating SONGS SNF are shaped by the long and complicated history of nuclear waste management…and by the regulatory, legal, and socio-political conditions and parameters that have evolved over that history.

The alternatives available for achieving the long-term objective of relocating SONGS SNF are shaped by the long and complicated history of nuclear waste management efforts in this country, and by the regulatory, legal, and socio-political conditions and parameters that have evolved over the course of this history. Chapter 5 describes in more detail how these parameters affect, and in many ways constrain, the SONGS co-owners' options. The history described in Chapter 5 also underscores the need to enlist a wide range of stakeholders—from policymakers and political leaders at all levels of government, to industry partners, local communities, tribes, and non-governmental organizations—to identify and implement solutions for the consolidated storage and permanent disposal of nuclear waste. These solutions are needed, not just for SONGS SNF, but for the SNF now being stored at dozens of individual nuclear plant sites across this nation. The timeframes involved will be long—on the order of decades—and the uncertainties are large. But this is all the more reason why efforts to advance a solution cannot wait.

Long timeframes also mean that conditions can change, and new opportunities can emerge.

NWT's goal in developing this Strategic Plan was to provide insights and information that would help the SONGS co-owners advance their near- and long-term objectives with respect to SONGS SNF. The actions the co-owners intend to take in response to this Plan and the accompanying Conceptual Transportation Plan are outlined in the Action Plan (Vol. I).

2.3 Approach to the Strategic Plan and the Role of the Experts Team

In identifying strategies, NWT aimed to be inclusive but also realistic—in two senses: First, by considering a wide range of perspectives while also being clear-eyed about what is and is not viable. And second, by seeking a wide range of inputs and opinions while also being willing to apply our own and the E xpert Team's e xtensive knowledge and e xperience. The E xperts Team was actively involved in the development of this Plan, meeting numerous times with NWT members and reviewing multiple Strategic Plan drafts, while also sharing their e xpertise on specific issues throughout.

Engagement with stakeholders, including particularly members of the local SONGS community, was another component of the plan development process. Local stakeholder support will be important to implement any strategy for removing SNF from SONGS and fully decommissioning the plant site. In addition, local stakeholders are a key constituency for building the political momentum needed to advance a solution. The scope of NWT's stakeholder engagement efforts and some of the insights that emerged from those efforts are discussed in Chapter 4

NWT was also aware that this effort will be of interest to a much broader group of stakeholders at the state, regional, and national level. As we have already noted, the problem of finding a viable, politically acceptable, and commercially reasonable disposition pathway for SNF is not unique to SONGS and SCE. On the contrary, utilities and communities around the country face the same issues as growing numbers of nuclear power plants retire with no actionable plan for removing and disposing of the radioactive materials being stored at these sites. Thus, any successful effort to advance a solution for SONGS SNF will have national-level and industry-wide implications.

2.4 Identification of Alternatives for Assessment

NWT's core task was to identify and assess specific alternatives for moving SNF off the SONGS site. This process started with a broad effort to identify reasonable possible alternatives based on direction provided in the Settlement Agreement, input from stakeholders, and NWT's e xpert judgement. Subsequently, NWT customized the level of assessment applied to each alternative using a set of defined criteria[17] together with input from SCE and the E xperts Team. Concepts that were deemed impractical or too risky (e.g., launching SNF into space) were e xcluded from consideration early in the selection process.

Once we identified the main alternatives to be assessed, we then defined a baseline that includes specific assumptions about details such as facility ownership, site location, title and possession of the SNF, and responsibility for each aspect of transportation. In general, the baseline selected represents the version of the alternative that is best defined or for which the most information is available. For some alternatives, we also developed additional variants. These variants differ from the baseline with respect to one or more detailed characteristics (other characteristics of the variant are assumed to be

[17] Specific criteria included whether the alternative involved a disposition concept that was generally accepted and sufficiently technically mature so as to be well-understood, licensable under e xisting regulatory frameworks, and allow for the development of cost estimates. See further discussion in Chapter 7.

the same as for the baseline). At all stages, NWT conducted background research to ensure that our assumptions and conclusions were fully informed by lessons learned from past experience and by the best available scientific and technical understanding.[18]

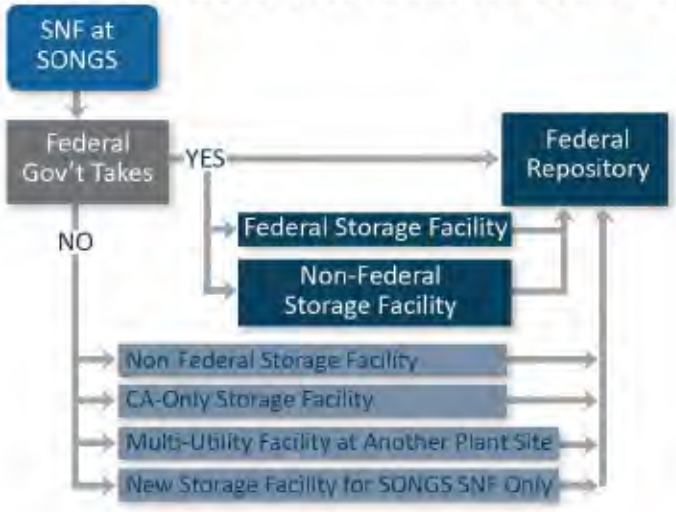
Ultimately NWT selected seven disposition pathways for detailed assessment. An additional category, "other concepts for permanent SNF disposition," was considered but not assessed in detail to capture the possibility that new concepts for SNF management might emerge that could present additional disposition options. These alternatives are listed below and shown in Figure 2.3:

1) Federal permanent geologic repository (Yucca Mountain and/or a new site)
2) Federal consolidated interim storage facility (CISF)
3) Federal use of a non-federal CISF (including various other forms of public/private arrangements)
4) Non-federal CISF
5) CISF for California SNF only
6) Multi-utility CISF at another nuclear plant site
7) New storage facility for SONGS SNF only at another site
8) Other concepts for permanent SNF disposition (beyond current policy and regulatory frameworks)

Worth highlighting in Figure 2.3 are the arrows that lead from all interim storage alternatives, whether federal or non-federal, to a geological repository. This is because the safe disposal of SONGS SNF, and of all the nation's inventory of SNF, ultimately requires permanent geological isolation in a way that provides adequate assurance of public health and environmental protection over very long timescales.

Detailed descriptions of the above alternatives and their variants, and a further description of the selection process itself, may be found in the Chapter 7, which provides the results of NWT's assessment.

Figure 2.3 Alternatives Included for Detailed Assessment



[18] Note that the information presented in this document is current up to December 31, 2020.

3. SPENT NUCLEAR FUEL MANAGEMENT AT SONGS

This chapter expands on the introduction to SONGS provided in the previous chapter, describing in greater detail both the nature of the radioactive materials being managed at SONGS and current arrangements for keeping these materials safely and securely stored at the site. The last section provides an update on decommissioning efforts at SONGS.

3.1 About Spent Nuclear Fuel and Greater than Class C Waste

This Strategic Plan focuses on the removal of two types of radioactive materials from the SONGS site: spent nuclear fuel (SNF) and greater than Class C (GTCC) [19] waste. SNF consists of the used assemblies of fuel rods—long metal tubes holding stacked pellets of uranium oxide—that drive the fission reactions in a nuclear reactor. After a period of four to six years in the reactor core, these fuel assemblies are considered spent and are removed from the reactor.[20] At that point, the assemblies are submerged in pools of water, which both cool the fuel and provide shielding from radiation. After an initial, multi-year period of cooling in pools (i.e., wet storage), nuclear plant operators in the United States have increasingly transferred their inventories of SNF to dry storage.[21] Originally, these dry storage facilities or "independent spent fuel storage installations" (ISFSIs) used casks to hold the bare fuel assemblies. Current practice, however (at all but one site in the United States), is to load the fuel assemblies into stainless steel canisters, which are then seal-welded and enclosed in storage modules or casks made of concrete and steel. Because natural circulation of air provides the necessary cooling at such facilities, no site power or active systems are required to contain and protect the SNF at dry storage ISFSIs. As already noted, the ultimate disposition of SNF requires permanent geological isolation from the biosphere.

To fully decommission SONGS and make the plant site available for other uses, all of the SNF being stored at the site will have to be removed.

GTCC waste is a category of radioactive material that, in the context of nuclear power plant decommissioning, mostly consists of activated metals from the reactor core. Though less radioactively hazardous than SNF, GTCC waste is also currently designated for deep geologic disposal. However, the NRC is currently evaluating the technical basis to support rulemaking that would allow GTCC waste to be disposed of in near-surface, low-level radioactive waste (LLRW) disposal facilities.[22] Such rulemaking, if approved, would create additional disposal options for the SONGS GTCC waste should an existing or new LLRW facility be licensed to receive it. To fully decommission SONGS and make the plant site available for other uses, all of the GTCC and SNF being stored at the site will have to be removed.

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[19] For simplicity, references to SONGS spent nuclear fuel, spent fuel, and SNF in this Plan should be understood to include SONGS GTCC waste unless otherwise specified.

[20] 10 CFR 72.3 defines SNF as "fuel that has been withdrawn from a nuclear reactor following irradiation, has undergone at least one year's decay since being used as a source of energy in a power reactor, and has not been chemically separated into its constituent elements by reprocessing. Spent fuel includes the special nuclear material, byproduct material, source material, and other radioactive materials associated with spent fuel assemblies."

[21] SCE began transferring SNF to dry storage in order to maintain room in the SONGS spent fuel pools for continued plant operation. Many nuclear plant operators did the same since the pools at many plant sites were not designed to hold all the SNF that the plant might generate over its operating life.

[22] "Disposal of Greater than Class C (GTCC) and Transuranic Waste," Draft Regulatory Basis for Public Comment, USNRC, ADAMS Accession No. ML19059A403.

3.2 Current Storage Arrangements for SNF and GTCC Waste at SONGS

SCE began storing SNF at the SONGS site in 1970, two years after Unit 1 came on line. As was industry-wide practice, all of this fuel was stored in pools of water.[23,24] Before dry storage was available on site, some SNF from SONGS Unit 1 was moved to the pools for Units 2 and 3 to create additional space in the Unit 1 pool to support continued Unit 1 operation. Unit 1 was permanently retired in 1992. In 2003, SCE began transferring some SNF to dry storage to create additional space in the Unit 2 and Unit 3 spent fuel pools. First to be moved to dry storage was Unit 1 SNF that was being stored in the Unit 3 pool. Subsequently, all of the SNF in the Unit 1 pool was moved to dry storage, followed by the remainder of the Unit 1 SNF that was being stored in the Unit 2 pool. The Unit 1 spent fuel pool and the rest of the Unit 1 Part 50 facility were dismantled shortly thereafter.

To enable this transfer, SCE received coastal development permits from the California Coastal Commission (CCC) to construct an ISFSI, notified the NRC of its intent to implement dry storage under the SONGS general license, and began loading fuel into the NRC-approved Transnuclear Americas, LLC (hereafter, TN) Advanced NUHOMS® storage system. The NUHOMS® system consists of stainless-steel canisters placed horizontally inside naturally ventilated concrete storage modules. Each TN canister has a design capacity of up to 24 spent fuel assemblies and each concrete storage module holds one loaded SNF canister.

Between 2003 and 2012, 50 SNF canisters were loaded into the SONGS Advanced NUHOMS® storage system (known as the TN ISFSI). In addition, the TN ISFSI currently contains one TN canister that stores GTCC waste from the decommissioning of Unit 1 (Figure 3.1).

As of 2013, all the SNF from Units 2 and 3 had been transferred to their respective unit's spent fuel pool. At that point, the 10 CFR Part 50 operating license for each unit became effectively a "possession-only" license.

In 2014 after the shutdown of the Unit 2 and 3 reactors, SCE decided to commence moving all fuel stored in the spent fuel pool into dry cask storage. SCE reviewed three canister-based SNF storage systems with NRC certificates of compliance (CoCs) for dry storage,[25] including expanding the existing TN Advanced NUHOMS® storage system at SONGS, before selecting the Holtec HI-STORM UMAX storage

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[23] Some period of time submerged in water, typically about five years, is required whenever fuel rods are removed from the reactor core—both to cool the rods and to provide shielding from radiation. Moving older, cooled fuel to dry storage at reactor sites became necessary over time as plant operators ran out of space in the fuel pools to support continued reactor operation.

[24] Between 1972 and 1980, 270 spent fuel assemblies from SONGS Unit 1 were shipped to a facility in Morris, Illinois for reprocessing. The U.S. government's reprocessing initiative was halted in 1977, however, and never restarted. These assemblies have been and will remain in wet storage in Illinois, at a facility that is currently owned by GE Hitachi Nuclear, until such time as they can be shipped to a storage or disposal facility. In addition, SCE moved some spent fuel assemblies from the Unit 1 pool to the Unit 2 and Unit 3 pools in the 1980s.

[25] The other dry storage options SCE considered were the TN (formerly ARE VA) and NAC International systems. In 2014 some members of the Community Engagement Panel and the public encouraged SCE to consider another option: the CASTOR spent fuel cask system (offered by GNS). The CASTOR casks use a bolted-lid design. SCE rejected this option on the grounds that the CASTOR system was not certified for use by general licensees (this certification was a selection criterion). For further details see SCE's November 2019 report titled *Overview of Dry Spent Fuel Storage at San Onofre Nuclear Generating Station.* Accessible at: https://www.songscommunity.com/need-to-know/overview/sce-releases-comprehensive-dry-storage-overview-paper.

system in December 2014. As described by SCE, this system "features a reinforced concrete pad; [1/2 inch] stainless steel cavity enclosure containers, surrounded by a thick concrete monolith, topped with 35,000-pound steel and concrete lids; and 5/8-inch-thick 316L stainless steel canisters." (Note that the 5/8-inch figure refers to the canister walls; canister bottoms are typically 2–3 inches thick and canister lids are 8–9 inches thick to provide extra shielding.)

Figure 3.1 The Advanced NUHOMS® System at the SONGS TN ISFSI

Further technical information about the SNF canister and storage module systems in use at SONGS is provided in a report issued by SCE in November 2019, titled *Overview of Dry Spent Fuel Storage at San Onofre Nuclear Generating Station*.[26] The report details SCE's reasons for selecting the canister-based Holtec storage system. That approach is in line with current practice in the nuclear industry: Of the approximately 3,300 SNF storage systems currently in service at ISFSIs in the United States, over 80 percent employ canister designs that are qualified for both storage and transportation.[27]

The Holtec multi-purpose canisters (MPCs), which are designed to hold up to 37 spent fuel assemblies, were placed in vertical, ventilated UMAX modules located in the concrete monolith built up from partially below grade at the SONGS site (Figure 3.2). Like the TN canisters, the Holtec canisters are certified for transportation inside a larger, NRC-certified transport cask. This will expedite the removal of SNF from SONGS once an offsite storage or disposal facility becomes available.

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[26] The report may be accessed at: https://www.songscommunity.com/need-to-know/overview/sce-releases-comprehensive-dry-storage-overview-paper.

[27] Source: Gutherman Technical Services, LLC. Other casks in storage service include both transportable and non-transportable bare fuel casks and canisters not designed for transportation.

Figure 3.2 The HI-STORM UMAX System at the SONGS Holtec ISFSI

The process of transferring remaining SNF in wet storage to dry storage at SONGS so as to allow for the decommissioning of the plant's above-ground structures, systems, and components, was completed in the summer of 2020. The two canister-based dry storage technologies used at SONGS are dual-purpose-certified by the NRC, which means that the SNF stored in the canisters can be transported in its current configuration. (To ship SNF off site in the future, the canisters will be placed in Type B transportation packages, which are separately certified by the NRC. These transportation packages will include robust, bolted-lid shipping casks designed to withstand even severe hypothetical transportation accidents.)

Seventy-three canisters of SONGS SNF have been placed into the Holtec dry fuel storage system (known as the Holtec ISFSI). All the SNF at SONGS—a total of approximately 1,600 metric tons of uranium (MTU) in 3,855 spent fuel assemblies—is now in dry storage. The TN and Holtec ISFSIs together store 123 SNF canisters (50 TN canisters and 73 Holtec canisters).

In addition to SNF, the decommissioning of Units 2 and 3 is expected to generate GTCC waste (in addition to the one GTCC canister already being stored on site from Unit 1 decommissioning). All of this material will be stored in specially designed TN canisters. The one TN canister containing GTCC waste from the deconstruction of SONGS Unit 1 is currently in storage at the TN ISFSI in an Advanced NUHOMS® horizontal storage module. It is identical to the 24PT1 canister being used to store SONGS Unit 1 SNF in terms of the materials used in canister construction, the canister's external dimensions, and lifting interface points. This was necessary to ensure compatibility with the TN transfer cask, horizontal storage module, and auxiliary equipment used to process and move the canister into ISFSI storage. Internally, the canister is custom designed to accommodate GTCC waste, which is geometrically unlike SNF.

SCE estimates that a total of 12 additional canisters will be used to move the GTCC waste generated by spent fuel pool deconstruction and reactor vessel segmentation into ISFSI storage. Similar to the canister

for GTCC waste from SONGS Unit 1, these canisters are externally identical to the TN 24PT4 canisters being used to store SNF from Units 2 and 3. These 12 GTCC canisters will be placed into Advanced NUHOMS® horizontal storage modules for storage at the TN ISFSI as part of the deconstruction of Units 2 and 3. A total of 13 GTCC canisters will ultimately be in storage at the TN ISFSI.

3.3 Canister Integrity and Inspection and Maintenance Plans

Both canister systems in use at the SONGS ISFSI are fabricated of highly corrosion-resistant Type 316L stainless steel. According to their designers, the canisters have a service life approaching 100 years based on current understanding of materials and service environments. The Holtec canisters and storage modules are subject to the SONGS ISFSI Inspection and Maintenance Program (IMP).[28] In addition, the canisters and storage modules will undergo aging management inspections required under their respective 10 CFR 72 CoC renewals beginning at 20 years of service. The limiting factor for long-term service life is chloride-induced stress corrosion cracking, which is a well understood phenomenon that takes many years—decades—to develop. If these inspections reveal problems, techniques for repairing canisters *in situ* (e.g., metallic overlay) are available.

SCE has implemented a number of specific enhancements to canister and storage system integrity at SONGS, including:

- Use of storage canisters with a shell thickness that exceeds vendor design specifications (TN and Holtec systems);
- Use of a more corrosion-resistant, low-carbon canister material than the industry standard (TN and Holtec systems);
- Over-rolling the canister shells and then relaxing them to eliminate surface tensile stresses (Holtec system);
- Use of high-strength concrete as the subgrade material between the ISFSI support foundation and the top of the concrete pad rather than soil (Holtec system);[29,30] and
- Laser peening of fabrication welds to reduce susceptibility to corrosion as soon as this technique was offered by the canister manufacturer (Holtec system).

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[28] See: https://www.songscommunity.com/used-nuclear-fuel/continued-safe-storage-of-used-nuclear-fuel/inspection-and-maintenance-of-spent-nuclear-fuel-canisters.

[29] The designer permits use of a "controlled, low-strength material," such as a soil–cement slurry, as the subgrade material (HI-STORM UMAX FSAR Section 1.2.2.e).

[30] The fully welded, stainless steel vault shells are designed to prevent groundwater intrusion into the space where the canister is stored. In this design, the surrounding concrete provides an additional barrier such that groundwater, if it ever rose above the level of the ISFSI support foundation, would have to penetrate through tightly compressed, horizontal construction joints in the concrete to reach the vault shells.

In addition, SCE has:

- Pioneered industry-leading application of an in-situ, robotic-delivered metallic overlay (i.e., "cold spray") technology for canister remediation if the need arises;
- Adopted an IMP for the SONGS ISFSI more than a decade ahead of when such a plan is required by the ISFSI license;
- Added an inspection "test" canister to the Holtec system that will contain no fuel, but will be heated to levels as if it did hold fuel, so that it can be easily extracted for examination without concern for any potential worker exposure to radiation;
- Implemented an ISFSI radiation monitoring system, including sharing of collected data with the surrounding community, and
- Worked with the Community Engagement Panel (CEP) to address subjects of interest or concern to the community. For example, special meetings of the CEP have focused on subjects such as "defense in depth" and responses to potential events that could arise outside the "design basis threats" used to develop current storage requirements. (The CEP is described in detail in Chapter 4)

As a result of these steps, the on-site storage program for SONGS SNF meets or exceeds current industry standards and applicable regulatory requirements with respect to safety and performance. The SONGS ISFSI will also be subject to ongoing NRC oversight and periodic license review and renewal in future years while the SNF remains on site. Key checkpoints on the safety of the on-site storage program include the regulatory submittals, reviews, and inspections associated with the following:

- Renewal of the coastal development permit (CDP) for the TN ISFSI in 2022;
- Renewal of the NRC 10 CFR 72 CoC for the TN cask system by 2023;
- Renewal of the NRC 10 CFR 72 CoC for the Holtec cask system by 2035;
- Renewal of the CDP for the Holtec ISFSI in 2035 (as a condition for renewal, SCE is required to prepare an updated assessment of potential coastal hazards, including sea-level rise, and associated impacts on the ISFSI); and
- Continuation of the NRC Part 50 License for the site, including periodic NRC inspections, until the site is fully decommissioned and all SNF is moved off site.

The on-site storage program for SONGS SNF meets or exceeds current industry standards and applicable regulatory requirements with respect to safety and performance.

3.4 Requirements to Assess Long-Term Site Risks

Of note, in light of SONGS's proximity to the coast, is the requirement to prepare an updated assessment of coastal hazards, including climate-change-induced sea-level rise, when SCE seeks an amendment to renew its CDP for the addition of the Holtec ISFSI in 2035. Elevations at the SONGS site range from 13 to 80 feet above mean lower low water (MLLW), with some structures, including the TN ISFSI, at roughly 20 feet above MLLW. Due to its built-up design, the top of the Holtec ISFSI is at

approximately 32 feet above MLLW.[31] In addition, the site as a whole is protected by a seawall, which has a crest elevation of 28 feet above MLLW.

Impacts from sea-level rise were addressed in the Final Environmental Impact Report (FEIR) for the decommissioning of SONGS Units 2 and 3, which was certified by California's State Lands Commission in March 2019, and in SCE's application for a CDP for the dismantlement of above-grade structures at SONGS in 2019. As part of that application, SCE analyzed the potential for sea-level-rise-induced flooding at SONGS using sea-level rise projections from the California Ocean Protection Council, as recommended in CCC-issued guidance from 2018. The most extreme scenario consistent with that guidance—the non-probabilistic H++ scenario—projects a mean sea-level rise of 3.1 meters (10 feet and 2 inches) at the SONGS site by 2100 (relative to sea level in 2000). Based on this analysis and given the height of the seawall, SCE concluded that the effects of coastal processes on SONGS would be "negligible" until the seawall is removed, which would not occur until after the ISFSI is removed and the site is fully decommissioned.[32]

The CCC concurred with this conclusion in approving the 2015 CDP, but also required that the reassessment due as part of the CDP renewal in 2035 must include "an evaluation of current and future coastal hazards based on the best available information" as well as a "plan for managed retreat, if retention of the ISFSI facility beyond 2051 is contemplated and coastal hazards may affect the site within the timeframe of the amended project."[33] Among the coastal hazards to be considered is the possibility that sea level rise could make the SONGS site more susceptible to inundation in the event of a tsunami (Box 3.1).

The 2019 FEIR estimated that tsunami elevations could be as high as 22 feet above MLLW, taking into account 13 inches of sea-level rise, which is the maximum projected for sea-level rise in the 2030–2040 timeframe under the most extreme scenario included in the CCC guidance. Based on the 28-foot height of the seawall, current tsunami protection at the site has been deemed adequate, although a footnote to the CCC staff report on the CDP application notes: "In the longer-term, actual tsunami run-up heights may be higher depending on the actual rate of sea level rise and would also depend on factors such as tide level and presence of storm surge or an El Nino event."[34]

Another concern related to climate change involves the potential for changes in the water table beneath the ISFSI. Analysis by SCE engineers indicates that the water table will remain below the ISFSI foundation for at least the next 30 years based on current climate change projections.[35]

Several features of the SNF storage system at SONGS are designed to enhance resistance to groundwater intrusion. These features are described in Section 3.3. In addition, there is contact

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[31] CCC Staff report on CDP Application 09-15-0228 (6/11/15), Section IV.D.

[32] CCC Staff Report on CDP Application 09-19-0194 (9/26/19) at https://documents.coastal.ca.gov/reports/2019/10/Th12a/Th12a-10-2019-report.pdf; Coastal Environments, Inc. Oceanographic and Coastal Services. 2018. Letter to Southern California Edison regarding assessment of H++ MSLR Scenario and Coastal Processes at SONGS. Submitted as part of application for Coastal Development Permit 09-19-1904.

[33] CCC Staff report on CDP Application 09-15-0228 (6/11/15), p. 44.

[34] *Ibid*. Regarding the potential for even higher water levels, the 2015 CCC permit application includes a flooding elevation estimate of 26.5 feet above MLLW under a set of worst-case conditions that combines a large El Nino event with extreme sea level rise, high tide, and storm surge. This is obviously closer to, but still below, the height of the sea wall. See: CCC Staff report on CDP Application 09-15-0228 (6/11/15), Section IV.D.

[35] The groundwater issue is also addressed in the 2015 CCC staff report.

between seawater and concrete at several existing engineered structures in the area (e.g., bridges, dams, etc.); these structures are available as indicators of seawater-induced aging impacts over time.

Box 3.1: ISFSI Features Relevant to Flooding Risks

Several features of the current TN and Holtec ISFSIs are specifically designed to address risks from flooding events, including potential water inundation due to a tsunami. The foundation of the TN ISFSI is located at elevation 19.75 feet above mean lower low water (MLLW). Tsunami-induced forces were evaluated to address overturning, sliding, flooding, and debris. The overturning and sliding forces were found to be bounded by the SONGS seismic criteria—the storage modules do not slide or overturn as a result of a design basis seismic event. A probable maximum precipitation (PMP) event (up to 12.25 inches of rain in six hours) could result in a flood level at the TN ISFSI of 8.25 feet. The TN Advanced NUHOMS® storage modules are designed for a flood level of 50 feet and water velocity of 15 feet per second. The site stormwater management system ensures runoff from the PMP is directed to desired locations, which keeps the velocity of the water at the TN ISFSI site negligible. Therefore, the TN ISFSI flooding design criteria bound the site conditions with significant margins of safety. The flooding height resulting from a tsunami is bounded by the TN storage module design flood height of 50 feet. The potential debris generated by a tsunami could block the TN storage module inlet vents and cause debris impact on the storage modules. These two conditions are bounded by the blocked storage module vent accident condition and the design basis tornado missile accident described in the Advanced NUHOMS® System Final Safety Analysis Report (FSAR).

As discussed in the main text, the Holtec UMAX ISFSI is built up from partially below grade. The lowest point of the finished surface of the UMAX ISFSI top pad is above elevation 31 feet. Based on the results of the flooding evaluation performed for the UMAX ISFSI, the maximum flood elevation was determined to be 21 feet and 6 inches as a result of a PMP event. Additionally, as described in Sections 2.4S.3 and 2.4S.6 of the SONGS UFSAR/DSAR for Units 2 and 3, the calculated highest run up at the seawall due to storm waves occurring during a tsunami is elevation 27 feet. Further, flooding from the ocean side is limited to approximately elevation 28 feet, which is the top elevation of the seawall. The UMAX ISFSI is designed to withstand a flood height of up to 125 feet. The maximum floodwater velocity allowed by the UMAX design is 15 feet per second. As discussed above for the TN ISFSI, floodwater velocity at the ISFSI area is negligible. Therefore, the flooding criteria of the SONGS site are bounded by the UMAX ISFSI design criteria.

3.5 The Decommissioning Process at SONGS

As noted in our introduction to SONGS in the previous chapter (Section 2.1), the overall process for decommissioning SONGS is spelled out in the Post-Shutdown Decommissioning Activities Report (PSDAR), which was submitted to the NRC in 2014 and finalized, after public review and comment, in September 2015. The PSDAR includes a decommissioning cost estimate and an "Irradiated Fuel Management Plan"[36] as well as detailed information about decommissioning activities and schedules, and an assessment of potential environmental impacts. Decommissioning activities, which are being handled by a general contractor, SONGS Decommissioning Solutions (SDS), are subject to NRC oversight, including unannounced site inspections.

SCE estimates that the decommissioning process will employ approximately 600 people over the estimated eight to ten years required to fully dismantle the facility. Dismantlement will occur in stages, as various plant structures are cleared to make room for the preparation and transport of materials,

[36] The Irradiated Fuel Management Plan (IFMP) focuses on financial adequacy and is not a detailed plan for managing SONGS irradiated fuel. Both the PSDAR and IFMP were updated in 2020.

including steel, concrete and reinforcing bar, away from the site, and to prepare for the removal of the containment domes. The Part 50 licenses for the three reactor units will be retained until all SNF is removed from the site, the ISFSI has been decommissioned, and final site restoration has been performed.

The cost of decommissioning SONGS is being covered by trust funds that were created during the years the plant operated, using fees collected from SONGS customers, plus interest. (All nuclear power plant operators are required by the NRC to put aside funds for decommissioning.)[37] At $3.9 billion as of the end of 2019,[38,39] SCE currently estimates that the size of the SONGS trust funds will be sufficient, with projected earnings on existing funds, to fully cover the remaining estimated $3.4 billion cost of decommissioning. Any unused funds at the end of the decommissioning process will be returned to customers. [04]

SCE and the other SONGS co-owners have articulated several core principles for guiding the decommissioning process, among them a commitment to safety, stewardship, and engagement: [14]

> *"We are determined to complete the safe decommissioning of San Onofre as expeditiously and cost efficiently as possible. Our immediate goal is to safely move the power plant's used nuclear fuel, now cooling in pools, into dry cask storage as quickly and as carefully as we can until the government creates the long-term storage option that it has committed to implement. We will continue to urge the government and other stakeholders to find a solution to provide the timely removal of used nuclear fuel from the San Onofre site."*

With regard to stewardship, the SONGS co-owners have a stated commitment to "leaving the community better off as a result of having been home to San Onofre for 40 years" and to spending the resources in the decommissioning trust fund "wisely."

With regard to engagement, the company has stated its commitment to managing the decommissioning process "in an inclusive, forward-thinking and responsible way." [28] This includes taking input from a Community Engagement Panel (CEP) that was created by the plant's co-owners to "bring together diverse stakeholders and open a conduit of information and ideas between the owners and the public." [31] The role of the CEP and some of the actions at SONGS that have been prompted by CEP input are discussed in the next chapter.

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[37] Note that these decommissioning trust funds were set up and funded in expectation that the federal government would fulfill its statutory and contractual obligations with respect to the acceptance and disposition of SONGS SNF. They do not include additional funds to cover expenses that might be incurred as a result of the federal government's failure to perform.

[38] Source: SCE letter to NRC, "Decommissioning Funding Status Report for Calendar Year 2019," dated March 17, 2020 (ADAMS Accession No. ML20079J032).

[39] According to SCE, of the $3.9 billion, approximately one-third was collected from customers and another two-thirds was generated by prudent investment of the funds.

[04] See: https://www.songscommunity.com/about-decommissioning/decommissioning-san-onofre-nuclear-generating-station/our-guiding-principles.

[14] *Ibid*.

[28] *Ibid*.

[31] *Ibid*.

4. SONGS STAKEHOLDER RELATIONSHIPS AND PERSPECTIVES

Stakeholder support will be important to achieve the Strategic Plan's objectives. This includes both support for the activities involved in moving SONGS SNF off site and support for the development of a facility that can receive the SNF, which is likely to present greater challenges in terms of public and stakeholder acceptance. Siting challenges for an offsite SNF storage or disposal facility, along with lessons learned from siting experience in the United States and internationally, are discussed elsewhere in this report. This chapter focuses on stakeholder roles and perspectives as they relate to the SONGS site and to plans for removing the SNF that is currently being stored there.

The first sections of this chapter focus on the relationship between SONGS and local communities, the U.S. Navy, and the state of California. The second part of the chapter describes NWT's stakeholder engagement efforts as part of the Strategic Plan development process. The federal government has primary responsibility for regulating nuclear waste management facilities and activities; its role is discussed at length in the next two chapters. Recent efforts in Congress to address the federal role are described in Section 5.6.

4.1 Local Community Relationships and the Role of the Community Engagement Panel

SONGS is surrounded by a number of communities and jurisdictions, including Orange and San Diego Counties, and, notably, the towns and cities of San Clemente (which is closest to SONGS), Dana Point, San Juan Capistrano, and Laguna Beach to the north; and Oceanside, Del Mar, and Solana Beach to the south. The plant site itself is located within the service territory of San Diego Gas and Electric. SCE is one of the largest retail providers of electricity service in the country, serving more than 15 million people in a 50,000-square-mile area of central, coastal, and Southern California.

Due to its highly visible presence from the I-5 freeway and nearby coastline, awareness of SONGS's existence among the broader public in the Southern California region is generally high. SONGS itself did not attract significant opposition or controversy for much of the time that it operated to produce electricity. A few stakeholders interviewed as part of the Strategic Plan development process did, however, reference controversy around the initial siting of the plant at its current location on the beach. According to one interviewee, many local residents argued at the time that a more inland location would be preferable.

The steam generator problem that prompted the temporary closure of Unit 3 in 2012, and the permanent shutdown of both the Unit 2 and 3 reactors in 2013, drew increased attention to SONGS and led to a surge of activism aimed at ensuring that SONGS would be permanently closed and decommissioned. In addition, events at the Fukushima Daiichi plant in Japan in 2011 likely heightened public awareness of nuclear safety concerns and SNF management issues in particular. [44][45]

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[44] On March 11, 2011, a tsunami generated by an earthquake off the coast of Japan caused flooding that damaged the backup generators at the still-operating Fukushima Daiichi Nuclear Power Plant. This led to a partial loss of containment and a release of radiation over land and into the sea. SONGS, by contrast, has been shut down since 2012 and is being decommissioned. With all SNF moved out of the storage pool, which required water to be circulated by pumps, SONGS no longer has active safety systems that require electricity to operate.

[45] See, for example: https://www.sandiegouniontribune.com/opinion/editorials/sdut-from-fukushima-to-san-onofre-2012mar10-story.html; https://www.latimes.com/opinion/op-ed/la-oe-chapple-san-onofre-20180815-story.html; https://www.thedailybeast.com/latest-accident-at-san-onofre-nuclear-plant-worries-activists-residents.

As already noted, the SONGS co-owners established a Community Engagement Panel (CEP) in 2014 to facilitate communication with local communities and groups, among other stakeholders, about all aspects of the decommissioning process. [68] The CEP is a volunteer, non-regulatory body; besides its mission to enhance and foster open communication, public involvement, and education on SONGS decommissioning activities, it is also intended to serve as a conduit for public information and to encourage community involvement and communication with SONGS co-owners on matters related to decommissioning. The CEP is not a decision-making body.

The CEP has 18 members and meets publicly on a quarterly basis. SCE facilitates the recruiting of CEP members in consultation with the other SONGS co-owners and/or working with local entities, such as city governments, which appoint their own representatives. The SONGS co-owners also appoint the CEP chairperson and vice-chairperson; SCE handles meeting logistics and provides administrative support. [71] Meetings are held in the local communities around SONGS; they are also streamed live and can be viewed after the event. Due to the COVID-19 pandemic, meetings during 2020 were held exclusively online to allow for physical distancing. Recorded meetings and meeting minutes are posted on the SONGS website: www.songscommunty.com. [88]

In its role as the primary conduit between the general public and SCE, the CEP has attempted to work closely with individuals who express interest in focusing on particular SONGS-related issues as they emerge, including seeking public input on recommended agenda items for future meetings.

The CEP has conducted extensive work and outreach in the following areas:

- Defense in depth. The CEP prepared a paper on the safety of long-term cask storage, organized a special meeting on this topic, and subsequently developed related recommendations.
- Canister design. Although the Holtec system likely would have been selected based on its seismic specifications regardless of CEP input, the below-grade attributes of the Holtec system were important to CEP members, who also valued the extra thickness and laser peening of canister welds as part of SCE's use of this system.
- Outlier events. The CEP organized a special session, held on May 28, 2020 and titled "Outlier Events and Response Strategies," to examine potential risks and impacts to SONGS as a result of sea-level rise, security threats, and other issues. [91] A public petition, which had collected 155 signatures when it was filed in March 2018, was a contributing factor in organizing this session, along with ongoing CEP and SCE discussions. A record of the session and access to online libraries with current information on natural and human outliers are available at www.songscommunity.com (the online libraries will continue to be updated in the future).

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[68] Details about the structure of the CEP and its relationship to SCE may be found in the CEP charter: https://www.songscommunity.com/internal_redirect/cms.ipressroom.com.s3.amazonaws.com/339/files/20182/SONGS_Decommissioning_CEP_Charter.pdf.

[71] While CEP members serve on a volunteer basis and are not compensated for their time, the SONGS co-owners cover certain expenses, such as travel expenses, to participate in CEP activities.

[88] See: https://www.songscommunity.com/community-engagement/community-engagement-in-decommissioning.

[91] See: https://www.songscommunity.com/internal_redirect/cms.ipressroom.com.s3.amazonaws.com/339/files/20182/LongTermStorageofSpentFuel_12091_4pdf.

- **National-level policy. The CEP as a group and some of its volunteer participants as individuals have met with local and national elected leaders and with government agency representatives to make the case for the necessity of an effective national strategy for SNF management and disposal.**

In several cases, issues raised by the CEP have led to specific actions by SCE to address community concerns. Examples include laser peening canister welds to minimize their susceptibility to corrosion and adding a spare inspection "test" canister to the Holtec dry storage system (discussed in Section 3.3).

SCE's engagement with communities around SONGS is not limited to the CEP: the company also conducted regular speaking events with local non-governmental organizations (NGOs), provided support to a number of local non-profit organizations, and offered public tours of the plant site. Since 2014 more than 2,500 members of the public have toured the SONGS site.

A few additional actions taken by SCE in the decommissioning process were prompted by community interest and later codified in state permitting processes. These include implementing a radiation monitoring system for the ISFSI and providing 48 hours of advance notice for batch releases of wastewater (the wastewater is first cleaned and diluted before being discharged more than a mile offshore through the conduits shown in Figure 2.1).[50]

Interest in the nation's broader nuclear waste management and disposition challenges has generally increased among those individuals who are actively following developments at SONGS, particularly as these individuals have become more aware of how the breakdown of the national-level program affects the options available for relocating SONGS SNF. (Among the broader public, by contrast, awareness and interest in these issues is likely considerably lower.[51]) Even as a majority of the people NWT interviewed express concern about the prospect of SNF remaining at the site for an indeterminate length of time, most also understand that there is no actionable, near-term option for temporarily storing or disposing of the spent fuel off site. And most realize that responsibility for the current impasse in finding a permanent disposal solution for SNF lies not with SCE, but with the federal government's failure to begin taking spent fuel for final disposition as required by current law and contract. Among groups and individuals who follow nuclear waste issues, this has put more focus on storage methods and systems for safely managing the SNF at SONGS and other reactor sites.

4.2 The U.S. Navy Relationship

The entire SONGS site is located on Camp Pendleton, an active military base used by the U.S. Marine Corps for training service members. The total area of Camp Pendleton is about 125,000 acres; SONGS-

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[50] An ISFSI radiation monitoring system was originally recommended by Gene Stone of Residents Organized for a Safe Environment; it was recognized as an "applicant proposed measure" in the environmental impact report on the SONGS ISFSI that was prepared for the California State Lands Commission. The radiation monitoring system has since been implemented and now streams data from an array of monitors around the SONGS ISFSI, in real time, to three state agencies, including the California Department of Public Health Radiologic Health Branch. For more information, see https://www.songscommunity.com/stewardship/environmental-monitoring-around-san-onofre/dry-fuel-storage-radiation-monitoring. Information about batch releases of wastewater can be accessed at: https://www.songscommunity.com/stewardship/environmental-monitoring-around-san-onofre/liquid-batch-releases.

[51] A broad-based survey of public opinion in the communities around SONGS would be required to generate more specific data on public views and awareness in the region.

related easements and leases total approximately 2,040 acres (excluding SCE and SDG&E transmission line easements). As the longtime operator and current decommissioning agent for SONGS, SCE has maintained a close working relationship with the Navy and Camp Pendleton.

The U.S. Navy issued four easements and a lease to SCE and SDG&E for the SONGS site. The initial easement for the 84-acre parcel occupied by SONGS was authorized by Congress in 1963 and issued in 1964 with a 60-year term. The easement authorizes use of the land for "the construction, operation, maintenance and use of a nuclear electric generating station, consisting of one or more generating units, and appurtenances thereto."[52,53,54] In December 2019, SCE submitted an application to the Navy to extend its land-use rights at the SONGS site through the end of the decommissioning process and until such time as the spent fuel is moved offsite. In addition, SCE requested that the Navy's "end state" land use decision, including future final site restoration conditions, be made after the spent fuel removal schedule is known.

In the 1970s, the Navy granted SCE a short-term license, followed by a lease encompassing an additional 135 acres, for auxiliary facilities to support the construction of SONGS Units 2 and 3. This land is located east of Interstate 5 at a site that is colloquially known as "the Mesa." The Mesa lease is due to expire in May 2023. SCE intends to return the Mesa to the Navy for training purposes. In a letter to the NRC in May 2018, U.S. Marine Corps Lieutenant General Michael Dana, writing on behalf of the commandant of the Marine Corps, requested the NRC's support in "seeking to expeditiously relocate" SONGS spent fuel off Camp Pendleton. In the letter, Lieutenant General Dana stated that relocating the fuel to a more inland location, off the base, would "promote Marine Corps security and safety interests, as well as restore valuable coastal land to military use." Consistent with this position, SCE's view is that the Navy would not support moving the SONGS SNF to another location within Camp Pendleton.

4.3 State of California Relationship

Although most of the direct regulation of nuclear facilities and materials occurs at the federal level, SCE staff work closely on an ongoing basis with California agency leadership and staff on a range of issues, including, but not limited to, SONGS. The California Coastal Commission (CCC), for example, has a role in approving certain activities at SONGS: A CCC permit was required to expand the SONGS ISFSI, as discussed in Chapter 3. In addition, state authorities would certainly be involved in planning for transportation infrastructure investments and shipping activities associated with moving SNF away from the site.

Other state agencies also have important relationships with SCE and are clearly stakeholders in the successful decommissioning of SONGS. For example, the California Public Utilities Commission (CPUC), exercises state-level oversight over regulated utility companies, including SCE and SDG&E, that provide electricity service to California customers. This oversight applies to the use of funds from the SONGS decommissioning trust funds and to any other expenditures or investments for which SCE and SDG&E might seek cost-recovery from their customers.

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[52] SCE and San Diego Gas & Electric share a four-fifths and one-fifth interest in the lease arrangements, respectively.

[53] Public Law 88-82, approved July 30, 1963, authorizes the Secretary of the Navy to grant the easement and lease the property for the specified purposes.

[54] "Grant of Easement between the United States of America through the Department of the Navy, and Southern California Edison Company and San Diego Gas & Electric Company, May 12, 1964

Another important state agency, the California Energy Commission (CEC), is the state's official liaison to the Nuclear Regulatory Commission. As such, it is the clearinghouse for organizing interagency policy positions on nuclear matters at the state level and often represents California at national and regional interstate meetings. CEC's major mission responsibilities include power system planning and ensuring that the state has adequate electricity generating resources, including reviewing proposals for new power plant construction. In addition, the CEC maintains an inspection and enforcement program to ensure that thermal power plants are, among other responsibilities, decommissioned in accordance with their permits. Finally, the CEC is also the lead state agency for the transportation of SNF and transuranic waste (see the Conceptual Transportation Plan, Vol. III, for more details.)

Other state agencies that have an interest in the successful decommissioning of SONGS include the California Environmental Protection Agency, which regulates hazardous waste contaminated with low levels of radioactivity; the California Department of Public Health, which maintains a nuclear emergency response program and a radiological health oversight program; the California State Lands Commission, which manages "sovereign or Public Trust lands," tidal and submerged lands, and the beds of natural navigable rivers, streams, lakes, bays, estuaries, inlets, and straits; the California Department of Parks and Recreation, which manages nearby San Clemente, San Onofre, and Doheny State Beaches; and the California Ocean Protection Council, which is charged with improving the protection, conservation, restoration, and management of coastal and ocean ecosystems.

4.4 Perspectives from Stakeholder Interviews

Social and political acceptance is crucial to the successful implementation of any nuclear waste management activity or facility. Experience has shown that solely top-down, mandate-driven approaches consistently produce years, and even decades, of contentious legal and regulatory wrangling. As a result, past efforts to site new consolidated storage or disposal facilities for SNF have ended in failure more frequently than not. But experience in the United States and in other countries also suggests that progress is possible when these issues are approached in a manner that meaningfully engages and empowers states, tribes, local governments, key stakeholders, and the public.

Progress is possible when issues are approached in a manner that meaningfully engages and empowers states, tribes, local governments, key stakeholders, and the public.

Between July 2019 and May 2020, NWT conducted one-on-one interviews with 68 individuals—including members of local communities and tribes, environmental organizations, local business and labor groups, and local governments, including representatives of school districts, emergency services, and other public officials—to better understand their views and perspectives with regard to the management and future disposition of SONGS and SONGS SNF. Members of the public were also invited to submit input to the Strategic Plan through the SONGS website (www.SONGScommunity.com).

NWT did not attempt to a conduct a broad-based survey of opinions concerning SONGS and SONGS SNF, either in the surrounding communities or in the broader Southern California region. Thus, the views summarized here should not be taken as representative of the views of the general public.

NWT's interviews were designed to accomplish several goals:

- Help ensure that the Strategic Plan development process is comprehensive, in the sense that it considers a full range of options for the disposition of spent fuel at SONGS, including innovative proposals or solutions.

- Build trust with local stakeholders and establish relationships that will be critical, not only to the credibility of the Strategic Plan itself, and to public trust in the integrity of the Strategic Plan development process, but to SCE's ability to implement elements of the Strategic Plan in the future.
- Learn what the public and stakeholders desire and expect in terms of ongoing involvement and information exchange once the Strategic Plan is complete, and build the mechanisms needed to support continued engagement in the implementation phases of spent fuel management and removal at SONGS.
- Learn about other issues and concerns local stakeholders may have that SCE is not aware of or has not yet encountered.

Local stakeholders generally share the view that the SONGS site is not appropriate for very long-term storage of SNF.

As the sampling of views in Box 4.1 illustrates, the people NWT interviewed are, for the most part, strongly supportive of efforts to relocate the SONGS SNF. Like SCE, many of these individuals view the current site as not appropriate for storing SNF over very long (e.g., greater than 75- or 100-year) timeframes. Proximity to major population centers and to the coastline, in a seismically active region, are among the site characteristics that local stakeholders often mentioned in expressing this view. Several interviewees saw climate change as an important issue that could pose long-term risks to the ISFSI. Some interviewees also cited concern about events such as earthquakes[55] or tsunamis and even terrorist attacks.[56]

[55] The coastline of California is generally considered to be seismically active, but a staff report of the California Coastal Commission on SCE's application for a coastal development plan for the decommissioning of SONGS Units 2 and 3 concludes: "In general, seismicity in the vicinity of SONGS has historically been relatively quiet compared to much of the rest of southern California, probably because of the relatively great distance from the San Andreas Fault, which accommodates most of the plate motion in the area, and the relatively low slip rates of the nearer faults." See: https://documents.coastal.ca.gov/reports/2019/10/Th12a/Th12a-10-2019-report.pdf (p. 25).

[56] Among the small number of interviewees who mentioned a concern about terrorist attacks, the plant site's coastline location was seen as increasing its vulnerability to an external threat of this type.

Box 4.1: Examples of Views Expressed by Local Stakeholders in Interviews

In dozens of interviews with local stakeholders who are following developments at SONGS, NWT heard a wide range of views and perspectives. A few direct quotes, reproduced below, help to give a flavor of the input we received.

"[The SNF] is too risky where it is and yes, I do believe [SONGS] is unique. I am sure there are others and they can do what they need, but I live along with millions right here where it is at risk."

"Although the waste may be considered safe for now, it would be naïve to think it will remain so and we need to start planning today for the uncertainties of tomorrow."

"I never thought of [interim storage at] a currently operating plant but that sounds very intriguing. It still doesn't help the big picture that we face and kicks the can down the road. We need to always keep the end game in mind."

"I don't want [SNF] to be moved without consent and if we can get [consent] in CA that may be the best."

"If someone wants to take the waste and they agree to and feel respected in the process it is fine by me."

"SCE needs to be the quarterback- the one working with all sides to make the plays and the touchdown. They should show more leadership and communicate better with us. They used to do this when the plant was operating but not anymore."

"I am also not so naïve to think that this is without major obstacles, permitting, political, military, cost. Having said that…these obstacles are something we must work to overcome. I live here. I do not want to pass this problem on to my children or grandchildren."

Not surprisingly, the integrity and safety of dry storage arrangements at SONGS for as long as the SNF is still on site emerged as a key priority in most interviews. A related focus, especially for local public officials, was maintaining good communication with SCE on issues such as emergency response plans, canister inspection and maintenance activities, and efforts to relocate the SNF.[57]

As already noted, NWT's stakeholder engagement effort focused on individuals and groups that have had some involvement with SONGS or who are following events at the plant site, including a few individuals who are active in nuclear waste policy discussions at the national level. Thus, interest in and awareness of the broader challenges and issues linked to relocating the SONGS SNF is almost certainly higher among the interview group than in the general public.

Most of the people NWT interviewed, for example, were aware that no immediate offsite storage option exists, and several understood that a federal solution for SONGS SNF could take decades to materialize. In light of this long timeframe, several interviewees expressed support for efforts to find a more suitable interim storage site pending the availability of a permanent repository. However, NWT also heard from a small number of stakeholders who are opposed to moving the SNF before a permanent disposal

[57] Among interviewees who expressed concern about communications with SCE, several referenced a specific incident that occurred in August 2018 during a fuel transfer operation at SONGS. The incident itself occurred when a multipurpose canister filled with SNF became stuck as it was being lowered into the underground storage vault. The situation was resolved successfully, and the canister did not drop. There was no release of radioactive material and no further hazard to workers. The public learned of it, however, when a worker disclosed the incident during a CEP public comment period held a few days later. For an NRC review of the incident see: https://www.nrc.gov/reactors/operating/ops-experience/songs-spec-insp-activities-cask-loading-misalignment.html.

repository is available—whether out of a desire to minimize transportation risks (i.e., don't move fuel twice) or because of environmental justice concerns (i.e., don't shift the SONGS communities' burden to some other community). Many of these individuals also advocate for constructing a "hardened" ISFSI at the SONGS site. Finally, some activists have raised concerns about the canister design being used at SONGS.[58]

Among interviewees who expressed support for pursuing offsite interim storage of SONGS SNF, several thought that the idea of partnering with other utilities to develop a consolidated interim storage facility at another site, potentially within California (as part of a statewide solution for commercial SNF being stored at the state's four nuclear plant sites), or potentially at another nuclear plant site outside the state, was "intriguing" or worth exploring. A point that was raised in multiple interviews was the need to obtain a threshold degree of support or acceptance from the communities around any new facility that might be proposed to receive SONGS SNF. Some of these ideas are reflected in the sampling of views shown in Box 41.

[58] Among interviewees who expressed skepticism about whether the casks currently in use at SONGS were adequate to safely store the fuel for very extended periods of time, several also spoke in favor of retaining a spent fuel pool at SONGS in case SNF needed to be repackaged in the future because a cask was damaged and need of repair.

5. NATIONAL PICTURE AND HISTORICAL CONTEXT FOR SPENT NUCLEAR FUEL MANAGEMENT

This chapter provides national context for the Strategic Plan and for the assessment of alternatives and development of recommendations in later chapters. The first section of the chapter contains information about the quantity of SNF being stored at other nuclear plant sites around the country; later sections review the history of the U.S. nuclear waste management program and summarize some of the important regulatory and policy parameters that govern decision-making in this space. The chapter closes with an overview of other countries' repository programs and a summary of lessons learned.

5.1 The National Picture for SNF Management

According to the Nuclear Energy Institute, the nation's inventory of SNF from commercial reactors totaled nearly 84,000 MTU as of the end of 2019.[59] This inventory is currently being stored at 76 locations across 35 states.[60] Most of these sites store SNF in both a spent fuel pool and in dry storage at an on-site ISFSI. The U.S. Department of Energy (DOE) currently stores commercial SNF at Fort St. Vrain in Colorado and at Idaho National Laboratory.[61] In addition, 3,217 SNF assemblies are stored at the GE-Hitachi facility in Morris, Illinois, including 270 assemblies from SONGS Unit 1.[62] Nationwide, 19 ISFSIs are located at shutdown plant sites, as of the end of 2020. An additional three plant sites (Indian Point, Palisades, and Diablo Canyon) are scheduled to shut down by 2025 (Figure 5.1). By 2030, there will be 25 shutdown plant sites with SNF from 31 reactors; as of 2040, the number is expected to increase to 37 shutdown sites and 54 reactors (see Appendix D).[63] More plants will follow as reactors become uneconomic to operate or reach the end of their operating licenses in subsequent years. Thus, the number of SNF storage facilities at closed plant sites is expected to rise dramatically in the coming decades.

Figure 5.2 shows the number of SNF storage sites (DOE or commercial) in each state, as well as the quantity of waste stored. Illinois leads both metrics with eight reactor sites and around 10,400 MTU of SNF as of December 2020. California had around 3,300 MTU of SNF stored at its four nuclear plant sites., the eighth-most of any state.[64]

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[59] See: https://www.nei.org/resources/statistics/used-fuel-storage-and-nuclear-waste-fund-payments.

[60] This figure includes 70 NRC-licensed ISFSIs at operating and shutdown nuclear plant sites; plus the three ISFSIs at GE Morris, Idaho National Laboratory, and Fort St. Vrain; plus three additional nuclear plant sites with no ISFSI (Three Mile Island, Wolf Creek, and Shearon Harris) for a total of 76. A very small additional amount of commercial SNF is stored at DOE's National Laboratories, where it was sent for research or other reasons (e.g., after the abandonment of reprocessing activities at West Valley).

[61] The material stored at Idaho National Laboratory is debris from the accident at Three Mile Island Unit 2.

[62] 10 CFR 72 Special Nuclear Materials license SNM-2500, Docket 72-01.

[63] Assuming no second license renewals.

[64] Note that Table 7.6 shows a higher total, approximately 3,800 MTU, because it includes projected SNF from the continued operation of the two units at Diablo Canyon to 2024 and 2025.

Figure 5.1 Shutdown Nuclear Plant Sites in the United States (Current and Announced)

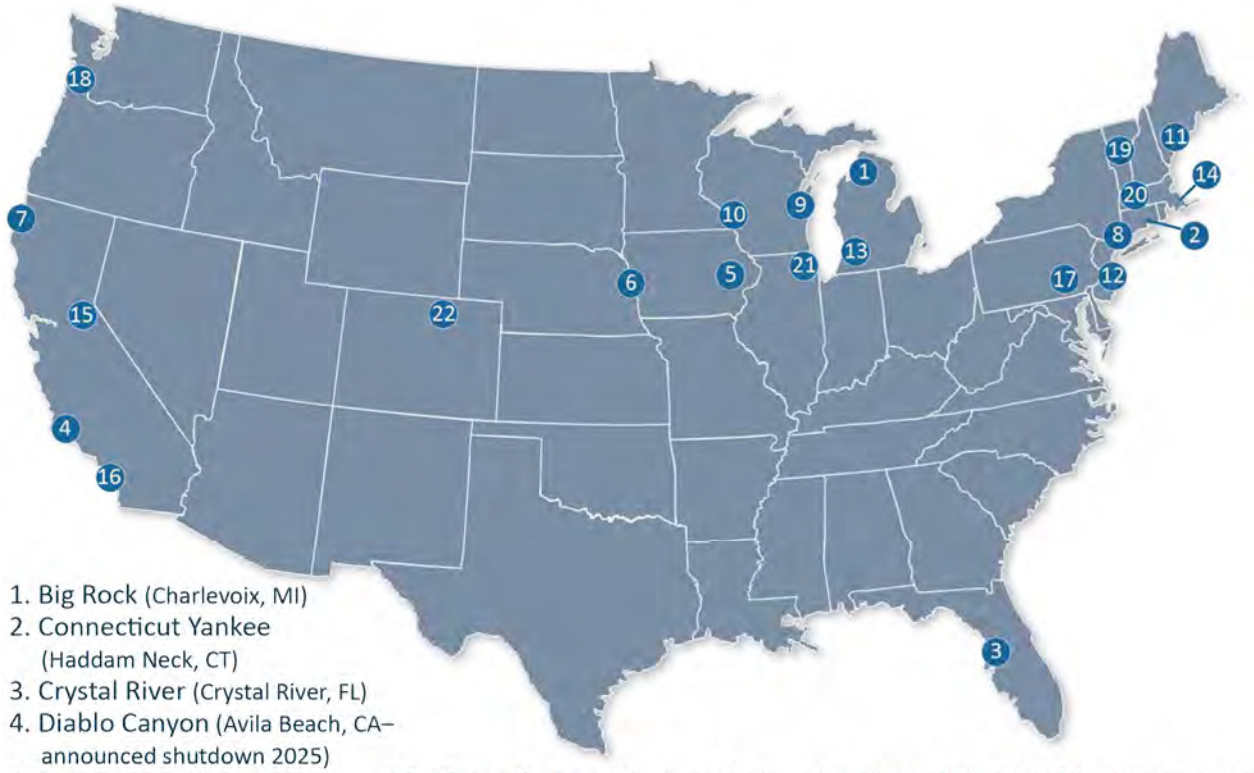
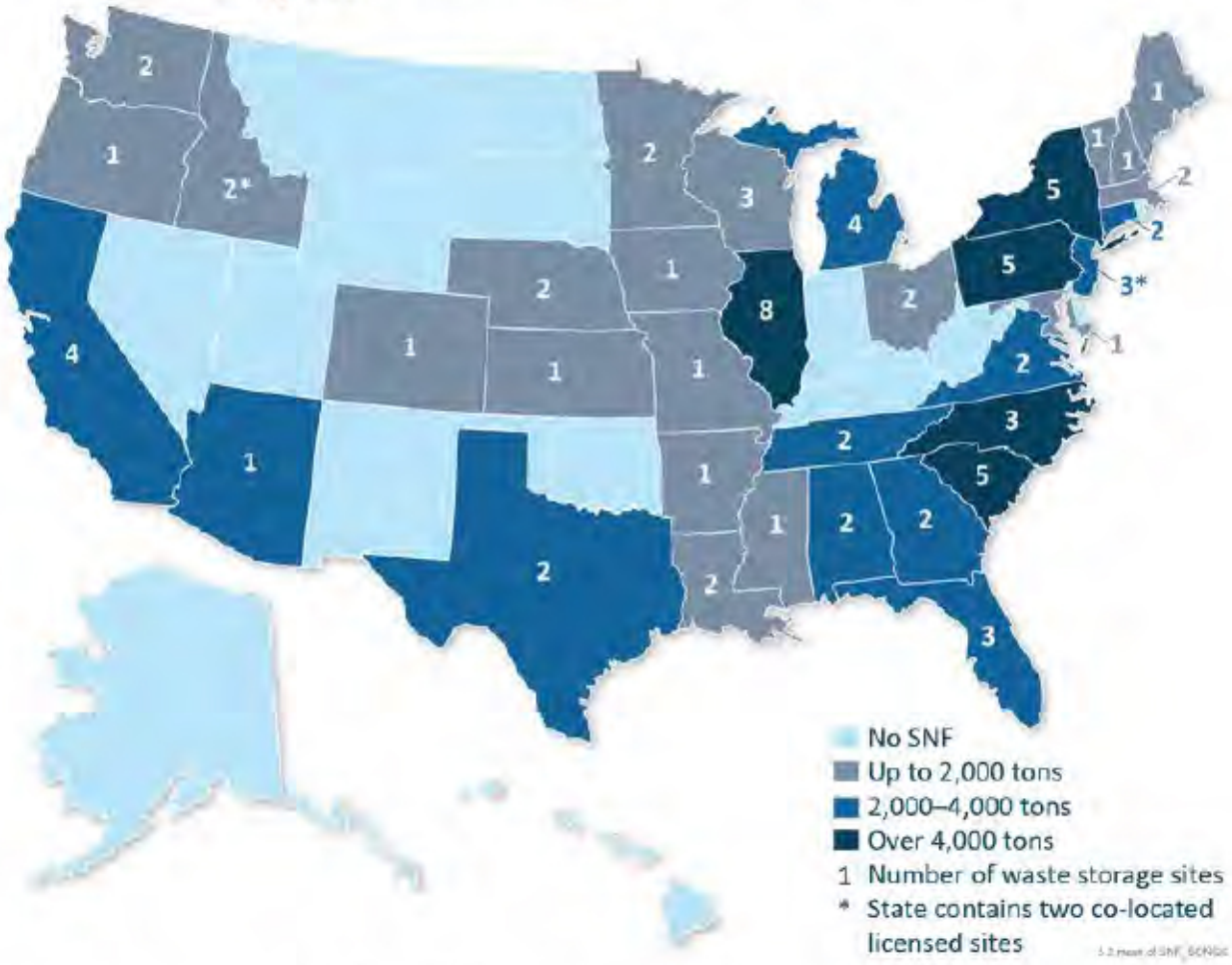


Figure 5.2 Mass of SNF Stored and Number of Spent Fuel and High-Level Waste Storage Sites by State[65]



5.2 Key Parameters for Nuclear Waste Management in the United States

Several of the alternatives considered in this Strategic Plan could require, or would have substantially greater chances of success with, changes to existing law or regulation.

Current thinking around the management and disposal of nuclear waste in the United States is framed by existing policy and regulations, which have steadily evolved since the advent of the commercial nuclear power industry beginning in the 1960s. These policies and regulations shape SCE's alternatives for removing SNF from SONGS, although it is important to stress that any or all of these conditions could also change in the future as a result of new legislative or regulatory developments. In fact, several of the alternatives considered in this Strategic Plan could require, or would have substantially greater chances of success with, changes to existing law or regulation.

[65] Waste storage sites include reactor sites and DOE storage sites. The licensed but never built site in Utah and potential future CISF sites are not included. Source: EJM, 2019. Compiled using data from NEI, 2018; NRC, 2018; NRC, 2019.

1-Federal Responsibility to Take Title

The federal government has a responsibility to take title to commercial SNF and devise a solution for SNF disposal. The federal government's responsibility to take title to SNF and high-level radioactive waste (HLW)[66] of commercial origin, and its responsibility to create a solution for disposing of waste from both commercial and governmental sources, was established in 1969 by the Atomic Energy Commission (AEC). This policy was codified in the Nuclear Waste Policy Act of 1982 (NWPA), which established a national program for the federal government to take responsibility for the disposal of all SNF and HLW. The Act required DOE to begin taking title to SNF and begin removing it from plant sites for permanent disposal by January 31, 1998. This deadline passed without DOE taking title or removing SNF because the federal government failed to establish a facility to receive the SNF as required by contract.[67] That failure, in turn, led the utilities to take legal action against the federal government. This has resulted in the federal government reaching settlement agreements with many utilities to cover ongoing costs associated with on-site SNF storage that utilities would not be incurring if the federal government had delivered on its statutory and contractual obligations; other utilities continue to sue on a regular basis to recover these costs. Under current law, the federal government remains responsible for the ultimate disposition of these materials.

2-Mined Geologic Disposal in Repository

The longstanding consensus is that the preferred disposal pathway for nuclear waste is geologic isolation. Specifically, federal policy (codified in the NWPA) has settled on deep geologic disposal—placement of radioactive waste in mined facilities in favorable geologic formations at depths from one thousand to several thousand feet below the Earth's surface—as the best available solution for a permanent repository. This disposition option was ultimately favored because it isolates and contains the spent nuclear fuel over very long time periods through the intrinsic properties of the host rock and robust engineered barriers. The passive safety features of deep geologic disposal avoid putting a burden on future generations to maintain and actively monitor a surface facility, protect the environment, and provide a security benefit by making it difficult to access plutonium and highly enriched uranium in the waste. A mined geologic repository also allows for, but does not require, active monitoring for radioactive releases beyond the repository boundary and (in the United States) must be designed to allow for SNF retrieval for a fifty-year period.

As discussed further in Section 5. 4 geologic repositories for SNF and/or HLW are under development in Finland (licensed and under construction), Sweden (in the licensing process), and France (in the pre-licensing stage at a selected site). Other countries are still in the process of selecting a site, with Canada well along in implementing its "Adaptive Phased Management" plan. Another facility in the United States, the Waste Isolation Pilot Plant (WIPP) in New Mexico, is a geologic repository for the disposal of certain defense nuclear wastes; it has been in operation since 1998 (see also Box 6.1).

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[66] As distinct from SNF, the term "HLW" includes nuclear fuel that has been reprocessed, and any other highly radioactive material that is designated as such by the NRC. In the early days of the U.S. nuclear energy industry, the expectation was that SNF would be reprocessed to recover plutonium and uranium for reuse, leaving only the residual HLW to be disposed of. This policy changed in 1977 when the U.S. government abandoned reprocessing efforts to protect against the proliferation of weapons-grade nuclear materials.

[67] After the January 1998 deadline passed, there have been proposals for DOE to begin taking title to waste while it is still stored at reactors. However, multiple stakeholders have argued that such proposals would contravene DOE's statutory responsibility to also remove and dispose of the waste.

3–Fluctuating Policy on Interim Storage

Historically, many engaged parties have taken the view that some form of away-from-reactor or consolidated 'interim' storage is needed. Such consolidated storage capability, in addition to a permanent disposal repository, would have the benefit of providing flexibility in the federal waste management program and, by accelerating the federal government's schedule for accepting waste, could shorten the time required to de-inventory shutdown nuclear plant sites if they were prioritized. A federal interim storage program could also begin to extinguish the government's financial liabilities for storage at shutdown sites sooner. Federal policy on interim storage has fluctuated over time, as have ideas about the design and status of such a facility—and a number of interim storage proposals have come and gone without success. A recurring barrier to away-from-reactor storage has been the concern that any interim facility, in the absence of tangible progress toward opening a permanent repository, could become a *de facto* permanent form of surface storage. This concern was recently raised again in opposition to a recent proposal by a private entity (Holtec) to develop consolidated interim storage in New Mexico.[68] Whether and how the development of consolidated storage should be linked to the development of disposal capability is a longstanding issue in U.S. nuclear waste policy, as discussed below and at other points in this Strategic Plan (Box 5.1).

4–Interim Storage Linked with Permanent Repository

The development of federal consolidated interim storage capability is constrained by current law. The NWPA as amended in 1987 contains two separate sets of provisions that address interim storage. One set of provisions (in Subtitle C) focuses on the concept of a federal monitored retrievable storage (MRS) facility. The federal government had attempted, unsuccessfully, to site such a facility in Tennessee earlier in the 1980s. Faced with opposition from the state, the 1987 Amendments rescinded the recommendation of the site in Tennessee and closely linked the siting, construction, and operation of any future federal MRS facility to the development of a permanent repository. The 1987 Amendments also created the MRS Review Commission, which eventually concluded that MRS would only be worthwhile if there were *not* linkages to a permanent repository (Box 5.1). Nonetheless, the legal requirements in the 1987 Amendments with respect to MRS capability have remained in place—as a result, under current law, the federal government can only site, design, and license (but not operate) a facility until after a construction authorization is issued for a repository. Past attempts to pass legislation de-linking interim storage from a permanent repository have been unsuccessful though bills have been introduced in Congress that would relax or eliminate these restrictions.

Separate from the NWPA's MRS provisions, Subtitle B of the original Act addresses a more limited form of federal interim storage capacity. These provisions allowed DOE to establish an interim storage facility of up to 1,900 MTU capacity if one or more nuclear utilities faced SNF storage constraints incompatible with continued plant operation before a repository was able to accept the SNF.

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[68] For example, in a letter to the DOE and NRC, New Mexico Governor Michelle Lujan Grisham, wrote: "[T]he absence of a permanent high-level radioactive waste repository creates even higher levels of risk and uncertainty around any proposed interim storage site," and "...given that there is currently no permanent repository for high-level waste in the United States, any interim storage facility will be an indefinite storage facility."

Box 5.1: Linkages between Consolidated Interim Storage and Repository Development

The single strongest and most persistent objection to the development of consolidated interim storage for SNF has been the concern that a storage facility could become a permanent waste repository by default. This concern is shared by those who believe national policy should stay focused on permanent disposal, and by potential hosts of interim storage facilities. As a result, whether and how the development of consolidated interim storage should be linked to progress on a permanent repository has long been a subject of debate.

As noted in the main text, DOE recommended a site in Tennessee for a monitored retrievable storage (MRS) facility in the 1980s. At the time, a community-based task force recommended several measures to address the concern that "The proposed facility could delay construction of the geologic repository and become a de facto site for permanent spent fuel storage."[a] These included caps on the amount of SNF that could go to the MRS facility that were tied to various milestones being reached in the repository program, along with provisions for a significant "overdue-removal penalty" for any SNF stored at the facility for longer than 15 years. Subsequent amendments to the NWPA, in 1987, nullified the Tennessee site and authorized new efforts to develop an MRS subject to severe constraints that linked MRS siting, construction, and operation closely to the repository. The 1987 Amendments also established a review commission to develop further recommendations on a federal storage facility program.[b] The commission found no technical basis for linkages, and in fact found that an MRS facility was only justified if it was not linked by statute to a repository. Nonetheless, the commission concluded that some linkages could be justified for policy reasons, and the linkages established in the 1987 Amendments have in any case remained in place.

In 2012, the Blue Ribbon Commission on America's Nuclear Future (BRC) recommended prompt steps to initiate new consent-based siting processes for both repositories and interim storage facilities. According to the BRC, "For consolidated storage to be of greatest value to the waste management system, the current rigid legislative restriction that prevents a storage facility developed under the NWPA from operating significantly earlier than a repository should be eliminated."[c] However, the BRC also emphasized that, to allay the concerns of host communities and states, a program to establish consolidated storage "must be accompanied by a parallel disposal program that is effective, focused, and making discernible progress in the eyes of key stakeholders and the public." The Obama administration agreed with the BRC that some linkage should be maintained.[d]

A bill aimed at completing the Yucca Mountain licensing process and at the same time facilitating the development of interim storage capability (including through private initiatives) passed the House in the 115th Congress and was reintroduced in 2020 as H.R. 2699 (see table 5.2). It ties initial operation of the first storage facility to the completion of the repository licensing process (rather than license approval) but retains the capacity limits in the 1987 NWPA Amendments for either a federal or private storage facility. Neither a current Senate bill (S. 1234), nor the Senate FY 2020 Energy and Water Development appropriation bill, which included language authorizing a pilot SNF storage program focused on shutdown sites, link storage to a repository.[e] (The pilot program was not included in the final appropriation bill.)

In sum, while there appears to be considerable agreement that the linkages in the 1987 NWPA Amendments are too tight, and unduly limit the potential value of consolidated interim storage to the waste management system, there is less agreement about how the linkages should be relaxed.

One approach is to relax mandatory requirements in favor of a negotiated solution between the host state for a storage facility and the federal government. If one or more storage facilities are developed within the framework of a consent-based siting agreement, conceivably the extent of linkage could be negotiated on a case-specific basis that both the host state and the federal government find appropriate.

Another suggested approach is to include steep "overdue removal" penalties in any agreement and/or legislation establishing a consolidated interim storage facility. In practice, however, if the payment of financial penalties is subject to congressional appropriations, the state or tribe may have little legal recourse. For example, in 2019 a federal judge dismissed South Carolina's suit against the federal government seeking $200 million in fines established in federal law for failure to remove plutonium stored at DOE's Savannah River Site on the basis that the law specified these fines could only be paid if Congress appropriated the necessary funds. South Carolina's appeal of this ruling is now before the Supreme Court. In the meantime, this recent case suggests that a financial penalty might have to be structured like a stipulated penalty (e.g., mandatory spending) to be meaningful from the point of view of a community or state that is considering hosting an interim storage facility.

a. Clinch River MRS Task Force, Position on the Proposed Monitored Retrievable Storage Facility, adopted 10/10/1985.
b. Nuclear Waste: Is There a Need for Federal Interim Storage, Report of the Monitored Retrievable Storage Review Commission, 1989.
c. Blue Ribbon Commission on America's Nuclear Future, *Report to the Secretary of Energy*, January 2012.
d. *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, U.S. Dept of Energy, January 2013.
e. The first version of S.123 (S. 3 B) barred storage at a facility licensed under that Act until Congress ratified a consent agreement for a repository, but allowed storage of up to 10,000 metric tons SNF at a facility licensed and constructed pursuant to a cooperative agreement under a pilot storage program included in the 2013 Energy and Water appropriations bill.

To use these provisions, utilities would have to request NRC approval of their determination that they cannot, with reasonable effort, expand their on-site wet and dry spent fuel storage capability and show that additional SNF storage is necessary to allow continued plant operation. Any utility that requested interim storage under this program would also be required to reimburse DOE for the cost of the program, separate from and in addition to any fees paid into the Nuclear Waste Fund. In addition, Subtitle B authority was linked to the opening of a repository and had a statutory expiration date of 1990. The Subtitle B provisions in the NWPA would have to be reauthorized and substantially revised before they could be useful for offsite storage of SNF from SONGS and other shutdown plant sites.[69]

5–Defense and Commercial Waste Linked

Defense waste and commercial waste disposal should be considered together, but policies on the management paths for these materials have varied over time. Under the NWPA, the president has limited discretion over the extent to which the management pathways for commercial and defense waste are linked, although the federal government retains responsibility for both. The Act requires that both waste streams be combined in a single waste disposal program, unless the president determines a defense-only repository, sited separately from the NWPA repository, is necessary. The Reagan administration determined that a separate defense repository was not necessary, and DOE proceeded to plan for a combined program. The Obama administration revisited this evaluation and determined that a separate repository for defense waste was required, largely because of a conclusion that such a repository could be sited, licensed, constructed, and operated more quickly outside the NWPA framework (in light of the stalemate over Yucca Mountain). Some take the view that proceeding more quickly with a repository for defense waste only would establish the experience base to increase confidence for proceeding with a commercial SNF repository. Others have taken the view that resolving the issue for defense waste could remove pressure for resolving the commercial waste problem and put a comprehensive solution further out of reach.

In any case, the proposal to pursue a separate non-NWPA repository for defense waste faced objections in Congress and no further steps, beyond development of a draft plan, were taken.[70] If repository siting efforts resume as part of a restart of the national nuclear waste program, arguments about the need for a separate, non-NWPA siting process for defense wastes might become moot.

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[69] Technically, Subtitle B ties federal interim storage to the utility's needs for continued operation. This was almost certainly intended to reference continued power operations, but in theory one could argue that keeping the SNF on site at SONGS is interfering with the current operation of decommissioning (because of the ISFSI's location with respect to former Unit 1). It should also be noted, however, that portions of Subtitle B have expired; thus, applying these provisions would most likely require statutory amendment.

[70] The Senate Armed Services Committee was very skeptical of the idea of a separate defense repository because of concerns that this could increase the cost of disposing of defense wastes. (See Senate Report 11 4255 to accompany S. 29 3 National Defense Authorization for 2017 at pp. 398-399. May 18, 2016.) In the House, H.R. 3053, the comprehensive nuclear waste bill that passed the House by a bipartisan majority in 2018 and that was reintroduced as H.R. 2699 in the 116th Congress, explicitly blocks the Secretary of Energy from taking any steps to implement a separate defense repository until the NRC makes a decision about a construction authorization for a repository (implicitly, Yucca Mountain).

6- Socio-political & role of other jurisdictions

Socio-political acceptance for the siting of nuclear waste management facilities—and the degree of control (or lack thereof) of affected state, local, and tribal governments over siting decisions—has been an ongoing issue. Nuclear facilities, including facilities for storing or disposing of SNF and other types of nuclear waste, are inherently difficult to site because of public concerns and perceptions about the health, safety, and environmental risks associated with radioactive materials and because of the long-lived nature of these risks. In the United States, differences have sometimes emerged between state governments and local jurisdictions in the way they view the relative risks and benefits of hosting prospective facilities.

In 1987, for example, when three candidate sites for a deep geological repository were being considered, the candidate jurisdictions for these sites worked collectively to secure amendments to the NWPA that would give them direct health and safety oversight authority and funding, independent of the host state, as well as impact payments (a.k.a., benefit payments) and payments-in-lieu of taxes.[71] Similarly, the city of Oak Ridge and Roane County in Tennessee expressed qualified support when an MRS facility was proposed there in the 1980s, contingent on certain health and safety impact mitigation measures, as well as impact payments and payments-in-lieu of taxes, which DOE accepted after informal negotiations. More recently, there has been support for the Yucca Mountain project at the local county level (under a set of detailed provisions for oversight and compensation) and the city of Carlsbad and Lea and Eddy Counties were and remain advocates of the Waste Isolation Pilot Plant (WIPP) facility in New Mexico (Box 6.1). In many of these cases, local jurisdictions were open to the economic benefits a nuclear waste facility would generate, provided they also received resources for independent technical assistance to support local oversight and other measures to protect public health and safety and the environment.

State governments, by contrast, have more often perceived the potential negative consequences of hosting a nuclear waste facility, economic and otherwise, as outweighing any benefits.[72] State-level opposition stopped the Oak Ridge MRS facility and has held up work on the Yucca Mountain repository.[73] And state opposition to a proposed storage facility in New Mexico has recently emerged despite the support of the host county and nearby city governments. Where local support exists, of course, it can be helpful in overcoming opposition at the state level or from other organizations, as was the case with WIPP. But experience also demonstrates that, while local support is necessary, it is not sufficient and state-level acceptance is needed too. It is not clear that WIPP would have been sited, for

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[71] The potential value of so-called "situs local governments" associating was first discussed at an April 15, 1987 meeting in Denver, Colorado that included representatives from Roane County, Tennessee; Deaf Smith County, Texas; the Mid-Columbia Consortium of Governments, Washington; and Nye County, Nevada. These jurisdictions were, respectively, prospective hosts to the Oak Ridge candidate site for the MRS and the three candidate sites for a deep geologic repository (i.e., Deaf Smith, Hanford, and Yucca Mountain). (Memorandum to Deaf Smith County Waste Deposit Impact Committee, June 15, 1987).

[72] While a topic of academic interest as far back as the mid-1960s, nuclear waste brought to the fore in a substantial way the concept of risk perception: i.e., the subjective judgement that people make about the characteristics and severity of a risk, often counter to expert observation, most commonly in reference to threats to public health and safety and the environment, as well as to impacts on the economy, including economic development, real estate values, and other land uses such as agriculture.

[73] In the case of the proposed MRS facility in Tennessee, the siting process was stopped after extensive state-wide opposition resulted in a legal challenge by the state and vetoes by the governor and state legislature. See: https://www.osti.gov/biblio/6787553-mrs-monitored-retrievable-storage-task-force-economic-non-economic-incentives-local-public-acceptance-proposed-nuclear-waste-packaging-storage-facility.

example, had the state of New Mexico remained in opposition rather than negotiating, in consultation with potentially impacted localities, for safety and economic terms that benefitted the whole state. Sovereign tribes, meanwhile, have likewise been divided in their willingness to consider hosting nuclear waste facilities: while some see the opportunity for economic development and resource generation, others are opposed for a variety of environmental and cultural reasons. Their positions, whether in favor or opposed, can be another crucial element in shaping the views of host state governments.

In sum, experience suggests that aligning state-level (and tribal, as pertinent) and local-level views is essential to successful siting in the United States.[7] The NWPA—in its 1982 version and in the 1987 Amendments—provided for states, tribes, and affected units of local government to receive funding to evaluate the impact of nuclear waste facilities and to conduct independent impact monitoring and oversight activities. The NWPA also authorizes impact mitigation and in-lieu-of-taxes funding. Importantly, Congress gave host states veto power over the siting of an SNF storage facility or repository, subject to congressional override. The state of Nevada used this authority to formally veto the proposed Yucca Mountain repository project in 2002, though Congress subsequently overrode the veto.

Nonetheless, staunch state opposition led to the suspension of Yucca Mountain licensing efforts under the Obama administration. Work has not resumed since, although budget requests were made for the project in fiscal years (FYs) 2018, 2019, and 2020. (Congress did not agree to those requests, however, which means that no funding for Yucca Mountain has been approved since 2011.) In a reversal of its former position, the Trump administration did not include funding for Yucca Mountain in the FY 2021 budget request and has indicated that it will not pursue the project. During the 2020 presidential campaign, candidates Trump and Biden both indicated their opposition to proceeding with the project.

Overcoming siting challenges has been a major focus of several expert studies, from the *One Step at a Time* report issued by the National Academies of Science in 2003, to the BRC report in 2012, to the more recent (2018) *Reset* report issued by Stanford and George Washington Universities.[75] All these studies considered U.S. and international experience in advocating for a more flexible, incremental, and "bottom-up" approach to siting with a heavy focus on two-way engagement with host communities and jurisdictions to build social and political acceptance of proposed facilities. While this approach has considerable support, several bills have been proposed in Congress that push for completing the licensing of Yucca Mountain. Future policy efforts will have to balance the concerns of localities and states where storage or disposal facilities might be sited against the concerns of communities with

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[7] While the same governance structure and dynamics that have created challenges in the United States (including, notably, the state–federal relationship) may not apply in other countries, international experience with siting nuclear waste facilities bears out the critical importance of aligning various levels of government—with each other and with the public interest. See *Reflections on Siting Approaches for Radioactive Waste Facilities: Synthesizing Principles Based on International Learning: A report prepared for the Organization for Economic Co-operation and Development's Nuclear Energy Agency's Forum on Stakeholder Confidence,* August 24 2012 (NEA/RWM/R(2012)5).

[75] National Research Council. 2003. *One Step at a Time: The Staged Development of Geologic Repositories for High-Level Radioactive Waste*. Washington, DC: The National Academies Press. https://doi.org/10.17226/10611; Blue Ribbon Commission on America's Nuclear Future. 2012. *Report to the Secretary of Energy.* Washington, DC. Report to the Secretary of Energy. https://www.energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf; Stanford University Center for International Security and Cooperation and George Washington University Elliott School of International Affairs. 2018. *Reset of America's Nuclear Waste Management Strategy and Policy*. https://fsi-live.s3.us-west-1.amazonaws.com/s3fs-public/reset_report_2018_final.pdf.

nuclear reactors that are currently storing SNF in facilities that were meant to be temporary. The topic of "consent-based" siting is discussed further in Appendix G of this report.

7-Storage Financed by Beneficiaries of Nuclear Power

Nuclear waste disposal is financed by a "beneficiary pays" funding arrangement. However, the resources collected through this arrangement have not been made available on a timely basis due to funding limitations set in congressional deficit control and appropriations acts.[76] The NWPA created a mechanism whereby utilities paid a fee, which was passed on to utility customers via rates, for every kilowatt-hour of electricity produced from nuclear plants. In exchange, DOE was required to take title to and dispose of the SNF. A special fund, the Nuclear Waste Fund (NWF), was set up to receive these fees. A series of subsequent congressional budget process reforms effectively de-linked NWF fee revenues from annual spending on the U.S. nuclear waste management program, which meant that waste program funding was again in direct competition with other spending priorities (this was precisely the situation that the nuclear waste fee and fund were created to eliminate). Consequently, appropriations from the NWF have been not only highly variable, but also substantially less than the amount of funds collected, uncertain in terms of their adequacy to cover program needs from year-to-year, and insufficient overall to meet yearly program objectives (Figure 5.3). The Office of Management and Budget (OMB) reported that the difference between NWF collections and expenditures left a balance of $40.4 billion available for appropriation as of FY 2019 and forecast that this figure would rise to $42.1 billion by the end of FY 2020.[77] The federal budget is reported on a cash flow basis, so the fees that have been collected in the past were credited to the federal budget in the years they were collected. Thus, any future appropriations from the NWF balance will add to federal spending and the deficit in the years those appropriations are made.

In 2013, after the Obama administration suspended efforts to develop a permanent repository at Yucca Mountain, the D.C. Circuit Court of Appeals ruled that DOE could not continue collecting the kilowatt-hour fee and the fee was reduced to zero pending development of an approved program and a new assessment showing additional fees are needed.[78] The NWF is still owed money (and interest) from so-called one-time fees; these are fees assessed on SNF that was generated before the kilowatt-hour fee began to be collected. The one-time fees are to be paid any time before the first scheduled delivery of waste to a federal storage facility or repository.

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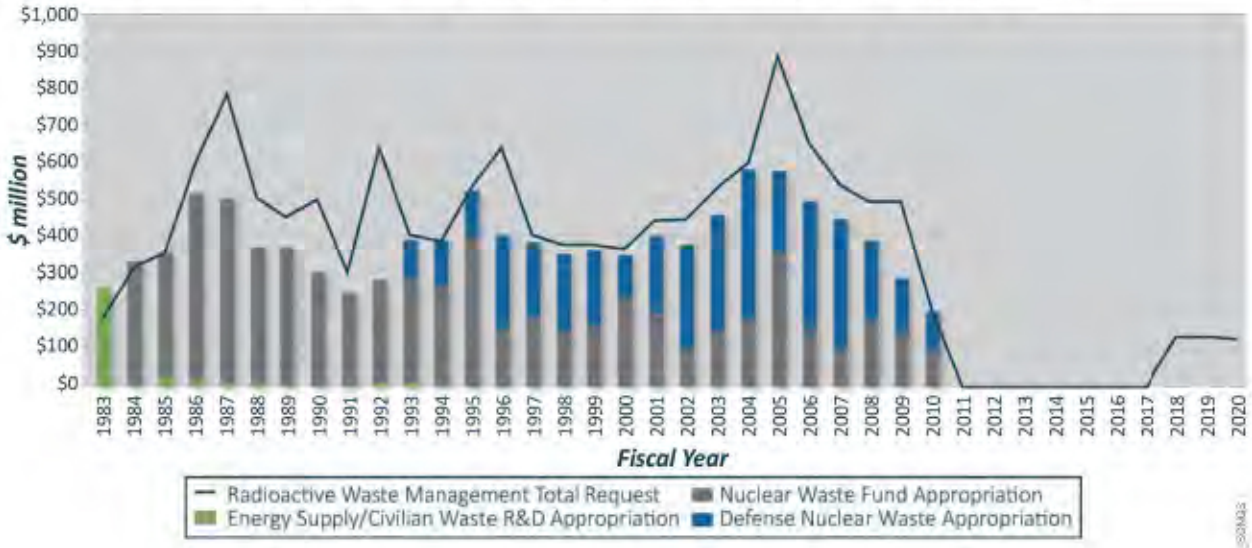
[76] Congress has developed certain rules and practices for the consideration of appropriations measures, referred to as the congressional appropriations process. The Congressional Research Service provides an overview of this process at https://fas.org/sgp/crs/misc/R42388.pdf.

[77] U.S. Office of Management and Budget, Budget of the U.S. Government, fiscal 2021.

[78] See: http://www.cadc.uscourts.gov/internet/opinions.nsf/2708C01ECFE3109F85257C280053406E/$file/11-1066-1466796.pdf.

Figure 5.3 Historical Nuclear Waste Fund Appropriations and Budget Requests[79]



8-Breach of Contract Has Led to Federal Liability

By failing to meet its statutory and contractual responsibilities to take title to commercial SNF on the timeline established in the NWPA, the federal government has created a financial liability for U.S. taxpayers. As noted previously, the NWPA specified a deadline of January 31, 1998 for DOE to begin accepting commercial nuclear waste for disposal. This deadline was incorporated into the Standard Contracts that DOE signed with nuclear utilities. After the 1998 deadline came and went, the courts found DOE to be in partial breach of these Standard Contracts. This finding opened the door to lawsuits from each utility holding a Standard Contract with DOE. The suits have led to a series of judgments and settlement agreements where each utility recovers costs for storing SNF at reactor sites that would not have been incurred had the DOE not partially breached its contract. These damages totaled $8.6 billion as of September 30, 2020.[80] The Judgment Fund pays out all costs incurred by the federal government as a result of litigation using ta xrevenues and borrowed money, without requiring appropriations and without affecting deficit accounting (see further discussion in Bo x5.2).

By failing to meet its statutory responsibilities to take title to commercial SNF…the federal government has created an ongoing financial liability for U.S. taxpayers.

[79] Does not include appropriations or requests for the NRC, the Nuclear Waste Technical Review Board, or the Nuclear Waste Negotiator. No appropriations have been made since FY 2010, but requests for funds have been included in the last three presidential budgets. Source: EJM, 2019. Compiled using data from DOE, 2010; OMB, 2017-2019.

[80] From the Department of Energy Nuclear Waste Fund's Fiscal Year 2020 Financial Statement Audit, p. 23-2 4 https://www.energy.gov/sites/prod/files/2020/11/f80/DOE-OIG-21-02.pdf.

Box 5.2: The Role of the Judgment Fund

Since DOE has still not begun accepting commercial SNF, despite the 1998 deadline specified under the NWPA and in DOE's Standard Contract with nuclear plant operators, multiple utilities have sued for partial breach of contract. As a result of settlements or final judgments in these suits, a total of $8.6 billion had been paid out by the U.S. Treasury's Judgment Fund through the end of September 2020.[a] As noted previously in the main text, the Judgment Fund pays out all costs incurred by the federal government as result of litigation. While 104 cases have been concluded (with 88 cases resulting in payments from the Judgment Fund), 16 cases remained pending as of the end of FY 2020.[an] Each year without work on a permanent repository adds to the federal government's future liability under similar lawsuits: in 2017, the DOE Inspector General audit estimated this liability at $27.2 billion; in 2018, the figure was $28.1 billion;[b] in 2019, the figure was $28.5 billion; and in 2020, the figure was $30.6 billion.[a] However, the latest estimate assumes that work towards a DOE facility (assumed to be either Yucca Mountain or a federal CISF) resumes by FY 2023. If this does not occur, resulting delays will increase the federal government's total liability, which, according to some estimates, may eventually reach $50 billion.[a]

The fact that the NWF is subject to appropriations, but the Judgment Fund is not, creates dysfunctional incentives that tend to favor continued delay over action on nuclear waste. Doing nothing to advance a long-term solution, while simply paying utilities damages for the continued storage of spent fuel at reactor sites requires no affirmative action by either the administration or Congress (it is in effect a mandatory expenditure). By contrast, any expenditures from the NWF to implement waste disposal program activities requires annual congressional appropriations that count against appropriations caps and require the allocation of funding away from other discretionary spending priorities. This competition exists despite the fact that the NWF is self-funded, in contrast to the rest of the DOE budget. Because of these dysfunctional funding dynamics, many observers have urged changes in the budget treatment of NWF fees and waste management expenditures to get the federal program back on track.

- https://www.energy.gov/sites/prod/files/2020/11/f80/DOE-OIG-21-02.pdf.
- https://www.energy.gov/sites/prod/files/2018/11/f58/DOE-OIG-19-08_0.pdf.

9-Lack of Stable Program Management

The U.S. nuclear waste program has suffered from a lack of stable organization and management at the federal level. Prior to the NWPA, nuclear waste management had to compete for resources with other areas of nuclear R&D.[81] To bring more focused attention to the program, the NWPA established the Office of Civilian Radioactive Waste Management (OCRWM) within DOE and made the OCRWM director equivalent to an assistant secretary, appointed by the President and confirmed by the Senate. Despite standing up this new program, and as a result of changes in the budget treatment of NWF revenues, the nuclear waste management program continued to be vulnerable to changing policy direction and appropriations levels under different administrations and Congresses. Ultimately, OCRWM was defunded and dismantled in 2010, along with the termination of the Yucca Mountain project.

Over time, multiple expert studies have recommended changing the federal management structure in this domain to make the nuclear waste program more independent from changes of administration and to de-link it from the government's normal budget process.[82] The most frequent suggestion has been to

[81] U.S. Congress Office of Technology Assessment. 1982. *Managing Commercial High-Level Radioactive Waste: Summary Report*. OTA-O-172.

[82] U.S. Congress Office of Technology Assessment, *op. cit.* also made this recommendation during the debates leading to enactment of the NWPA.

create a federal corporation chartered by Congress (similar to the Tennessee Valley Authority) to handle nuclear waste management.[83] Since none of these concepts has yet to be acted upon, an opportunity now exists to apply lessons learned from past experience and to design a stable, new organization, with a reliable funding stream to implement the nation's nuclear waste management mission responsibilities.

10-Waste Acceptance Queue

The Standard Contract established the concept of a queue, which governs the order in which the federal government would accept commercial SNF. Specifically, the Standard Contract allocates acceptance rights to contract holders based on the age of the oldest SNF still in their possession—this is known as the "oldest-fuel-first (OFF) queue." A contract holder is free to use its annual acceptance rights under the OFF queue for any SNF in its possession that meets other acceptance criteria specified in the contract. (An exception to this ordering is allowed for emergency deliveries.[8]) The OFF queue is complicated by the fact that utilities may exchange acceptance rights subject to federal approval. Meanwhile, several analyses have found that following a nationwide, OFF removal sequence would be extremely inefficient in practice (see Appendix F for further discussion and references). These critiques, combined with the failure of the OFF sequence to consider other relevant factors, such as site-specific risks (e.g., seismic potential or population density), have prompted legislative efforts to alter the prioritization of waste acceptance. Because the OFF framework is embedded in the Standard Contracts and not in legislation, any changes that would alter acceptance rights for all Standard Contract holders would have to be renegotiated with the parties. However, the Standard Contract allows the federal government to prioritize acceptance of SNF from shutdown reactors independent of the acceptance sequence dictated by the OFF principle. The potential advantages of the federal government's choosing to exercise that authority, and associated implications for moving the SONGS SNF, are discussed in more detail in Subsection 6.3.5 and in Appendix F.

5.3 Financial Status of the U.S. Nuclear Waste Management Program

As discussed under Parameter 7 in the foregoing section, the NWF was created by statute as a special fund within the Department of Treasury to cover the costs of SNF and HLW disposal. In 2014 after active efforts to pursue a repository at Yucca Mountain were suspended, the courts reduced further fee collections into the NWF to zero.

The federal government's financial reporting of the NWF provides three different measures: asset value, value of investments, and balance available for appropriation. At the end of FY 2020, total assets in the NWF (on an accrual basis, including receipts, interest, receivables, and property, plant, and equipment) amounted to nearly $45.1 billion. This amount includes $2.4 billion in receivables due from utilities that are responsible for paying one-time fees for SNF generated prior to 1983 (with interest).[85] Fees collected

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[83] Report of the Advisory Panel on Alternative Means of Financing and Managing Radioactive Waste Facilities (AMFM Panel). 1984. *A Report to the Secretary of Energy.* (transmitted to Congress in April 1985); Blue Ribbon Commission on America's Nuclear Future. 2012. *Report to the Secretary of Energy*. Washington DC; *Obama Administration Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste: A Response to the Blue Ribbon Commission Recommendations*. January 2013; Davis, Lynn E., Debra Knopman, Michael D. Greenberg, Laurel E. Miller, and Abby Doll. 2012. *Choosing a New Organization for Management and Disposition of Commercial and Defense High-Level Radioactive Materials*. Santa Monica, CA: RAND Corporation. https://www.rand.org/pubs/monographs/MG1230.html.

[8] See: https://www.law.cornell.edu/cfr/text/10/961.11.

[85] See: https:/www.energy.gov/sites/prod/files/2020/11/f80/DOE-OIG-21-02.pdf.

in excess of program costs must be invested in securities.[86] The NWF balance exists in the form of special securities held by the U.S. Treasury. The fair market value of these securities, if held until maturity, has been estimated at $5 43 billion. Finally, for appropriations purposes, OMB reported the balance in the Fund available for appropriation at $ 40. 4billion as of the end of FY 2019 and forecast that this figure would rise to $ 42.1 billion by the end of FY 2020.[87]

A separate assessment of the NWF by the Nuclear Energy Institute (NEI) estimated total contributions (with interest) from California consumers of nuclear power at $2.0 billion. Roughly half this total was contributions and half was interest (Table 5.1). According to these figures, California's NWF contributions are the sixth largest of the 50 states.

Table 5.1 NWF Contributions and Accrued Interest from California Reactors ($M)

Reactor	Total NWF Contributions	Allocation of Interest on NWF	Total Contributions and Accrued Interest
Diablo Canyon 1	226.8	240.0	**466.8**
Diablo Canyon 2	223.7	236.8	**460.5**
Humboldt Bay	5.1	5. 4	**10.6**
Rancho Seco	40.9	43.3	**84.3**
San Onofre 1	72.6	76.8	**149.4**
San Onofre 2	206.0	218.0	**424.0**
San Onofre 3	201.8	213.6	**415.3**
Total	**977.0**	**1,034.0**	***2,011.7****

*This figure includes an additional $700,000 in one-time fees that are outstanding on California reactors but not yet paid into the NWF. Totals may not sum due to independent rounding. Source: EJM, 2019. Compiled using data from NEI, 2016.

Since 1982, funding for the federal government's efforts to develop nuclear waste disposal solutions has primarily come out of the NWF, subject to annual congressional appropriations. In addition to implementing the permanent repository program, the NWF may be used for a number of other activities related to SNF management, including interim storage, R&D, administrative costs, and waste transportation. However, all of these activities are subject to specific eligibility requirements set in the NWPA.[88]

When the OCRWM was still active, appropriations for its waste management activities ranged from a low of $197 million in FY 2010 to a high of $576 million in FY 200 4(Figure 5.3). From FY 2005 through FY

[86] See: https://www.law.cornell.edu/uscode/text/ 42/10222.
[87] U.S. Office of Management and Budget, Budget of the U.S. Government, fiscal 2021.

[88] See: https://www.law.cornell.edu/uscode/text/ 42/10222.

2010, however, appropriations decreased every year and in FY 2011, the Obama administration ceased requesting funds altogether for the waste management appropriations accounts.[89]

No appropriations were made in FY 2011, nor have they been made in any year since. The Trump administration has requested appropriations in each of its budget requests (for FYs 2018, 2019, and 2020), but no funds were appropriated in any of these years.[90] The small remaining balance of funds from prior year appropriations continues to be expended in small amounts for administrative costs.

Though Congress could restart appropriations from the NWF at its discretion, there are practical impediments that would need to be overcome given the long lapse that has now occurred in funding and program activity. A 2017 Government Accountability Office (GAO) report outlined three necessary actions for restarting the Yucca Mountain project, in particular: recruiting personnel (at the time of its disbandment, OCRWM had about 180 staff and utilized thousands of contractor personnel—much of this capacity and institutional experience has been lost; in addition, other key agencies, including the NRC, would also need to rebuild capacity); updating key documents (i.e., the Yucca Mountain license application, environmental impact statement, and safety evaluation report); and rebuilding physical infrastructure, including reopening field offices and information technology and document management systems. Most of these actions will be required to restart a comprehensive waste management program whatever is decided about Yucca Mountain.

5.4 International Context

According to the International Atomic Energy Agency (IAEA), 441 nuclear power plants are currently in operation in 30 countries around the world, mostly in North America, Europe, Asia, and the Middle East.[91] Almost all of these countries are planning to develop deep geological repositories to dispose of the by-products of their nuclear fuel cycles. Globally, however, progress toward developing such repositories has been slow in most cases and stopped in many others—often for reasons that are similar to problems encountered in the U.S. program, though there are notable exceptions.

Among those programs that are moving forward, a common denominator has been an approach to siting that emphasizes collaboration and engagement with host communities. The country that is currently furthest along in this process is Finland, which is building a deep geological repository at Olkiluoto Island in the municipality of Eurajoki. The repository site was selected with the support of the host community in 2000, following a consent-based site-selection process that began in the 1980s. A license to construct the facility was submitted in 2012 and granted in 2015. Construction is currently underway with the expectation that the project's builder, Posiva (a joint venture of Finland's two utilities), expects to begin operations in 2023.[92] Notably, Finland's program has remained essentially on schedule for more than 20 years. Moreover, while an apples-to-apples comparison of governmental systems calls for caution in drawing definitive conclusions, it is worth noting that the community that will host the repository initially rejected the proposed facility but subsequently reconsidered. Thus, Finland's experience provides an important example of success with a consent-based approach to siting.

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[89] See: https://www.energy.gov/sites/prod/files/2018/11/f58/DOE-OIG-19-08_0.pdf.
[90] See: https://www.energy.gov/sites/prod/files/2018/11/f58/DOE-OIG-19-08_0.pdf; 2019 budget; 2020 budget.
[91] See: https://pris.iaea.org/PRIS/home.aspx
[92] More information is available at: https://www.nwmo.ca/en/Canadas-Plan/What-Other-Countries-Are-Doing. For a media report on the Finland program, see: https://world-nuclear-news.org/Articles/More-contracts-concluded-for-Finnish-disposal-faci.

Sweden's efforts to develop a geologic repository date back to the 1970s. The country's nuclear fuel and waste management company, SKB, was formed in 1978 and site selection activities began in earnest in the early 1980s, when SKB began drilling test sites at a variety of locations. By the mid-1980s, these tests, which were conducted without consulting with local municipalities, were generating mounting public opposition. This led to a pause and reset of the national approach. In early 1992, SKB initiated a new siting process that started with an invitation to municipalities to volunteer for feasibility studies, with the understanding that participants in the process could be eligible for substantial benefits. Ultimately SKB selected two communities that had experience hosting nuclear facilities. Detailed evaluations of these sites were conducted between 2002 and 2008. Based on these evaluations, SKB selected an existing nuclear plant site, Forsmark, as the location for its repository and submitted an application for a construction license in 2011. In 2018, Sweden's nuclear regulator approved the construction license application, but a separate approval, from the country's Environmental Court, was withheld pending a request for further information. SKB submitted the additional information in early 2019 and the Court extended approval in November 2019. Now that the project has both approvals, the next step is for the national government to decide to move forward.[93]

Andra, the company responsible for nuclear waste disposal in France, began studying a proposed repository site near the village of Bure in the northeastern part of the country in 2007. An application for a repository construction license was submitted in 2019 with the expectation that construction at the Bure site could get underway as soon as 2022.[9] Though the Bure site has attracted some controversy, public consultations in 2013 showed a willingness on the part of the local community to accept the facility but with provisions for a pilot phase of demonstration and provisions for reversibility. In its pilot phase of operations, beginning as soon as 2025, the facility will be designed to accept 10,000 cubic meters of high-level waste, most of which consists of vitrified material from the reprocessing of SNF.[95]

Switzerland's waste management organization, Nagra, has been searching for a suitable repository site in the northern part of the country since the 1980s (Nagra, which stands for National Cooperative for the Disposal of Radioactive Waste, was formed by a group of SNF owners in 1972). Nagra is currently in the third phase of an effort to site a repository for high-level radioactive waste. In the first and second phases, three sites were identified as candidates after working closely with proposed siting regions and conducting socio-economic and ecological evaluations. A public consultation phase was launched in late 2017 and lasted until March 2018. Nagra plans to announce the site(s) for which it will seek a general license in 2022; license submission is expected in 202 4 Following a period of further evaluation and public consultation, a national decision is anticipated in 2029.

Canada's Nuclear Waste Management Organization (NWMO) adopted an "Adaptive Phased Management" (APM) approach to managing SNF in 2007 and launched efforts to site a geological repository in 2010. The siting process began with 22 municipalities and indigenous communities that expressed interest in engaging with the NWMO. Based on initial evaluations and community engagement, the list was narrowed (one community withdrew itself) over the course of several years. Currently Canada's NWMOA is engaging two potential study areas: the township of Ignace, in northwestern Ontario, and the township of Huron-Kinloss and municipality of South Bruce in southern Ontario. The NWMO will be working toward identifying a specific site in one of these two areas with the

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[93] See: https://www.skb.com/okategoriserade/double-approval-of-skbs-final-repository-application/.

[9] See: https://www.nwmo.ca/en/Canadas-Plan/What-Other-Countries-Are-Doing. See also: https://www.bloomberg.com/graphics/2019-nuclear-waste-storage-france/.

[95] See: https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx

consent of local stakeholders over the next five years and published an updated implementation plan in March 2020.[96] More generally, the NWMO has stated that its APM plan will be implemented in phases, "over many decades."[97]

Other countries that are in earlier phases of the process for selecting a site for deep geological disposal of SNF and HLW include China, Germany, India, Japan, and the United Kingdom. In China, Japan, and the United Kingdom, these efforts are being led by an entity other than the national government, typically either by plant owners or by an independent organization with mission responsibility for nuclear waste management.

5.5 Lessons Learned from Nuclear Waste Management Efforts to Date

Experience with past efforts to manage, store, and ultimately find a permanent disposal solution for SNF and other types of radioactive waste—both in the United States and in other countries with commercial nuclear power programs—suggests several lessons that are relevant in assessing options for the future disposition of SONGS SNF. Three key points are summarized below:

Siting new facilities for the storage or disposal of nuclear materials is inherently challenging. As the BRC report stated in the U.S. context: "Siting storage or disposal facilities has been the most consistent and most intractable challenge for the U.S. nuclear waste management program."[98] A few countries are moving forward with identified repository sites, but their siting approaches have been implemented by an independent, dedicated, well-funded, and stable organization, with broad authority and flexibility to act, a high degree of commitment to stakeholder engagement, and willingness to entertain a range of positive incentives for host communities. In the United States, support in principle for a consent-based approach to siting has been complicated by the politics surrounding the Yucca Mountain repository, which remains the only site designated for a future repository under current U.S. law so far.

The timescales involved in siting, licensing, building, and opening nuclear waste facilities have often proved long—i.e., years to decades, and on the order of multiple decades in the case of a geologic repository. In the U.S. context, milestones and deadlines for the federal program have been consistently missed, in key instances by decades. Other countries' efforts to move forward with significant nuclear waste management facilities have likewise encountered substantial delays. Even in Finland, where schedules have been met, the time needed to site, license, and build a repository has exceeded 20 years, with several more decades expected to be required to emplace the waste.

Inconsistent funding and the lack of an independent, national-level organization with single mission responsibility for SNF management and disposal have been major deficiencies of the U.S. program. As is clear from even a cursory review, federal waste management efforts in this country have long suffered from inconsistent funding and shifting policy direction under successive administrations and Congresses. By contrast, all other countries that are moving forward with repository

Federal waste management efforts in this country have long suffered from inconsistent funding and shifting policy direction.

[96] See: https://www.nwmo.ca/~/media/Site/Reports/2020/03/06/19/17/NWMO-Implementation-Plan-20202_4ash x?la=en.

[97] See: https://www.nwmo.ca/en/Canadas-Plan/About-Adaptive-Phased-Management-APM/Implementing-the-Plan.

[98] See: Blue Ribbon Commission on America's Nuclear Future. 2012. Report to the Secretary of Energy; p. viii. https://www.energy.gov/sites/prod/files/2013/0_4f0/brc_finalreport_jan2012.pdf; p. viii.

siting and development have located responsibility for SNF management and final disposal in a single-mission, independent organization that can reliably access adequate funding as needs demand.

Many experts and observers have recommended the creation of a new, single-purpose waste management organization in the United States, possibly modeled on other federally chartered entities that have sufficient independence to sustain policy continuity over multiple political cycles. Together with budgetary reforms to ensure that NWF fees are available to serve the purposes for which they were intended, a new organization could provide, in the BRC's words, the "stability, focus, and credibility" needed to implement durable solutions to our nation's nuclear waste management challenges.[99]

5.6 Recent Legislative Proposals

The breakdown in the national nuclear waste management program has prompted a number of legislative proposals in past sessions of Congress, including in the 116th Congress (2019–2020) to address some of the issues discussed in this chapter. To provide a sense of current political interest and direction with regard to SNF policy at the national level, we summarize the most recent of these proposals in Table 5.2 (more detailed descriptions are provided in Appendix E). Of the draft bills included in the table, a few moved through the relevant committees, but none came up for a vote in the full House or Senate. While all of these bills expired when the 116th Congress adjourned, they provide the best available guide to legislation that is likely to be reintroduced for further consideration by the 117th Congress.

The impetus for congressional action could change in future years as the number of shutdown plant sites with "stranded" SNF grows.

In the Senate, the most comprehensive bill considered in the 116th Congress was the *Nuclear Waste Administration Act of 2019* (S. 1234). This was the most recent version of a bill developed in 2012 as a response to the recommendations of the Blue Ribbon Commission on America's Nuclear Future; it was jointly introduced by the senior Republican and Democratic leadership of the Committee on Energy and Natural Resources and the Appropriations Subcommittee on Energy and Water Development, including Senator Feinstein. Bipartisan support from the two committees has been sustained through subsequent Congresses.

S. 1234 would have created a new Nuclear Waste Administration (NWA) to assume the powers and duties of DOE with respect to the siting, licensing, construction, and operation of nuclear waste management facilities. It would also have provided for improved access to nuclear waste fees paid by contract holders, and directed the new NWA to pursue consent-based siting for both interim storage facilities and repositories.

The most comprehensive legislation considered in the House in the 116th Congress was the *Nuclear Waste Policy Amendments Act of 2019* (H.R. 2699), sponsored by Representative Jerry McNerny (D-CA) and 25 other members including California Representatives Scott Peters (D) and Salud Carbajal (D). (A companion measure, S. 2917, was introduced in the Senate by Environment and Public Works Committee Chairman John Barrasso (R-WY).) This bill was essentially identical to H.R. 3053, which was approved by the House in the 115th Congress by a bipartisan majority. The original version of the bill focused on expediting completion of the halted licensing process for Yucca Mountain and on moving forward with repository development if approved by the NRC. However, through the efforts of Representative Doris Matsui (D-CA), the final bill also included bipartisan provisions for interim storage

[99] *Ibid*, p. X.

of SNF with priority given to decommissioned plants and with authority for DOE to use storage facilities developed and operated by non-federal entities. This would have allowed DOE to make use of SNF storage services provided by private facilities such as those being proposed (and currently in the licensing process) in Texas and New Mexico.

Other less comprehensive bills have been introduced in the House by California representatives who are specifically concerned with the SONGS SNF. Representative Mike Levin (D-CA), whose district includes SONGS, introduced *The Spent Fuel Prioritization Act of 2019* (H.R. 2995), which would have amended the NWPA to require DOE to prioritize the removal of SNF from nuclear plant sites based on the size of the population near the plant site and seismic hazards in the area.[100] (The bill did not address a permanent repository or consolidated interim storage and it did not authorize the transfer of SNF to any non-consenting state or locality.) In 2019, Representative Levin convened a task force, called the SONGS Task Force, to focus specifically on issues related to the storage and relocation of SONGS SNF. The SONGS Task Force issued a report in March 2020 (Box 5.3) that includes a number of recommendations for congressional action.[101] Reflecting one of the recommendations in the report, Rep. Levin introduced a bill in September 2020 that would establish a new R&D program at DOE on SNF storage and disposal.

In an earlier Congress, Representative Darrell Issa (R-CA) introduced H. R. 4741, the *Interim Consolidated Storage Act of 2017*, to amend the NWPA to authorize the Secretary of Energy to enter into contracts for the storage of high-level radioactive waste and SNF with any person that holds a license for an interim consolidated storage facility, and to pay for such storage from the Nuclear Waste Fund.

Prospects for national-level progress on nuclear waste management issues remain difficult to predict. On the one hand, the impetus for congressional action could increase as the number of members with shutdown plant sites and "stranded" SNF in their home states or districts grows. On the other hand, a number of other pressing issues are likely to crowd the legislative agenda in the 117th Congress. Moreover, the range of approaches reflected in Table 5.2 suggests that a national political consensus on how to move forward may continue to prove elusive, with some members focused on removing hurdles to the Yucca Mountain project while others favor seeking a new repository site. Several pending bills attempt to advance federal consolidated interim storage options or to allow the federal government to contract for storage services at a non-federal facility. In some cases, these provisions include an explicit tie to progress in the repository program.

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[100] See: https://mikelevin.house.gov/issues/energy.

[101] The SONGS Task Force report may be accessed at: http://www.samuellawrencefoundation.org/wp-content/uploads/2020/06/2020-SONGS-Task-Force-Report.pdf.

Box 5.3: The SONGS Task Force

In January 2019, shortly after taking office as U.S. Representative for California's 49th district, Congressman Mike Levin launched a task force to address SNF storage at SONGS and develop related policy recommendations. The San Onofre Nuclear Generating Station (SONGS) Task Force is co-chaired by Len Hering, a retired rear admiral U.S. Navy, and Gregory Jaczko, former chairman of the NRC. Its 33 members (four of whom also serve on the SONGS Community Engagement Panel discussed in Section 4.1 of this report) include interested citizens and elected officials from surrounding municipalities, as well as NGOs and academics. The Task Force, which has a technical committee and a policy committee, issued a report in June 2020. The report covers five main topic areas: federal legislation and regulatory oversight, state legislation and regulatory oversight, best practices, storage and aging management, and safety and handling; it also offers a number of findings and 30 recommendations. Many of the recommendations have a federal nexus; they include national legislation to implement reforms proposed by the Blue Ribbon Commission with respect to facility siting and the creation of a new federal nuclear waste management entity; to prioritize SNF removal from sites with greater population density and higher risk from sea-level rise and seismic events; and to give states a greater oversight role in SNF storage, facility siting, and transportation. Other recommendations in the report focus on SNF storage arrangements at SONGS. Though there are differences of opinion in some of these areas, including among SONGS Task Force members themselves, advancing long-term solutions that would allow for the safe relocation of SONGS SNF to a site farther from the coastline is a core objective for Rep. Levin and the SONGS Task Force, as it is for the SONGS co-owners and this Strategic Plan.

Table 5.2 Legislation on Nuclear Waste Storage and Disposal in the 116th Congress

Title and Bill Number	Purpose and Key Provisions	Status
Senate		
Nuclear Waste Informed Consent (S. 69) [Senators Cortez-Masto and Rosen (D-NV)]	• Prohibits DOE from using the Nuclear Waste Fund to pay for disposal in a repository or planning, construction, or operation of a repository unless DOE has entered into an agreement with the state and tribes in which the repository is located and with affected local governments.	Referred to the Com. on Environment and Public Works (EPW); no action taken to date.
Nuclear Waste Administration Act of 2019 (S. 1234) [Lisa Murkowski (R-AK), Lamar Alexander (R-TN), and Dianne Feinstein (D-CA)]	• Creates a new Nuclear Waste Administration to conduct siting, licensing, construction, and operation of SNF management facilities. • Sets 2025 deadline for an interim storage facility; 2052 for a permanent repository.	Hearings held by Energy and Natural Resources Committee
The Sensible, Timely Relief for America's Nuclear Districts' Economic Development (STRANDED) Act of 2019 (S. 1985) [Tammy Duckworth (D-IL)]	• Creates multiple programs to provide relief to communities with "stranded" waste at shutdown plant sites. • Directs Secretary of Energy to establish a Stranded Nuclear Waste Task Force to study resources and funding available to affected communities and their economic adjustment plans.	Referred to the Energy and Natural Resources Committee; no action taken to date.
Energy and Water Development Appropriations Act, 2020 (S. 2740) [Lamar Alexander (R-TN)]	• Introduces a pilot program for storage and geologic disposal. • The pilot allows for the creation and operation of one or more federal consolidated interim storage facilities for SNF from "stranded" sites.	Provisions dropped in final conference version of the Appropriations Act

Table 5.2 (continued)

Title and Bill Number	Purpose and Key Provisions	Status
Jobs, Not Waste Act of 2019 (S. 721/H.R. 1619) [Senate: Jacky Rosen (D-N V); House: Susie Lee (D-N V)]	• Prohibits DOE from licensing, planning, developing, or building a nuclear waste repository at Yucca Mountain until a study of the economic viability of other uses of the site is completed. • The bill builds on Nevada legislators' longstanding position against the development of the Yucca Mountain facility.	Referred to EPW and House Energy and Commerce Committee (ECC); no action taken to date.
House of Representatives		
Nuclear Waste Informed Consent (H.R. 15 4) [Dina Titus (D-N V)]	• Prohibits DOE from using the Nuclear Waste Fund to pay for disposal in a repository or planning, construction, or operation of a repository unless DOE has entered into an agreement with the host state and tribe and with affected local governments.	Referred to the ECC, Subcommittee on Environment and Climate Change; no action taken to date.
Nuclear Waste Policy Amendments Act of 2019 (H.R. 2699/S 2917) [House: Jerry McNerny (D-CA); Senate: John Barrasso (R-WY)]	• Permits DOE to site, construct, and operate one or more monitored retrievable storage facilities, but does not allow use of the nuclear waste fund for that purpose. • Permits the storage of DOE-owned civilian waste at an NRC-licensed non-federal facility. • Addresses a range of issues: consent from affected governments; the government taking title to SNF for a storage facility, not just a permanent repository; rules for funding and using the nuclear waste fund; and reestablishing an office to manage the program. • Maintains Yucca Mountain as the site for a permanent repository.	Reported on voice vote by ECC; Introduced in Senate
Spent Fuel Prioritization Act of 2019 (H.R. 2995) [Mike Levin (D-CA)]	• Defines priorities for transportation and disposal of SNF removal. • Three factors to be considered: deactivated and decommissioned reactors, population, and seismic activity.	Referred to the ECC; elements incorporated into H.R. 2699.
The Storage and Transportation of Residual and Excess (STORE) Nuclear Fuel Act of 2019 (H.R. 3136) [Doris Matsui (D-CA)]	• Authorizes DOE to develop nuclear waste storage facilities and enter into a contract to store waste at a non-federal facility. • Requires DOE to obtain state, local, and tribal consent • Authorizes financial and technical assistance to states, local governments, and tribes. • Storage priority assigned to waste from closed reactors.	Referred to the ECC; no action taken to date
Spent Nuclear Fuel Solutions Research and Development Act (H.R. 8258) [Mike Levin (D-CA)]	• Directs Energy Secretary to conduct an advanced fuel cycle research, development, demonstration, and commercial application program. • Seeks to improve fuel cycle performance. • Supports options for used nuclear fuel storage, use, and disposal.	Referred to the House Committee on Science, Space, and Technology
Nuclear Safety Protocols for Extended Canister Transfers (INSPECT) Act (H.B. 8673) [Mike Levin (D-CA), with Katie Porter (D-CA) and Harley Rouda (D-CA)]	• Would require the US NRC to keep a resident inspector at decommissioning nuclear power plants until all the spent fuel is out of the pool and into dry storage. • Resident inspector would conduct inspections of decommissioning activities and spent nuclear fuel transfer activities.	Referred to House Energy and Commerce Committee

6. KEY CROSS-CUTTING CONSIDERATIONS AND CHALLENGES

As a transition to the alternatives assessment described in Chapter 7, this chapter reviews a set of issues that are broadly applicable to all alternatives for relocating SONGS SNF, and their variants. An important note at the outset: This chapter does not specifically address technical and safety issues, though these are clearly a high-priority, cross-cutting consideration. This is because the starting presumption for every alternative we included in our detailed assessment is that implementation would be conditioned on the proposed facility (or facilities) meeting or exceeding all applicable licensing requirements. These licensing requirements would, in all cases, entail rigorous technical and engineering analyses as well as detailed demonstrations of site suitability and safety protections. More exotic disposition pathways that clearly fail this stipulation were excluded from further consideration at the outset.

Taking protection of public and worker health and safety – as well as protection of the environment – as overarching imperatives, the purpose of the remainder of this chapter is to explain why various considerations and challenges are important and how they might differ for different alternatives (and for variants within these alternatives).

Protecting public and worker health and safety – as well as the environment – are foundational and overarching imperatives.

6.1 Socio-Political Factors and Siting Challenges

The fact that there is currently no actionable plan to remove commercial SNF from nuclear plant sites for consolidated interim storage or permanent disposal reflects, to a large degree, the federal government's failure to develop a nuclear waste management strategy that secures and sustains sufficient social and political acceptance.

As discussed at length in Chapter 5, the challenge is more socio-political than it is scientific and technical.[102] Siting a repository, in particular, has been a persistent obstacle, together with mustering the sustained political and financial commitment needed to identify and implement solutions. Many of these same factors extend to dry storage in ISFSIs or to a potential CISF, as well as to the transportation of SNF.

While there is broad recognition of the need for a permanent disposal program for spent nuclear fuel, there has been no immediate safety imperative to move much of the SNF that is currently in dry storage at plant sites around the country.[103] Utilities and other influential national-level stakeholders, such as environmental groups, also have not made this a priority matter. Few (if any) utilities want to be in the long-term nuclear waste management business—on the contrary, as we have already noted, the industry's development was premised on federal responsibility for this aspect of nuclear energy production—but they face little immediate business pressure to act, particularly at still-operating plant sites. This will be true as long as most companies can recoup their SNF storage costs from the federal government's Judgment Fund. The Fund, in turn, is immune to normal budget constraints and pressures,

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[102] The NRC characterized the political versus technical aspects of the current stalemate in its Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel (NUREG-2157, at https://www.nrc.gov/docs/ML1419/ML14196A105.pdf).

[103] For example, the NRC's 2014 Continued Storage of Spent Nuclear Fuel Rule does not specify a maximum time for storing spent fuel in pools or casks and expresses confidence that SNF can be stored safely in ISFSIs at reactor sites indefinitely—*assuming private or governmental institutional controls continue to exist*—without significant environmental effects.

so even though the burden being imposed on U.S. taxpayers is real and steadily growing, it is also easy for Congress to ignore.

The environmental community, meanwhile, is split on the merits of nuclear power, with some groups taking the position that climate goals can be achieved with energy efficiency and renewables only, while others view nuclear as a necessary contributor to a carbon-free energy mix. With little business interest in building new nuclear plants in the United States at present, however, most groups' primary focus is on other issues such as climate change. Forceful consensus about an SNF management agenda is also lacking among non-governmental public health and safety advocates. Some argue that the whole objective should be to build a repository, others advocate for maintaining storage on site, and still others believe as a matter of social justice that SNF should not be moved from plant sites, or should, at a minimum, be stored within the state where it was generated.

Finding support for moving SNF off the SONGS site is not likely to be difficult, though some members of the public can be expected to have concerns about the potential movement of waste shipments through or near their communities. By far the greater challenge, in terms of public and stakeholder acceptance, is likely to arise at the receiving end: that is, in building sufficient support—locally and at all levels of affected government—to allow for the siting and construction of a facility, whether elsewhere in California or in another state, that can accept the SONGS SNF.

The magnitude of this challenge is evident from the history of the U.S. nuclear waste management program to date. However, it is important to point out that positive siting examples also exist, both in this country and elsewhere. The Waste Isolation Pilot Plant (WIPP) in New Mexico, which is the world's only operating deep mined geological repository for radioactive waste, is one such example (this facility, it should be noted, is prohibited by law from accepting commercial SNF; it is authorized for the disposal of defense-generated transuranic, or "TRU", waste from DOE sites only).[10] WIPP was sited with the support of the local community and the surrounding counties of Eddy and Lea, and eventually won acceptance at the state level also (Box 6.1).

In Finland and Sweden, repository development is proceeding at sites that were selected with host community support.[105] Other countries, such as Canada, are making steady progress while still others, such as Germany, have decided to "reset" their national programs and are renewing efforts to identify a repository site. In the United States, more recently, two private consolidated storage facilities proposed for sites in New Mexico and Texas have advanced to the point where they seem likely to receive NRC licenses, although both projects still face regulatory and financing hurdles as well as issues of acceptance by state political leaders and local communities that the facility developers will have to work through. (These two proposals are discussed in detail in Section 7.5).

Where projects have moved forward, they have generally benefitted from a particular confluence of factors and circumstances, together with patient attention to process and trust-building engagement with stakeholders and local communities.

All of these "successes" have followed years of sustained effort and have encountered difficulties and controversy at points along the way. Where projects have moved forward, they have generally

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[10] Limiting the type and quantity of waste that could be accepted at WIPP was part of the lengthy set of conditions and compromises that was ultimately necessary to gain the political support needed to move the project forward. See Box 6.1 for further discussion.

[105] In Finland, construction is proceeding. In Sweden, the host community recently issued its final approval of the project but final government approval is still required before construction can begin.

benefitted from a particular confluence of factors and circumstances, together with patient attention to process and trust-building engagement with stakeholders, local communities, and states.

Box 6.1: A Positive Siting Example: The Waste Isolation Pilot Plant

The Waste Isolation Pilot Plant (WIPP) is the world's only operating deep geological repository for nuclear waste. A DOE facility, WIPP is located near Carlsbad, New Mexico and accepts only long-lived transuranic defense waste. Efforts to site this facility date back to the 1970s; at the time, local officials expressed interest in being considered but the state of New Mexico was opposed. Further action by Congress and years of regulatory and legal maneuvering by the state ensued before the facility was completed in the late 1990s. WIPP received its first shipment in 1999; to date, more than 170,000 containers of waste have been shipped to WIPP for permanent disposal in ancient salt beds, 2,000 feet below the surface. In February 2014, an accidental release of radioactive materials at WIPP caused a three-year closure of the facility (see: https://www.energy.gov/ehss/downloads/accident-investigations-february-14-2014-radiological-release-waste-isolation-pilot). WIPP resumed accepting waste in April 2017; it is expected to close in the 2025–2035 timeframe.

Despite the controversy that surrounded its early history, WIPP eventually came to enjoy considerable support at the state and local level. At key points in the 1990s, concessions and confidence-building measures by the federal government, including more studies, increased communication, and emergency response and highway improvements, allowed the project to move forward. The creation of an independent oversight entity, the Environmental Evaluation Group (EEG), housed at a local university, for example, was important to local communities and state officials. The EEG conducted independent technical evaluations of WIPP. While funded by DOE, DOE did not select EEG staff or control what issues the EEG considered, nor did DOE approve EEG reports before they were published.

Also important was action by Congress to subject the facility to waste disposal standards under the Resource Conservation and Recovery Act (RCRA), which meant that the State of New Mexico retained some regulatory authority over mixed waste at WIPP. According to the BRC report: "The crucial difference in the WIPP case was the presence…of a supportive host community and of a state government that was willing to remain engaged." That support "helped to sustain the project during periods when federal and state agencies had to work through disagreements." It took 20 years to open WIPP, but the project's eventual completion suggests that successful siting outcomes are possible. A further lesson from the WIPP experience is that there is no such thing as a simple formula for success. As the BRC put it: "[N]o one could have designed the process that was ultimately followed ahead of time nor could that process ever be replicated."

As the WIPP example shows, efforts to provide for independent oversight and to affirm a defined role for states, tribes, and local governments—or for the independent authorities advising them—can be pivotal in gaining support for a facility.

6.2 Cost Considerations and "Commercial Reasonableness"

Cost is a key factor in assessing alternatives for removing SNF from SONGS for the simple reason that the costs involved in constructing and operating nuclear waste storage facilities, and in transporting SNF, are substantial. As discussed in Chapter 5, the costs to transport SNF away from reactor sites and dispose of it were to be borne by the federal government using funds collected up front from nuclear utility customers. Having paid through Nuclear Waste Fund fees for the offsite disposition of SONGS SNF, SONGS customers have already fully met their obligation to the federal government for covering the costs of managing and disposing of this material.

The Settlement Agreement stipulates that any actions the SONGS co-owners might undertake with respect to relocating the SONGS SNF in light of the federal government's failure to perform must meet the test of "commercial reasonableness," where commercial reasonableness is defined as "such actions a prudent utility would undertake or decisions it would make under similar circumstances based on the information reasonably available to it at the time." The Settlement Agreement goes on to state that:

> *"Commercially reasonable actions or decisions are those that a similarly situated utility determines in its reasonable discretion:*
>
> a. *Are practicable and reasonably financially prudent taking into account relevant considerations such as safety, scientific and technical factors, the regulatory environment, financial costs, resource availability, and the likelihood of success of any such actions or decisions;*
>
> b. *Would not unreasonably impair or delay SONGS decommissioning activities, financially or otherwise; and*
>
> c. *Would allow the owners of SONGS to recover all of their costs from their respective decommissioning trust funds or from the DOE."*

Thus, a first question concerns how much of the cost of implementing an offsite storage or disposal solution for SONGS SNF would fall on the SONGS co-owners and their customers versus be covered or reimbursed by the federal government or another funding source. At present, much of the ongoing cost of keeping SNF in dry storage at SONGS and other plant sites is being reimbursed through the Judgment Fund mechanism discussed in Section 5.2 and Box 5.2 of this report. In concept, it might be reasonable to expect that alternative offsite storage arrangements should continue to be eligible for Judgment Fund reimbursements, at least up to the level of current on-site storage expenses, through a modification of existing reimbursable settlement agreements or through litigation (and without the need for further action by Congress). Other costs, however, including acquisition or leasing costs for transportation assets, operating costs to ship SNF to an offsite storage location, insurance against risks or liabilities associated with transportation or offsite storage, or costs to site, license, and construct an offsite facility, might not be eligible without a presumably positive cost-benefit analysis. But such recovery issues have not yet been presented and so substantial uncertainties remain.

As a result, all the alternatives NWT considered for relocating SONGS SNF—with the exception of the federal alternatives (i.e., a federal disposal repository, a federal consolidated interim storage facility, or federal use of a non-federal facility)—could entail significant additional net cost to the SONGS co-owners and their customers, relative to leaving the SNF on site.

Federal support…could be forthcoming, particularly if the federal government saw value in demonstrating the concept of consolidated storage and building confidence in the federal waste management program.

In principle, federal funding could cover some of the expenses associated with implementing offsite storage for SONGS SNF, especially if the federal government saw value in demonstrating the concept of consolidated storage and associated transport capabilities. Such a demonstration could offer benefits in terms of (1) reducing current federal legal liabilities, (2) mitigating longer-term waste management costs, and (3) building confidence in the federal waste management program.

A related question is whether Congress could help advance non-federal consolidated interim storage solutions as a way to reduce overall SNF storage costs (not just at SONGS) and associated outlays from the Judgment Fund. In that case, it would be important to provide federal support in a way that provides adequate certainty to private facility developers who will presumably need to be able to enter into multi-year commitments to move forward.

Another consideration is that any costs to move the SNF that are not paid from the NWF will need to be initially budgeted and paid by the SONGS co-owners and their customers contemporaneously with the activities related to moving the SNF. Only *after* those expenses are incurred can the SONGS co-owners seek reimbursement of some or all of the costs from the Judgment Fund. And obtaining reimbursement from the Judgment Fund in any amount above what is currently being received for on-site storage expenses, as we have already noted, could be challenging. To make such a demonstration, new information or a finding that current on-site storage arrangements are no longer tenable could be required.

An important question is whether Congress could be persuaded to appropriate funds to help advance a non-federal solution as a way to reduce annual outlays from the Judgment Fund.

Similarly, any use of SONGS decommissioning trust funds to implement SNF storage off site would be highly constrained, both in terms of the amount of funding available and in terms of restrictions that apply to possible uses of these funds under Internal Revenue Service (IRS) rules. The specific concern is that using the SNF management portion of the decommissioning trust fund to manage SNF at a site other than SONGS could violate IRS rules for a qualified trust, thereby creating a tax liability and potentially incurring additional penalties and interest when the terms of the trust are broken. This issue would have to be carefully examined before contemplating the use of SONGS decommissioning trust funds for offsite SNF storage, which would ultimately have to be approved by the California Public Utilities Commission (CPUC) on behalf of the SONGS co-owners' customers. More generally, the prudency of any additional expenditures to relocate the SONGS SNF, if those expenditures are intended to be borne by SCE and SDG&E customers, would need to be defended in a CPUC proceeding and approved by the CPUC before they could be passed through to customers.

Given the importance of cost and commercial reasonableness considerations, NWT developed cost estimates as part of its assessment of different SNF disposition alternatives in the next chapter (Chapter 7), while also exploring potential cost sharing opportunities and the likelihood of cost recoverability under the Judgment Fund or from other sources. Later sections of this chapter address additional legal and regulatory issues, particularly related to title, liability, and indemnification, that could affect the cost and financial risk associated with different alternatives for moving the SONGS SNF off site. Resolving issues of liability and indemnification, in particular, would likely present significant "commercial reasonableness" challenges for any disposition pathway that does not involve the federal government taking title to the SONGS SNF, for reasons discussed further in Section 6.4

6.3 Legal and Regulatory Requirements and Challenges

As noted in Chapter 5, the use, transportation, storage, and disposal of SNF in the United States is regulated by the NRC under authority granted by the Atomic Energy Act (AEA) of 1946, as amended, and the Nuclear Waste Policy Act (NWPA) of 1982, as amended (in 1987). Related activities may also fall

under the Price-Anderson Act (PAA) of 1957, which provides for financial protection and indemnification in the case of nuclear accidents.[106]

This section summarizes existing legal and regulatory requirements as they apply to different options for moving SONGS SNF to an offsite location. This section also discusses requirements under the National Environmental Policy Act (NEPA) as they apply to SNF transport and receiving facilities.

6.3.1 "Reasonable Assurance of Adequate Protection" Under the Atomic Energy Act (AEA)

The AEA is the overarching federal law that governs the use of nuclear materials and technology in the United States. Other laws, including the NWPA and the Price-Anderson Act, are rooted in AEA authority to govern specific aspects of the nuclear power industry. The creation, maintenance, administration, and enforcement of federal regulations to implement these laws are assigned to the NRC and DOE for civilian and government use of nuclear materials, respectively. NRC and DOE regulations are codified in Title 10 of the Code of Federal Regulations (CFR), "Energy": NRC regulations are set forth in Parts 1 through 199 and DOE regulations are set forth in Parts 200 and higher.

This regulatory framework creates distinct roles for the NRC and DOE with respect to the eventual removal of SNF from SONGS. It also establishes the legal boundary conditions that will apply to this process, absent changes to current regulations or underlying law. Because this Strategic Plan relates specifically to SNF storage and disposal, the subsections that follow focus on these aspects of current law and regulation. In addition, the role of states and tribes is briefly addressed in Subsection 6.3.6.

The core premise of this Strategic Plan, as we noted at the beginning of the chapter, is that storage, transportation, and disposal of the SONGS SNF must be carried out in accordance with the highest standards of nuclear safety and security. Furthermore, meeting the highest standards of safety and security is the first and foremost responsibility of owners and operators of all nuclear facilities. This includes the responsibility to ensure worker and public health and safety, security, and protection of the environment. As an important and necessary independent measure of assurance, owners and operators of nuclear facilities must meet, and where practicable, exceed minimum regulatory requirements. In practice this means that any facility that is designed, licensed, certified, constructed, operated, and maintained in accordance with NRC regulations, and any nuclear-related activity that is undertaken in compliance with NRC regulations, is considered by the industry and its regulators to be, by definition, safe, secure, and protective of the environment. The remainder of this section therefore focuses on explaining how nuclear safety and security are defined and implemented across the industry.

The AEA provides the highest-level legal framework for ensuring the safe and secure use of nuclear materials by the civilian population in the United States. In approving the AEA, Congress made a determination that, as in other scientific and industrial settings, "zero risk and zero consequences" for public health and safety are not a reasonable standard for operation. Colloquially, the appropriate standard for any undertaking involving public health and safety is *reasonable* risk and *acceptable* consequences. In the language of the AEA, this requires that nuclear activities be conducted in a manner that provides "reasonable assurance of adequate protection" of the public and workers. Specifically, the AEA states that, in order to be granted a license, the applicant will provide information such that the "utilization or production of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public."[107]

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[106] The text of the Price-Anderson Act may be found in Section 170 of the Atomic Energy Act, as amended.
[107] Atomic Energy Act, as amended, Section 182.a.

NRC regulations and related guidance are developed within the "reasonable assurance of adequate protection" envelope established under the AEA. How this expectation applies to the activities of the NRC's Office of Nuclear Material Safety and Safeguards (NMSS), which regulates SNF storage, transportation, and disposal, was most recently clarified in a 2019 memorandum to staff from the NMSS Director, which states: [108]

> *"The purpose of this memorandum is to reiterate some of the key principles that guide the manner in which we conduct our work and make decisions, particularly with respect to the concept of 'reasonable assurance of adequate protection.'*
>
> *These key principles are:*
>
> - *We operate in a manner consistent with the Principles of Good Regulation (i.e., independence, clarity, openness, reliability, and efficiency).*
> - *We make our findings based upon reasonable assurance of adequate protection of safety and security, as implemented in NRC requirements, and not on absolute certainty or total risk avoidance.*
> - *We identify, elevate, and resolve process and organizational barriers that impede our ability to achieve effective and efficient licensing reviews and make decisions through a graded or risk-informed, performance-based approach where appropriate."*

Pursuant to this guidance, NRC regulations for any activity should be (1) commensurate with the risks that activity presents to public health and safety and (2) consistent with providing reasonable assurance of adequate protection. It is up to each applicant for an NRC license or certificate of compliance (CoC) to demonstrate the likelihood that the facility or component provides reasonable assurance of adequate protection. If the NRC is convinced, the NRC grants the license or CoC. However, that is only half the story.

The licensee responsible for the nuclear material must then implement the conditions of the license in a consistent, long-lasting manner that ensures robust compliance and often exceeds minimum requirements. This includes developing and maintaining a safety-conscious work environment that prioritizes nuclear safety, security, and environmental protection in balance with productivity. Creating such an environment, in turn, requires a management team that emphasizes a strong safety culture at the highest levels and an organization that has a questioning attitude, is self-critical, strives for continuous improvement, and implements a robust corrective action program. All of the above reinforces the fact that the licensees, not the NRC, are ultimately responsible for ensuring the protection of public health and safety for all they do. Holders of CoCs must also embrace these principles in the design and fabrication of SNF storage systems and transportation packages.

To successfully implement any of the recommendations in this plan, SCE must continue to operate the SONGS ISFSI in a safe manner over the years to come. Any licensee of a facility that receives nuclear materials from SONGS in the future must likewise provide this level of confidence to SCE with respect to their operations when the material arrives on site. Planning and executing the transportation of SNF to a future receiving facility must have safety as its first and highest priority. In fact, broad-based acceptance of

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[108] Memorandum to the Office of Nuclear Material Safety and Safeguards Staff from Marc L. Dapas, Director, Office of Nuclear Material Safety and Safeguards, January 15, 2019, ADAMS Accession No. ML 19015A290.

efforts to relocate SONGS SNF requires that the public has confidence that all three major steps involved—i.e., loading, transporting, and receiving the material—will be performed with a very high level of safety.

6.3.2 Financial Protection and Indemnification Considerations under the Price-Anderson Act (PAA)

The PAA specifies financial protection and indemnification requirements for NRC licensees and DOE contractors, requires omnibus coverage for licensed activities, and caps total financial liability for NRC licensees and DOE contractors, who are indemnified against claims of personal injury and property damage associated with nuclear or radiological incidents, including the costs of incident response or precautionary evacuation, and the costs of investigating and defending claims and settling suits for such damages. These provisions apply to the use, transportation, and storage of nuclear fuel at covered facilities. Covered licensees must maintain PAA financial protection and indemnity coverage for their facilities in accordance with 10 CFR 1 40, "Financial Protection Requirements and Indemnity Agreements."[109]

The alternatives and variants considered in this plan for moving SONGS SNF to an offsite location involve different combinations of federal, SCE, and other private-entity NRC licensees taking possession of and/or taking title to the SNF and transporting the material to another NRC-licensed facility for further interim storage or disposal. Whether PAA protections and 10 CFR 1 40 requirements apply to these entities and facilities is a crucial economic risk factor in analyzing the merits of each alternative and variant.

Questions to be addressed include:

- Is the PAA applicable to the entity and facility as described in the PAA or implementing regulations?
- What coverages and agreements are available and what liability limits are required or prudent?
- How do the financial protection and indemnification elements apply and overlap for the entities responsible for transportation and the receiving facility?
- How do variants involving title transfer and possession affect these matters?
- What gaps exist that need to be addressed?

A comprehensive analysis of financial protection and indemnification as it relates to the offsite relocation of SONGS SNF is provided in a separate report prepared for NWT; that report is included in full as Appendix C.

6.3.3 Requirements of the Nuclear Waste Policy Act (NWPA) and Standard Contract

As detailed in Chapter 5, the NWPA and Standard Contract, together, establish what may be considered the default position if no other alternative for moving SONGS SNF is successful and no action is taken by Congress to modify the NWPA. In that case, SNF currently at the SONGS site would stay at SONGS until removed by the government, either for further interim storage or for ultimate disposal. The NWPA and

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[109] Excerpted from AHL Consulting report to the NWT, "Availability of Financial Protection and Indemnification for the Transport of Spent Nuclear Fuel and Reactor-Related Greater-Than-Class C Waste from the San Onofre Nuclear Generating Station to Offsite Storage and/or Disposal." (2020)

related appropriations establish what work DOE is currently permitted to perform with respect to SNF and high-level waste (HLW) management; they also limit what activities may be paid for from the NWF.

In particular, the NWPA specifically constrains DOE's ability to develop federal interim storage capacity using the NWF. Provisions in the Act for developing a federal "monitored retrievable storage" (MRS) facility are linked to specific progress milestones for geologic repository construction and operation that have not all been met. At this point, DOE would be able to site, design, and license an MRS facility, but construction of such a facility remains dependent on NRC approval of a construction authorization for a repository, or on legislation to remove this linkage. Other provisions under Subtitle B of the NWPA, which are now expired, allow for federal interim storage but only under specific circumstances and on the basis of utilities demonstrating need and paying a storage fee—in addition, NWF funds cannot be used to provide this capability. There is a possibility that the storage fees required by Subtitle B could be paid out of the Judgment Fund, but it remains the case that pursuing either federal interim storage facility or an MRS would require congressional appropriations and, at some point, changes to the language of the NWPA.

This Plan looks at each alternative and variant involving DOE in the context of what the NWPA, Standard Contract, and settlement agreements currently allow.

6.3.4 Nuclear Regulatory Commission (NRC) Requirements

The NRC regulates the transportation and storage of SNF under 10 CFR 71 and 10 CFR 72, respectively. In its original form, 10 CFR 72 offered only specific ISFSI licenses using the typical NRC site-specific application process (with associated site characterization and technical and environmental reviews). Applicants for specific licenses must also submit separate plans for certain aspects of facility operation (e.g., quality assurance, emergency response, security, etc.) and a demonstration of financial qualifications.

Pursuant to the NWPA amendments of 1987, the NRC revised 10 CFR 72 in early 1990 to add provisions for the general license process and storage cask design certifications. The intent of the general license process is to allow facilities that are already licensed under 10 CFR 50 or 52 (i.e., power plants) to leverage their operating experience and familiarity with NRC regulations to operate on-site ISFSIs without further applications to the NRC or need for NRC review.[110]

Conditions for a 10 CFR 72 general license (at 10 CFR 72.212) include, among other requirements, the use of an NRC-certified cask design and the development of a "212 Report" by the general licensee.[111] NRC-certified storage cask designs are issued a CoC and are added by rulemaking to an NRC list (under §72.214).[112] The Part 72 general license requires the licensee to maintain an active Part 50 or 52 license, even if there is only an ISFSI on site. The general licensee may use an unlimited number of different certified cask designs at the ISFSI. Of the 73 ISFSIs currently operating in the United States, nine use a specific license, 60 use a general license, and four use a combination of both licenses.

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[110] The 10 CFR 72 general license is issued to all Part 50 and 52 licensees by rule at 10 CFR 72.210.
[111] The primary purpose of the 212 Report is to document general licensee compliance with the storage cask CoC and to summarize the evaluations that demonstrate the generic cask design and associated design criteria that bound conditions at a particular ISFSI site.
[112] GTCC waste is not permitted to be included in the allowed contents of a storage cask CoC. GTCC waste stored at a general license ISFSI is stored under the site's Part 50 license.

SCE operates the SONGS ISFSI under a 10 CFR 72 general license, using two NRC-approved storage system CoCs: the TN Advanced NUHOMS System (CoC 72-1029) and the Holtec HI-STORM UMAX System (CoC 72-1040). Shipping SONGS SNF canisters would require the use of transportation packages approved under 10 CFR 71 that include both the SONGS canister designs and the contents of each specific canister in service at the ISFSI (see further discussion in the Conceptual Transportation Plan). NRC regulations applicable to the receiving facility depend on whether the facility is for interim storage, which is regulated under 10 CFR 72, or for permanent disposal, which is regulated under 10 CFR 60 or 63.

Either a private entity or a government entity can be licensed under 10 CFR 72. However, only DOE is allowed to apply for a geologic repository license under 10 CFR 60 or 10 CFR 63. Licensing a private geologic repository in the United States, therefore, would require the NRC to amend its regulations and would likely require statutory changes. It is important to note for this plan that an NRC rulemaking to allow GTCC waste disposal in a near-surface low-level waste disposal facility is moving forward. This effort, if successful, could allow the SONGS GTCC waste canisters to be disposed of at a land disposal facility that can be licensed by either NRC or an Agreement State licensed under 10 CFR 61 or equivalent regulations, assuming such a facility becomes available.[113]

Each of the alternatives and variants in this plan are given consideration in the context of applicable regulatory frameworks. The key challenges involve whether the alternative or variant may be implemented under current regulations or if new NRC rulemaking is required.

6.3.5 The Standard Contract Queue

A key parameter in current U.S. nuclear waste policy is the concept of a queue that would govern acceptance rights (or allocations) for SNF that is being shipped to a "DOE facility"— whether a federal repository for disposal or another facility (e.g., a consolidated interim storage facility) to which DOE may ship SNF prior to final disposal.[114] (See Appendix F for a detailed discussion of the queue, its implications, and alternatives.) The Standard Contract established between DOE and owners of SNF or HLW pursuant to NWPA requirements requires DOE to issue an "an annual acceptance priority ranking for receipt of SNF and/or HLW… based on the age of SNF and/or HLW as calculated from the date of discharge of such material from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance…." While this "oldest-fuel-first" (OFF) principle is used to allocate rights to the available annual acceptance capacity among contract holders based on the age of the oldest SNF still in their possession, contract holders are free to use their annual acceptance rights to deliver any SNF in their possession, at the site of any reactor they own, that meets other acceptance criteria specified in the contract.[115]

In 2004 DOE published its *Acceptance Priority Ranking and Annual Capacity Report* that allocates the projected annual receipt capacity among contract holders using the OFF principle, based on the

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[113] Licensing Requirements for Land Disposal of Radioactive Waste. Two additional points are worth noting here. The first is that recovery of such disposal costs could be very uncertain. The second point is that DOE has prepared an Environmental Assessment (EA) concerning the potential impacts of using the WCS facility in Texas to dispose of the nation's complete inventory of GTCC waste. The EA finds that potential impacts would not be significant. See: https://www.energy.gov/sites/prod/files/2018/11/f57/final-ea-2082-disposal-of-gtcc-llw-2018-10.pdf.

[114] Standard Contract Article II (b) sections 1 and 10.

[115] The planning basis for operation of a Yucca Mountain repository assumed that utilities would prefer to use their acceptance rights to deliver the youngest (and hottest) SNF in their pools allowed by the contract – 5 years after discharge.

assumption that federal waste acceptance would begin in 2010.[116] SONGS has a favorable position in the OFF queue in terms of initiating early shipments of SNF due to the early start of operation of SONGS Unit 1. Specifically, DOE's 200 4report indicates acceptance of about 10 MTU of SNF from SONGS in the first year.

[116] See DOE/RW-0567, July 200 4With the federal repository program at a standstill, DOE has not published an update to this acceptance schedule since 200 4

However, this priority ranking would result in only about one-third of the SONGS SNF being shipped within the first decade of federal waste acceptance operations. If all contract holders exercised their SNF acceptance rights under the current OFF sequence, completing the shipment of all SONGS SNF to a federal facility could take a total of two to three decades.

Because the only reactors belonging to the SONGS co-owners are located at a single site, the SONGS co-owners cannot shift acceptance rights from another reactor site they own to speed up clearance of the SONGS site. However, the schedule for SONGS SNF might be accelerated to some extent by exercising the latitude afforded to SNF owners in the Standard Contract to exchange acceptance rights, subject to DOE approval. It has been suggested that such exchanges could be monetized—in other words, that SNF owners could pay other owners to change places for a more favorable position in the acceptance ranking. Thus, SCE could potentially negotiate with other nuclear utilities to move SONGS's allocation forward in the queue, subject to DOE approval. However, to clear the SONGS site completely in the first 10 years after the federal government starts accepting SNF, the SONGS co-owners would have to acquire acceptance rights for an additional 1,100 MTU from other utilities holding those rights in that period. While analyses indicate that a market for such exchanges would likely develop,[117] this has not yet occurred, so the feasibility and cost of acquiring the needed rights is unknown.

A fundamental inefficiency built into the OFF queue is that it could lead to a large number of reactor sites each shipping a relatively small amount of SNF each year. For example, the 2004 Acceptance Priority Ranking report shows that in the tenth year of operation of the system the expected 3,000 MTU receipt capacity would be divided among 46 contract holders with 63 different sites. This fragmented allocation of annual acceptance according to an OFF-based removal sequence would increase costs to the government due to system inefficiency. It would also substantially extend the time required to clear SNF from sites after the last reactor has shut down. Fixed costs to SNF owners for storage operations (primarily for security) do not decrease proportionally as SNF inventories decline; rather, these fixed costs are constant and cease completely only after all SNF is removed from the site. Thus, the OFF sequence tends to maximize the complexity and impacts SNF transportation logistics while also extending the time SNF remains on reactor sites—which in turn affects the compensatory damages contract holders receive from the federal government.

Several studies have focused on alternative acceptance approaches that could facilitate more rapid and efficient clearance of SNF from shutdown reactor sites.[118] These studies clearly show that both the number of sites that are conducting shipments in a given year and the cost of continued storage at shutdown sites can be substantially reduced by a strategy that focuses on clearing a few shutdown sites at a time in full-scale campaigns that remove SNF at the maximum rate achievable at each originating

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[117] Van Ness Feldman, PC, *Legal Background and Questions Concerning the Federal Government's Contractual Obligations Under the "Standard Contracts" with "Utilities,"* December 20, 2010, pp. 45. https://cybercemetery.unt.edu/archive/brc/20120620222929/http://brc.gov/sites/default/files/documents/20101220_standard_contract_memo_revised_final_2.pdf.
"In fact, it appears likely, assuming DOE at some point in the future begins performance under the Contract, that the utilities will thereafter begin to exercise their rights under the exchange provision and that an exchange market will develop. This prediction stems from both the treatment of the exchange provision in Standard Contract litigation and the fact that the exchange provision was incorporated into the Standard Contract at the utilities' behest. When calculating damages under the Standard Contract, the courts have consistently determined that utilities would have exercised their right of exchange had DOE not breached its duties under the Contract, particularly in instances where a utility would have had a strong financial incentive to procure such an exchange. DOE itself has stated its belief "that once the Federal waste management system is operational, the exchange provision will be exercised by the Purchasers as originally anticipated."

[118] See Appendix F for a detailed discussion.

site, instead of removing small amounts of fuel from every site that has an OFF allocation for that year. These efficiencies are further amplified if all the shipping sites are in the same region of the country and use overlapping shipping routes.

In this prioritization strategy, the *start* of SNF shipments away from some sites would be delayed (relative to the schedule under the OFF queue), but in most if not all cases the removal of the *last* SNF from each site would occur no later than under the OFF queue. In many cases, full removal would be accomplished *sooner*. The same studies further show that a more efficient strategy would have substantial system-wide benefits compared to the OFF queue, thereby potentially giving policymakers greater motivation to restart the federal waste management program:

- A reduction in the number of sites with stranded SNF—by 16 or more within a decade.
- A sharp reduction in the number of sites shipping SNF each year (around 10 instead of around 50 during the period of peak shipments). This would reduce actual and perceived transportation impacts by limiting the number of active transport routes, the number of states affected, and the cost of training emergency responders each year.
- Dramatic reductions in the cost of unnecessary extended storage at shutdown sites. This would, in turn, reduce federal liabilities via Judgment Fund damage payments for activities that do nothing to advance final disposition of the SNF.

It should be noted that these studies have generally assumed that in the OFF queue case, the SNF is shipped from the site to which the annual allocation is assigned, without the SNF owner exercising the right to ship SNF from another reactor site or to exchange rights with a different SNF owner. While such exchanges would likely reduce the inefficiencies of the OFF allocation system, it is not likely that the full benefits of an alternative site-by-site clearance strategy could be achieved by multiple SNF owners independently exercising their rights.[119]

The Standard Contract gives DOE discretion to prioritize acceptance of SNF from shutdown plant sites, independent of the order that would be dictated by the OFF framework. However, DOE has been reluctant to use this discretion in the past due to a concern that doing so could raise equity issues and lead to litigation by other contract holders. Accordingly, DOE has stated that legislation to establish a mandated storage program would need to "expressly direct the Department to exercise its discretionary authority under the Standard Contract to take SNF from the decommissioned reactors on a priority basis..."[120]

It is worth noting that in congressional testimony in 2012 on proposed nuclear waste legislation, a representative of the nuclear industry stated, first, that the industry agreed with giving priority to shutdown commercial sites with no operating reactors and, second, that utilities would not argue with a determination by DOE to exercise its discretion under the Standard Contract to prioritize shutdown sites.[121]

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[119] The 2004 Annual Capacity Report identifies 60 "Purchasers" (contract holders) with allocations in the first 10 years.

[120] U.S. Department of Energy, *Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites*, December 2008, DOE/RW-0596.

[121] The testimony was given in relation to S. 3469 (The Nuclear Waste Administration Act of 2012). This was the first version of current S. 1234 and was the first nuclear waste bill that gave priority to storing SNF from shutdown reactors. See: https://www.energy.senate.gov/public/index.cfm/hearings-and-business-meetings?Id=228FE2E8-8C9E-4440-B266-1D3885C3FA93&Statement_id=B2AC790B-66BB-478C-86E7-973EC86B229A, p. 32.

As the expected time for the start of federal waste acceptance extends into the future, growing numbers of plant sites can be expected to shut down based on the expiration of their operating licenses (in many cases within the next two decades).[122] Others will surely be retired early due to financial challenges. Nuclear waste bills introduced in the 116th Congress that provide for the development of consolidated interim storage facilities give priority to SNF from shutdown reactors, but do not explicitly direct DOE to use its authority under the Standard Contract.[123] Given that DOE does have that authority, legislative direction to prioritize shutdown reactors might be sufficient. However, additional explicit direction might be needed to provide guidance about how DOE should prioritize acceptance of SNF *among* the group of shutdown sites to ensure that the approach taken is efficient and commercially acceptable to the affected parties.[12 4]

Given DOE's past reluctance to take initiative in exercising this discretion, it would likely be advantageous in any case—for all owners of shutdown reactors— if Congress directed DOE to accept SNF in a way that minimizes both the time required to fully empty individual sites and SNF transportation impacts. There may be an opportunity for the industry to work together, perhaps via the Nuclear Energy Institute and/or the Decommissioning Plants Coalition, to create a consensus-driven prioritization scheme for removing SNF from shutdown sites and to recommend that scheme be adopted.

6.3.6 States and Tribes

Neither states nor tribes maintain a formally delegated regulatory responsibility for SNF, but they do have significant influence over whether a SNF storage or disposal facility is sited within their jurisdiction. In addition to their influence on the political environment for siting a facility, states and tribes are experienced in exercising regulatory authority (see, for example, the discussion of regulatory roles played by California agencies in Section 43), which can be used to influence certain aspects of siting, construction, or operation through permitting and enforcement.

Of note, California (along with New Mexico and Texas) is an "agreement state" and therefore has experience exercising regulatory authority over certain nuclear facilities and materials within its borders.[125] The state is supported in these efforts by the NRC, which conducts training courses and workshops, evaluates technical licensing and inspection issues from agreement states, evaluates state

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[122] See Appendix D for a list of shutdown commercial nuclear sites with spent fuel projected through 2040 ordered by year of last reactor on site shutting down.

[123] H.R. 2699, S. 1234 and S. 2470 (appropriations for energy and water development and related agencies FY 2020, including a pilot interim storage program).

[12 4] The Senate bills do not address this question. The House bill limits priority acceptance not only to plant sites that have ceased commercial operation, but also more narrowly to only those sites that are located in "(I) an area that is of high seismicity" and "(II) close proximity to a major body of water." If adopted, these criteria would favor priority acceptance of the SNF at SONGS but would not clarify how acceptance would be prioritized among other sites that also meet this more restrictive qualification.

[125] Section 274 of the AEA provides a statutory basis under which NRC can relinquish to states portions of its regulatory authority to license and regulate byproduct materials (radioisotopes), source materials (uranium and thorium), and certain quantities of special nuclear materials. Under the AEA, the NRC also provides assistance to states that express interest in establishing programs to assume NRC regulatory authority. Importantly, states' ability to assume regulatory control is limited to intermediate-level and low-level radioactive waste—it does not extend to SNF, GTCC, or high-level waste. The mechanism for this transfer of authority, as described in Section 274b of the AEA, is an agreement signed by the governor of the state and the NRC chairman.

rule changes, participates in activities conducted by the Organization of Agreement States or the Conference of Radiation Control Program Directors, Inc., and provides for early and substantive state involvement in NRC rulemakings and other regulatory efforts. The NRC also coordinates with agreement states on the reporting of event information and on its responses to reported allegations that involve agreement states. Finally, the NRC oversees agreement state implementation and can suspend or rescind agreement state status if the state is not performing its duties properly.[126,127]

As an example of state influence, Private Fuel Storage, a utility-led effort to develop a consolidated storage facility in Utah in the 1990s, ultimately failed for reasons that included state-level opposition.[128] Opportunities to encourage state support and address state concerns are therefore extremely important (see also discussion in Section 6.1 of this chapter). Provisions that may be negotiated with states and tribes include monitoring and other safety measures beyond the regulatory basis and payments in lieu of taxes (in the case of a federal facility).[129]

This Plan does not evaluate the proper mix of these considerations other than to assert that any successful siting attempt of a repository or CISF must gain sufficient socio-political support at the state and tribal level, as well as at the local level. As we have noted at multiple points in this Plan, the lack of such support has been a major barrier; however, positive models also exist—in the U.S. context and in other countries—for developing strong local support for a project and then building on that support to generate broader acceptance of a facility at higher levels of government.[130]

6.3.7 Requirements Under Other Environmental Regulations

Several additional environmental regulations would apply in varying degrees to any of the analyzed alternatives and variants. Without providing an exhaustive review of these regulations, this subsection briefly summarizes some of the better-known requirements that could have a bearing on the movement of SNF from SONGS.

NEPA requires federal agencies to assess the environmental effects of proposed major federal actions prior to making decisions. Individual federal agencies have their own established procedures for implementing NEPA. For instance, DOE's NEPA implementing procedures are found at 10 CFR Part 1021, while the NRC implements NEPA through 10 CFR Part 51.

When seeking a license for an interim SNF storage facility, for example, a private applicant will submit an environmental report.[131] As part of its review, the NRC will typically consider the applicant's submission, do its own analyses, and then prepare an environmental impact statement (EIS) to evaluate alternatives and potential impacts on the human environment, including impacts with respect to environmental

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[126] No similar mechanism exists for transferring NRC regulatory authority to tribal nations. Both the NRC and DOE do maintain a government-to-government relationship with tribes and communicate with their national organizations. DOE sponsors several tribal groups to facilitate consultation with tribal governments regarding energy projects and radioactive materials management.

[127] See: https://www.nrc.gov/about-nrc/state-tribal/agreement-states.html.

[128] See Subsection 7.4.2 for further discussion.

[129] For example, some communities near shutdown plant sites have suffered from a substantial loss of tax revenue since plants were retired and may be open to considering uses of these sites that would provide a new stream of benefits.

[130] The experience with WIPP, discussed in Box 6.1, provides a good example of this dynamic.

[131] If the applicant is a government agency such as DOE, the government agency may opt to develop its own environmental impact statement for EPA approval and NRC adoption, rather than submit an environmental report.

justice, public and occupational health, air quality, surface and ground water resources, transportation, geology and soils, and socioeconomics. A typical EIS will also analyze potential impacts on historic properties and cultural resources and on threatened and endangered species, as well as economic, technical, and other costs and benefits.

When other federal agencies are involved, they too will have NEPA obligations. For example, DOE may be involved in funding, transportation, title transfer, disposal, and other aspects of nuclear materials storage and disposition. (DOE's NEPA obligations with respect to an MRS facility sited by DOE or the Nuclear Waste Negotiator are spelled out in the NWPA.) Approval from federal land management agencies, such as the Bureau of Land Management or Bureau of Indian Affairs, may be needed at some sites. When multiple agencies are involved in the same action, the Council on Environmental Quality's NEPA regulations (40 CFR Parts 1500-1508) include provisions to reduce duplication and paperwork. The regulations provide for the designation of a lead agency for joint preparation of EISs, and an allowance that enables agencies to adopt appropriate environmental documents prepared by another agency. In several instances, DOE has adopted EISs prepared by the NRC and recirculated them to the public. Similarly, provisions of the NWPA (Section 114(f) 4) require the NRC to adopt, to the extent practicable, any EIS prepared by DOE in connection to the proposed repository at Yucca Mountain, while Section 407(c)(1) extends the same requirement to any repository or MRS facility sited by the Nuclear Waste Negotiator.

In addition to NEPA, 16 states, including California, have adopted state environmental policy acts, which require that state actions (as well as, in some states, actions by local governments or private entities) be evaluated for their potential environmental or public health impacts. (In California, these requirements are set out by the California Environmental Quality Act or CEQA.) Typically, state agencies are required to prepare environmental analysis documents that outline all potential environmental consequences of proposed actions, potential alternatives to the proposed actions, possible unavoidable environmental effects, and mitigation steps to be taken. In most instances, states may adopt NEPA documents if they are available and/or develop joint NEPA and state environmental documents to adequately evaluate the state's action.

At the federal level, Section 106 of the National Historic Preservation Act (16 U.S.C. 470 et seq.) requires federal agencies to assess effects on historic properties and provide the Advisory Council on Historic Preservation with a reasonable opportunity to comment. In addition, federal agencies are required to consult with state and tribal historic preservation offices and with Indian Tribes. Compliance with Section 106 is typically coordinated with NEPA review; associated complexity would vary with each alternative depending on the presence of historic properties that could be affected.

The Endangered Species Act requires federal agencies to assess potential impacts on threatened or endangered species or their habitat, and to develop measures to minimize those impacts. Agencies must also consult formally with the U.S. Fish and Wildlife Service. Compliance with these requirements is frequently part of the NEPA process; associated complexity would vary with each alternative and would depend on the presence of threatened or endangered species or their habitat.

6.4 Title and Possession (including related issues of risk, liability, and indemnification)

Title and possession of SNF have significant implications for the allocation of costs and liability associated with each of the alternatives assessed in this plan. Under the language of the NWPA and DOE's Standard Contract with individual utilities, DOE is required to take title to the SNF at the time that DOE removes SNF from plant sites. From that point on, the cost of all SNF management activities,

including preparation, processing, transportation, storage, and disposal are allocable to DOE to be paid from the Nuclear Waste Fund. Also, once DOE takes title to the SNF, any future accident liability would still be covered under the Price Anderson Act (PAA). This transfer of liability is another key aspect of the longstanding understanding between the federal government and private utilities with respect to SNF management in the United States.

The PAA establishes a framework of three tiers of financial protection: a first tier of private insurance obtained by the nuclear plant license holder, a secondary tier of financial protection provided through a pool of deferred premium payments from all operating licenses, and a third tier of indemnification in the form of congressional consideration of additional appropriations. Appendix C provides a more detailed discussion of financial protection and indemnity considerations.

The framework is somewhat different for the licensee of a shutdown reactor. The NRC has approved various exemptions that have allowed the SONGS co-owners to reduce their on-site and primary offsite/third-party liability coverage and exit the secondary offsite liability coverage tier. Pursuant to these NRC-approved exemptions, the co-owners have reduced their on-site liability coverage to $130 million and exited the secondary tier liability pool for offsite liability. The co-owners currently maintain their primary tier of offsite liability coverage at $450 million, even though it could be reduced to $100 million. In either case, when combined with the NRC indemnity, the total offsite liability coverage is $560 million, which is also the statutory limit of liability. See Appendix C for a more detailed discussion of general and SONGS-specific financial protection and indemnity considerations.

The Settlement Agreement that triggered this strategic planning process stipulates that:

> *"Any relocation of SONGS Spent Fuel to an Offsite Storage Facility must result in the transfer of liability for and title to the SONGS Spent Fuel to a third party unless SCE obtains contract terms from the third party, such as, but not limited to, indemnities and insurance provisions, that offer Commercially Reasonable protection from liabilities and risks that may arise from SCE's retention of title to the SONGS Spent Fuel."*

This condition is readily satisfied if the federal government takes title to spent fuel because in that case the government also assumes the liability that results from transporting, storing, or disposing of the spent fuel. Under PAA authority, the federal government may provide indemnification to any contractor transporting or storing SNF on its behalf, with a cap on liability of $12.63 billion, to be paid from the NWF. The Standard Contract assumes that the federal government will take SNF at the plant site and be responsible for transportation. It states:

> *"DOE shall accept title to all SNF and/or HLW, of domestic origin, generated by the civilian nuclear power reactor(s) specified in Appendix A, provide subsequent transportation for such material to the DOE Facility, and dispose of such material in accordance with the terms of this contract."*

The challenge of securing "commercially reasonable protection from liabilities and risks"—both for transportation and for continued storage at an offsite facility—becomes much more significant, by contrast, in all disposition scenarios that do not involve the SONGS co-owners transferring title to the SONGS SNF to a third party. For example, if the SONGS co-owners retain title and then SCE contracts for transportation to an offsite facility, then the SONGS co-owners hold liability, and the current mix of private insurance and NRC indemnification ($560 million) would continue to apply for transportation off site. In that case, SCE may need to seek a determination from the NRC that the current level of insurance is adequate. This may be required because SCE has received approval of an exemption to the

NRC's regulations to substantially reduce its limit of liability. This reduction was granted on the basis of reduced risk for at-reactor storage and did not specifically address potential accidents and liability for offsite transportation.

If the SONGS co-owners contract for storage at a private or other non-federal CISF (without the federal government taking title), the owner/operator of the CISF is not eligible to obtain financial protection and indemnification agreements with the NRC under the PAA because 10 CFR 1 40.2 does not include Part 72 specific licensees in its scope. Consequently, the owner of the CISF would need to obtain private insurance coverage for the CISF facility. While the CISF owner would take possession of the SONGS SNF, as currently contemplated in the draft Holtec and ISP licenses, if the SONGS co-owners are the customer, the co-owners would need to retain title to the SNF even after possession transfers to the CISF licensee. The draft Holtec and ISP CISF licenses both include a condition that requires CISF customers to retain title to SNF stored at these facilities and share legal and financial liability for the SNF with the CISF licensee. Were an event to occur where the financial liability to the parties exceeded the amount of available insurance, the SONGS co-owners, as title holders to the SNF, could be held liable to cover excess damage claims. It is unknown if an insurance product to protect the SONGS co-owners against this risk could be obtained, and, if it could be obtained, how much it might cost.

The same would be true in any scenario that involves moving the SNF to a new, offsite facility that is developed either by the SONGS co-owners alone, or by the SONGS co-owners in partnership with other SNF owners (as in the California-only or multi-utility CISF concepts discussed in Chapter 7). (As we have already noted, there is no issue if DOE takes title and contracts for storage at the CISF, because in that case DOE coverage under the PAA would apply, and neither the CISF owner nor the SONGS co-owners would need private insurance for the SNF.) If a third party (other than DOE) were to acquire the SONGS assets and become the CISF customer, that third party would be subject to the same insurance requirements as those discussed above for the SONGS co-owners.

Thus, questions of title, arrangements for transportation, ownership of the CISF, financial protection and indemnity, and the federal government's role in the CISF create a number of potential legal permutations and combinations that affect the need for, and level of, private financial protection. These title transfer and associated liability considerations are critically important issues for assessing the commercial reasonableness of potential disposition pathways for the SONGS SNF under any scenario where the federal government does not take title. Moreover, as noted above, these considerations apply both to the disposition solution itself, and to the transportation of SNF from SONGS to the receiving facility. They are discussed in more detail in the assessment of individual alternatives and their variants in Chapter 7. A review of the existing contractual agreement for the interim storage of SONGS Unit 1 SNF at the GE Morris ISFSI facility in Illinois may be informative in this regard. The agreement, which addresses the shipment of SNF to GE Morris as well as ongoing storage operations and the future shipment of SONGS Unit 1 SNF from GE Morris to another receiving facility, includes provisions for liability, insurance, and indemnification.

6.5 Transportation Requirements

The Conceptual Transportation Plan (CTP), Volume III of this compendium, discusses the transportation of SNF in great detail, highlighting the different considerations that apply if the federal government is responsible for transportation versus another entity. We do not repeat that material here other than to give a brief overview of transportation issues that are common to all the alternatives discussed within this Strategic Plan and, more generally, to underscore the importance of transportation considerations

in assessing the viability—including the commercial reasonableness—of any strategy for moving the SONGS SNF to an offsite storage or disposal facility.

SNF has been safely transported within the United States and abroad for more than 60 years. Such shipments are covered by extensive regulatory requirements that are intended to protect public health and safety, and the environment. The NRC, the U.S. Department of Transportation (DOT), state and tribes through which such shipments travel, and sometimes DOE (see Volume III for further explanation), all play an oversight role in implementing these requirements and ensuring the protection of public health and safety, and the environment.

The transportation of radioactive materials is a complex process involving a web of entities, each with defined roles and responsibilities. Which entities are involved at different points in the process will vary depending on the type of radioactive material being shipped and the circumstances governing each shipment (i.e., the transportation mode). SNF shipments are governed by strict standards for packaging design and movement. In most if not all cases, the list of entities involved in SNF shipments is likely to include DOE, the NRC licensee who owns the SNF (in this case, the SONGS co-owners); private logistics companies, packaging owners, and carriers (such as railroads); the owner of the licensed receiving facility (if not DOE); federal regulatory agencies; and other state and tribal entities.

Together these multiple entities must coordinate—often well in advance—to execute the actual movement of SNF. That process typically includes (at a minimum) preparing packages for shipment; selecting transportation modes and routes (and acquiring NRC approval), planning for security and emergency response, training personnel, and communicating with local communities and stakeholders, while also ensuring that necessary handling equipment and capabilities are in place to load the SNF at the source site and to unload it at the receiving site. In many cases, logistics companies may be retained to integrate activities among multiple stakeholders; to ensure regulatory compliance and safe, secure, and event-free shipments; and to prepare a coordinated response in the event of any accidents or unforeseen incidents.

The entity responsible for shipping the SNF – either the federal government or a private entity – will also have to consider and plan for the cost and schedule implications of transporting SNF. The transport casks used to package SNF canisters for shipment cost $5–$10 million each (including cradle, impact limiters, and ancillary equipment) and take more than a year to procure. The cask rail cars, security cars, buffer cars and other ancillary equipment needed for transportation all impact a shipper's cost and schedule decisions. While these costs would be covered by the federal government if SNF is shipped under the auspices of the NWPA, a private shipping model means the costs would be borne by the SNF owner or factored into the amount charged by the owner/operator of the receiving facility if transportation services are provided with storage services.

The on-site activities and planning required to prepare SONGS SNF for shipment are described in detail in the CTP, which also develops an "all-in" estimate of cost for a first, three-package shipment of SONGS SNF away from the site.[132] NWT's rough order-of-magnitude cost estimate for on-site preparations and cask loading operations is $62 million.[133] These costs would be covered by the SONGS decommissioning trust funds and are the same regardless of where the SNF is being shipped or which entity is responsible for implementing transportation. It has been suggested that a case could be made for federal

[132] See Tables 5.1, 6.1, and 7.1 and related discussion in Sections 5-7 of the CTP (Vol. III).
[133] This estimate is dominated by costs for on-site infrastructure equipment and facility upgrades.

reimbursement of certain on-site costs to prepare the SONGS SNF for shipment if those costs would not have been incurred *but for* the federal government's failure to perform on its statutory and contractual obligations to remove the waste. NWT did not explore this issue, however, because such recovery issues have not yet been presented and so substantial uncertainties remain.

Separate from site costs, NWT's rough order-of-magnitude estimate of rail transportation costs for an initial three-package shipment of SNF is approximately $39 million. This includes costs for planning and logistics, as well as costs for the procurement of needed equipment and assets—primarily rail cars and transportation casks. We estimate that further cask-and-rail-car sets could be added at a cost of $28 million per set, if a systems analysis revealed that shipments of more than three packages at a time would be more cost-effective. Cost sharing among two or more private shippers would reduce the cost on a per-site basis.

Once rail cars and casks have been procured, the cost for subsequent shipments could be substantially lower—by as much as an order of magnitude in NWT's expert judgment. However, expected costs per shipment would still depend on a whole host of factors that cannot be analyzed in any detail before the final destination for the SNF is known and before key features of the overall shipping campaign have been established. For example, the identity of the shipper (whether the federal government or another party), the scale and pace of shipments, operational and other requirements (such as for insurance while the SNF is in transit), and the ability to amortize capital costs across multiple shipments and (in some scenarios) to share costs with other involved entities are all factors that would have important cost implications. Given that a total of 136 casks of SNF and GTCC waste will have to be shipped to fully clear the SONGS site, however, it is safe to conclude that the overall cost of transporting these materials to another facility would be well above $100 million if requisite equipment, such as specialized rail cars and casks, has to be procured for SONGS alone.

In any scenario where the federal government takes title to the SONGS SNF at the SONGS site boundary, of course, these offsite transportation costs would be fully covered by the federal government using funds that have already been collected from the SONGS customers. In other scenarios, particularly those that do not assume a major federal role, our analysis suggests that transportation costs would constitute another significant hurdle in terms of finding a commercially reasonable path to relocating the SONGS SNF.

Another important transportation-related challenge involves public acceptance and engagement. As discussed at length in the CTP, the industry capability available for transporting SNF in the United States is mature, has an enviable record of safety, and is subject to stringent requirements for packaging, security procedures, and many other aspects of planning and implementation. However, shipments of SNF from a utility to an interim storage or disposal facility can still be expected to generate significant public interest. People will have many questions about the potential for radiological exposure, safety measures taken, procedures in the event of an accident, possible impacts from an accident, and other issues. Thus, any entity responsible for SNF shipments will need to create a robust outreach program that actively engages and partners with state, tribal, and local governments along planned routes to create a transportation system that is safe and secure and that earns the confidence of affected communities and members of the public.

6.6 Impact on SONGS Decommissioning

The decommissioning of SONGS Units 2 and 3 continued as this Strategic Plan was being developed. In general terms, SONGS personnel anticipate completing major elements of decommissioning (e.g., removal

of all above-ground structures and wastes except for the SNF; the sea wall, walkway, and riprap; and the switchyard) by the end of 2028. NWT considered two broad questions: Will preparing for and executing SNF shipments from the site disrupt decommissioning? And will schedule changes in moving SNF from the site disrupt decommissioning? The most obvious way in which SNF movement could disrupt decommissioning would be if rail shipments of SNF materially interrupt the movement of decommissioning waste from the SONGS site that is also being shipped by rail. A general analysis of the site and rail layout, and discussions with SONGS technical staff regarding likely operations involving the rail facilities, leads to the conclusion that any conflicts between decommissioning activities and SNF shipping—in the event an offsite facility becomes available before 2028—could be managed. Given the timeframes required to implement an offsite storage or disposal solution for SONGS SNF, however, it is far likelier that decommissioning and site restoration activities will have been completed, up to the point where only the ISFSI, the switchyard, and the seawall/walkway/rip-rap remain, before SNF can begin to be shipped off site.

SCE will need to decide whether to retain on-site and near-site rail lines to facilitate shipments off site while it waits for a receiving facility to become available (at other shutdown plant sites, utilities have sometimes opted to remove all transportation infrastructure in the expectation that the federal government would pay to rebuild rail spurs or to heavy-haul canisters to a nearby rail transfer station). In addition, given the uncertain and potentially lengthy timeframes involved, maintaining trained and experienced personnel to transfer SNF to transportation casks and move casks to the gate for the federal government to take title and possession could present staffing and cost challenges. SCE will need to consider what skills will be needed for this phase and how best to either retain or find trained and experienced personnel when the time comes to actually move the SNF.

The schedule for removing SNF from SONGS does impact the decommissioning schedule in one important respect because SONGS Unit 1 was located on a portion of the site that is now being used for the ISFSI. Additional work needs to be done to complete decommissioning and cleanup for Unit 1, and this work cannot proceed until all the SNF is removed.

In sum, moving all the SNF is a necessary step to allow for the full decommissioning of SONGS, but it is unlikely that SNF movements off site will interfere with or delay the current schedule of decommissioning activities, particularly since most of those activities are likely to be complete before an offsite facility that could accept the SONGS SNF becomes available.

6.7 Timeframe to Achieve Objective

Among the most critical questions to answer about different alternatives for moving SONGS SNF offsite is how long it might take to do so. The SONGS co-owners' objective and that of most stakeholders and members of the local community is to remove these materials from SONGS as soon as practical in a commercially reasonable manner. Unfortunately, determining what this might mean in the context of different disposition pathways for the SONGS SNF, and given the history of past nuclear waste management efforts in this country more broadly, is not currently possible. This is because any

discussion of timeframes must necessarily contend with high levels of uncertainty—from multiple sources, including, but not limited to:

- Need for congressional action. Many of the alternatives considered in this Strategic Plan would require congressional action either (or both) to amend current law and provide federal funding. However, the current national-level impasse on moving forward with Yucca Mountain versus embarking on a new approach has persisted for about a decade and shows no signs of being resolved in the near future. Moreover, any new effort by the federal government to seek a different site for a repository, or to site and construct a consolidated interim storage facility, will require the reestablishment of a program management capability, specific appropriations and, ultimately, legislation to allow the process to be completed. Since it is only possible to speculate about how long this process might take, we acknowledge that projections must be considered "best guesses."

- Siting challenges, coupled with bureaucracy and regulatory complexity. Even if the federal government were to initiate new efforts to find an alternative repository site or to site and construct a consolidated interim storage facility, history suggests that the process is likely to be long and prone to uncertainties and delay. The 1987 amendments to the NWPA anticipated that the Yucca Mountain repository would be open by 1998.[13] In 1989, DOE projected that receipt of SNF would begin in 2010, meaning that the time to establish the repository had increased from 16 years (from the 1982 NWPA) to 28 years.[135] The July 2008 DOE Total System Life-Cycle Cost Report assumed initial operations of the Yucca Mountain Repository in 2016.[136] Repository programs in other countries have likewise taken longer than planned, and while some governments have made progress with consent-based approaches to siting, experience suggests that the process of gaining public support and acceptance for new nuclear facilities is inherently time consuming and difficult to predict with confidence.

- Transportation. Moving SONGS SNF to another location will require transportation infrastructure, transportation assets (i.e., specialized rail cars and transport casks with long procurement lead times), and planning and coordination, including for training and emergency preparedness. Before the federal government can ship spent fuel, a number of preparatory steps must be taken subject to provisions of the NWPA. If a commercial entity ships these materials, it must first acquire necessary equipment and meet other regulatory requirements.

- The Standard Contract "queue." As discussed in detail earlier in this chapter (Subsection 6.3.5), the Standard Contract establishes a queue for federal acceptance of SNF on an "oldest fuel first" basis. However, DOE has discretion to prioritize the removal of SNF from shutdown plant sites and there are numerous other uncertainties and nuances that could affect the way the queue functions in practice. For alternatives that involve the transfer of SONGS SNF to a federal facility, SONGS's place in the queue directly affects the timeframe needed to move all

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[13] By the end of 1987 the expected date had slipped to 2003. The MPA [1987 draft Mission Plan Amendment] advised Congress of the extension of the date contemplated for initiating operation of the first repository from January 31, 1998 to 2003. Office of Civilian Radioactive Waste Management Annual Report to Congress, August 1988, DOE/RW-0189. https://www.osti.gov/scitech/servlets/purl/6041.

[135] See Department of Energy, Reassessment of the Civilian Radioactive Waste Management Program: Report to the Congress by the Secretary of Energy, November 29, 1989 DOEIRW-0247.

[136] See: https://www.nrc.gov/docs/ML0927/ML092710177.pdf.

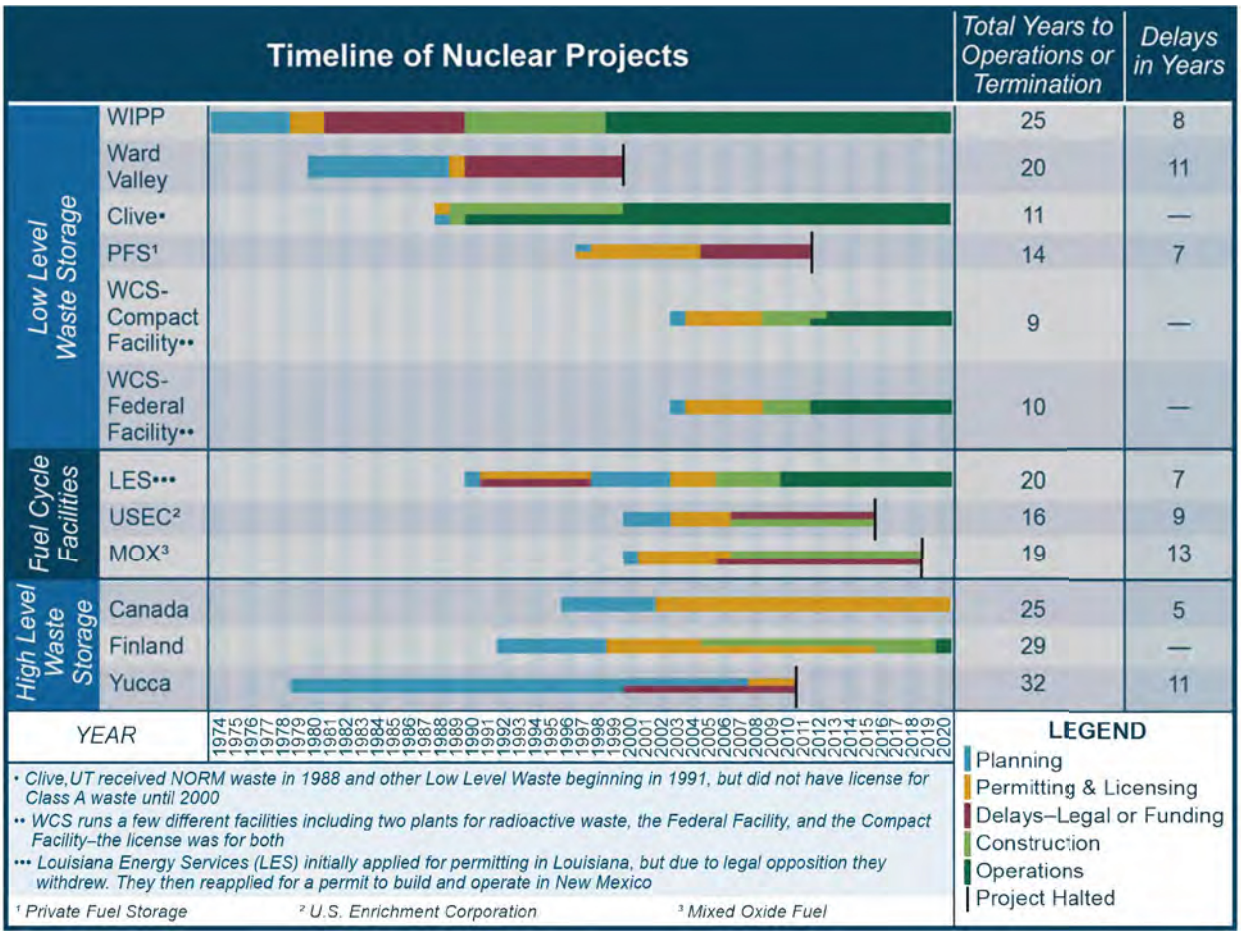
the fuel off site. Moving SONGS SNF to another non-federal storage site, without DOE taking title to the SNF, would not impact SONGS's current standing in the queue. Whether divergence from the OFF queue could be negotiated with DOE and other utilities, or might come about as a result of congressional action, has a significant bearing on the timelines associated with removing SNF from the SONGS site.

- Financing and other factors. Two private entities that are currently proposing to build consolidated interim storage facilities have projected that they can complete the NRC licensing process by mid-2021 and finish construction 18 to 24 months after license approval. Whether these targets can be met, however, depends on the companies securing financing, which in turn may depend on whether at least a few utilities or other SNF owners are willing to negotiate "term sheets" or otherwise demonstrate interest in using these facilities on a fee-for-service basis. Issues of risk, liability, and indemnification would also have to be resolved, along with questions about who assumes the costs, procures the equipment, and bears the responsibility for conducting SNF shipments.

These multiple sources of uncertainty make it difficult to develop reliable estimates of the time required to implement particular alternatives for moving SONGS SNF off site. Chapter 7 nonetheless provides estimates of the implementation timeframes that might reasonably be associated with different alternatives. Unless otherwise stated, these estimates are based on NWT's expert judgment, drawing on our understanding of regulatory and other requirements and U.S. experience with similar facilities. We offer these estimates as a bounding exercise, to highlight, at least approximately, the schedule implications of discrete implementation steps for a given disposition pathway, and to provide some basis for comparing the different alternatives in terms of the relative timeframes they are likely to involve. In most cases, our estimated timeframes take as their starting point a decision or agreement to move forward with a particular alternative—for example, congressional authorization in the case of a federal disposal or storage facility. In all cases, a later start date or significant delays or obstacles at any stage of implementation would push the date for completing the full removal of SNF and GTCC waste from SONGS further out into the future.

In fact, experience suggests that the process of siting, licensing, and constructing nuclear waste facilities is prone to delay and often quite lengthy. Figure 6.1 illustrates this point by showing the time spent to complete various phases of development for past projects, including six projects that were eventually completed and four that ultimately failed (other projects in the chart are still in process or face uncertain prospects, such as Yucca Mountain). In NWT's view, a realistic appreciation of the time likely to be required to implement a commercially reasonable offsite storage or disposal solution for SONGS SNF underscores the importance of taking action sooner rather than later. Absent meaningful progress within the next decade, whether toward resolving the current impasse in the federal program or developing consolidated interim storage options, or both, it is difficult to see how the objective of relocating SONGS SNF can be achieved on a timeframe consistent with current decommissioning plans.

Figure 6.1 Timeline of Past Nuclear Waste Management Projects



7. ALTERNATIVES ASSESSMENT

This chapter presents NWT's assessment of the specific disposition pathways or alternatives we identified that would enable the removal of SNF from the SONGS site. As discussed in Chapter 2, NWT drew from the Settlement Agreement, input from stakeholders, and team members' expert judgment to identify these alternatives. The first two sections provide an overview, both of the alternatives and of the assessment factors we applied in analyzing them. Remaining sections discuss the results of our assessment for each alternative.

7.1 Alternatives Included in the Assessment

Table 7.1 summarizes the different possibilities for moving the SONGS SNF that were included in this assessment. With the exception of the last alternative (emerging concepts for geologic isolation), all of these alternatives met our criteria for detailed consideration. Those criteria included: (1) the technical concept for the receiving facility is mature enough to be well-understood and to allow for the development of cost estimates and (2) the type of facility involved can meet rigorous safety and other requirements and can be successfully licensed by the NRC under existing regulatory frameworks.

In the simplest terms, SNF removed from the SONGS site will have to go either directly to a facility for permanent disposal or to another storage facility that would keep the SNF until a permanent disposal option is available. Geologic isolation is widely accepted as the ultimate and necessary disposition endpoint for all SNF. Hence, the first disposition pathway in our assessment, sending the SONGS SNF directly to a federal geologic repository, is distinct from the next five alternatives we considered, which all involve interim storage of the SNF at a different location as an intermediary step prior to final disposal. The last pathway we considered is likewise distinct, and receives a less detailed assessment here, because it focuses on less developed concepts for SNF disposition.

Geologic isolation is widely accepted as the ultimate and necessary disposition endpoint for SONGS SNF and for all SNF.

For each disposal or storage concept, we then specified a baseline, which generally represents the version of the concept that is best defined or for which the most information is available. For example, in the case of the non-federal consolidated interim storage facility (CISF) alternative we use two actual private proposals that are currently proceeding through the NRC licensing process as the baseline. For several concepts we defined additional variants from the baseline. Each variant typically alters one or two of the discrete parameters or assumptions in the baseline (i.e., which entity has responsibility for transportation) but leaves other parameters the same as in the baseline.

As we have emphasized elsewhere in this document, the dynamic and long-term nature of the SNF disposition challenge means that the pathways available for relocating SONGS SNF—and the socio-political environment around those pathways—are likely to change. NWT's assessment of each alternative reflects current information and circumstances, but we recognize that new developments may shift the relative advantages and disadvantages of different pathways and warrant reconsideration of aspects of our assessment. Recognizing these uncertainties, our aim has been to identify key issues and develop insights that should prove durable in helping the SONGS co-owners identify and leverage opportunities to move one or more solutions forward in the years ahead.

Table 7.1 Summary of Disposition Pathways Included in the Assessment

Disposition Pathway	Baseline Concept				Variants
	Implementer	Location	Title to SNF	Responsible for Transport	
Federal repository for geologic disposal	Federal entity	Yucca Mountain	Federal government	Federal entity	Federal repository at another site, possibly implemented by a new federal entity.
Federal consolidated interim storage facility (CISF)	Federal entity	TBD	Federal government	Federal entity	None
Federal use of a non-federal CISF	Non-federal entity such as ISP or Holtec, or PPP	TX/NM (if ISP or Holtec facility)	Federal government	Federal entity	• Other public-private partnership (PPP)
Non-federal CISF	ISP and/or Holtec	TX/NM	SONGS Co-owners	SCE	• SONGS assets and SNF sold to CISF-connected 3rd party • CISF owner takes possession at SONGS and transports to CISF • One or more other, privately led CISFs
CISF for California SNF only	California utilities: PG&E, SMUD, SCE	TBD, in CA	PG&E SONGS Co-owners SMUD	PG&E SCE SMUD	• NEWCO takes title at the CISF; utilities perform transportation • NEWCO takes title at sites and performs transportation • State of CA leads siting, development, and operation of CISF • Enlist other CA NRC licensees • Collaborative industry-federal government demonstration or research project
Multi-utility CISF at another nuclear plant site	SONGS co-owners with other SNF owner(s)	Another plant site TBD	SONGS Co-owners	SCE	• Participants form NEWCO to develop CISF at another plant site
Relocation of SONGS SNF to a new ISFSI	SCE	Higher ground on SONGS site	SONGS Co-owners	SCE	• Another site in CA • Another site on Camp Pendleton
Other disposition pathways	TBD	TBD	TBD	TBD	• Deep boreholes • Sub-seabed disposal • International disposal facility

7.2 Assessment Factors

The alternatives shown in Table 7.1 have different advantages and disadvantages, many of which relate to the cross-cutting issues and considerations discussed in Chapter 6. Our assessment considered a number of specific factors, not all of which are equally important, but all of which bear on the appeal and practical viability of different paths forward:

✓ **Safety, scientific and technical Issues, and regulatory feasibility**

- *Safety.* Safety is the first and most fundamental consideration for any disposition pathway or action that might be pursued with respect to the SONGS site and SONGS SNF. No disposition pathway was considered that could not meet rigorous NRC regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.
- *Scientific and technical issues*, including any issues that must be surmounted before the alternative can be deployed. The existence of such issues can increase the time or cost likely to be associated with deployment. We also consider technical maturity.
- *Regulatory feasibility.* Questions considered for each alternative and variant include: (1) Does the alternative face regulatory challenges that might delay or stop it? (2) Are changes in federal regulations or guidance needed to implement the alternative? (3) Has the alternative previously been licensed? The broad intent in applying this factor is to draw an informed conclusion as to what regulatory path applies to the alternative, whether federal regulatory compliance is a significant obstacle for the alternative, and to identify what, if any, federal regulatory action is required to implement the alternative.

✓ **Commercial reasonableness**

- *Cost*, including costs to develop different types of offsite interim storage facilities, as well as costs to the SONGS co-owners and their customers taking into account capital and operating requirements.
- *Ability to recover costs* from prior fees paid into the Nuclear Waste Fund, the Judgment Fund or allowable uses of decommissioning funds.
- *Commercially reasonable protection against liability* and other financial risks and uncertainties associated with moving SNF off site, particularly if the SONGS co-owners retain title to the SNF after it leaves the SONGS site.

✓ **Timeliness of offsite storage or disposal**

- *Implementation schedule*, meaning specifically the potential length of time ultimately required for (1) an initial agreement to be reached for waste acceptance, (2) initial waste receipt at a CISF or repository, and (3) receipt of the final shipment of SONGS SNF. This assessment factor encompasses the ability to accept all SONGS waste and any implications for the priority given to SONGS in terms of SNF acceptance. (Note that issues of transportation readiness are discussed in the Conceptual Transportation Plan, Volume III of this compendium.)

✓ **Other implementation considerations (beyond commercial reasonableness)**

- *Need for statutory change* to undertake the alternative (with a focus on federal legislation). The need for congressional action, where applicable, tends to increase the time and uncertainty associated with a particular disposition pathway.

- *Potential socio-economic-political considerations.* This qualitative factor takes into account likely stakeholder support or opposition, siting challenges, and (related to stakeholder support) the ability to generate champions and build coalitions to advocate for a particular alternative.
- *Degree to which SONGS co-owners have control over implementation*. This assessment factor considers whether and to what extent SCE can take action to ensure that a particular alternative becomes available within a reasonable timeframe. In many cases, SCE's ability to influence success will be indirect and will take the form of working with other stakeholders and decisionmakers to catalyze or leverage change.

A matrix table, summarizing the results of our assessment for all the alternatives we considered, is provided at the end of this chapter (see Table 7.9).

Of the assessment factors applied in this chapter, several present analytical challenges, either (or both) because they entail large uncertainties or because it is difficult to generate estimates absent specific information about the location and other features of a future facility, or about the contractual arrangements and fees that might apply to the use of that facility. Obviously, site conditions and characteristics, including infrastructure assets, will bear directly on the viability of any proposed facility, as will host community and host state acceptance. Thus, except for those baselines or variants in our assessment that involve an identified location, some of these factors could not be evaluated with much specificity.

SONGS co-owners will need to monitor developments and dynamically update its assessment of the relative merits and disadvantages of different paths forward as circumstances inevitably change.

In sum, our assessment necessarily entailed a large number of assumptions, most of which, as we have already noted, are subject to change over the long timeframes likely to be required to implement any particular disposition pathway. The SONGS co-owners will need to monitor developments and dynamically update their assessment of the relative merits and disadvantages of different paths forward as circumstances inevitably change.

7.3 Disposal in a Federal Repository

7.3.1 Synopsis

The concept of geological isolation in a mined repository is considered mature and has been extensively studied. This is the disposal concept that other countries are pursuing and that has been the preferred disposition pathway for SNF and other long-lived radioactive materials in the United States since the 1950s.[137]

[137] Other countries have, however, selected different geologic environments for their repository programs. For example, Sweden's repository will be sited in fractured granite, but in the water table where conditions are reducing and the SNF is therefore less soluble and less mobile. At Yucca Mountain, by contrast, SNF would be emplaced in the unsaturated zone under oxidizing conditions. In these conditions, the environment must be relatively dry as the SNF becomes more soluble and mobile in the presence of water.

Current law, embodied in the NWPA as amended, calls for DOE to open a deep geological repository for the permanent disposal of SNF and other high-level radioactive waste at Yucca Mountain in Nevada.[138] Thus, an obvious option for the SONGS co-owners is to wait for the federal government to make good on its statutory and contractual responsibility to take title to the SNF at SONGS and transport it to a geological repository for final disposal. This approach might entail the least cost and regulatory risk to the SONGS co-owners and their customers, since the current ISFSI at SONGS is fully compliant with NRC requirements and since most of the cost to operate and maintain the ISFSI may be reimbursed through the Judgment Fund until such time as the federal government takes title and removes the SNF.

The timeline for implementing a permanent waste repository is highly uncertain, however, and likely to approach the later decades of this century—for reasons detailed in this section. An initial source of schedule uncertainty stems from the federal government's inability to resolve the question of whether to resume the NRC licensing process for the proposed Yucca Mountain repository or launch a new process to select another repository site. The current impasse has lingered for a decade and has become deeply embedded in national political dynamics; consequently, it is impossible to predict whether it will be resolved in one year, five years, or longer. Resolution of this issue will, in turn, have significant impacts on the development schedule for an eventual permanent waste repository.

Considering the technical issues and political uncertainties, it is possible that a permanent repository will not become operational until mid-century or later.[139] Considering the schedule for shipment and acceptance of SNF at a repository, this means that clearing all SNF from the SONGS site could take five to seven decades. That is a timeframe far outside the goals and expectations of SONGS co-owners, the Navy, and many local stakeholders.

As the timeline for a federal repository extends farther into the future, the uncertainties and potential costs and risks of continued SNF storage at SONGS increase. For example:

- Storage conditions at SONGS could change as a result of environmental or other factors. For example, climate change could alter conditions due to a combination of changes in average temperature and precipitation, sea-level rise, and more frequent and severe extreme weather events.
- Requirements for use of the site, whether for military or other purposes, could change to create a more urgent need to clear the SNF.
- Aging management programs for the ISFSI may identify currently unforeseen issues with canister system integrity over very extended periods of time.
- Certificates of compliance (CoCs) for one or both of the SNF dry storage systems at SONGS may not be renewed a second time, potentially creating the need to transfer SNF to new storage systems later this century. These canister systems are due for first renewals in 2023 (TN) and 2035 (Holtec). Given that renewal requests typically extend the term of the CoC by an additional 40 years, second renewals for the TN and Holtec systems would be required in 2063 and 2075, respectively.

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[138] To be clear, neither the North Wind team nor the SONGS co-owners take any position with respect to the suitability of the Yucca Mountain site or with respect to any decision that might be taken regarding whether to continue the licensing process for Yucca Mountain and/or pursue another repository site.

[139] Unless an agreement can be reached with Nevada about terms under which Yucca Mountain would be allowed to proceed.

- The California Coastal Commission coastal development permits for the TN and Holtec ISFSIs will have to be renewed in 2022 and 2035, respectively. This process could result in new or revised permit conditions.
- Organizational consistency, continuity of expertise, and financial assurance could be subject to unforeseen changes over a period of many decades.
- Site management requirements and costs will continue to accumulate. At $26 million per year, on average, to operate and maintain the current ISFSI once other facilities at SONGS have been decommissioned, a 20-year delay in removing the SNF amounts to more than half a billion dollars in expenses.[1] The SONGS co-owners will need continued reimbursement from the Judgment Fund for these expenses.

As we have noted elsewhere, SCE has been proactive in planning for and implementing enhancements and mitigation measures at the SONGS ISFSI to address external contingencies such as these (see, for example, discussion in Section 3.3). Nonetheless, there are many sources of uncertainty that could have large impacts, particularly over long periods of time—an obvious case in point, and a salient concern for many local stakeholders, is climate change. These risks and uncertainties create a compelling case to seek commercially reasonable offsite interim storage alternatives for SONGS SNF while continuing to advocate for progress toward a permanent disposal solution. They also underscore the importance of planning for new contingencies and maintaining readiness to act in the future as circumstances warrant.

The remainder of this section discusses the status of the national repository program. Alternatives for offsite storage that could be pursued as an interim step to final disposal are assessed in later sections.

The range and magnitude of potential uncertainties, which will increase over long timeframes, create a compelling case to seek offsite interim storage alternatives.

7.3.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume a licensed federal geological repository would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

Scientific and technical issues: Two key documents needed to support the Yucca Mountain licensing process have been issued by NRC staff: NRC's supplement to DOE's environmental impact statement (NUREG-2184) and the Safety Evaluation Report (NUREG-1949). Due to the time that has elapsed since DOE prepared its environmental impact statement (EIS), the EIS will likely need to be amended to update the supplemental evaluations last made in 2008. In addition, significant technical issues await final resolution and some other completed reports may need to be revised. For example, approximately 300 outstanding contentions, many involving technical issues, have been admitted by the Atomic Safety

[1] This figure for SONGS O&M costs is an approximation, based on the average of spent fuel management costs for the period 2029 to 2045 estimated in the 2017 SONGS Decommissioning Cost Estimate (DCE). How these costs might change over time if SNF transfer off site is delayed beyond 2045 is uncertain. On the one hand, there may be cost savings in some areas; on the other hand, a longer period of on-site storage could also result in as yet unforeseeable costs. Note that all estimates for continued SONGS storage costs and costs to implement other storage or disposal alternatives discussed in later sections of this chapter are adjusted for inflation to real 2019 dollars, using the Consumer Price Index

and Licensing Board (ASLB) during the licensing process.[1] [14]These contentions would need to be resolved as part of a hearing process, and more contentions could be admitted in the future. Hearing and resolving these contentions would take years and could result in legal challenges that would take longer to resolve.

Another technical issue is that surface facilities for the Yucca Mountain repository were optimized for receiving 90 percent of the SNF in "transportation, aging, and disposal" (TAD) canisters. However, TAD canisters have not been certified and implemented for commercial SNF storage and that could reduce the receipt rate.

If or when the federal government pursues an alternative repository site, all scientific and technical issues specific to that site would have to be addressed as part of the site characterization and license application and approval process.[1] [24]As discussed further under schedule of and time to success, this would certainly add to the time required to develop a repository at another location.

Regulatory feasibility: The regulatory path forward for the Yucca Mountain project has been severely constrained for a decade due to the decision to stop work on the project in 2010 and Congress's failure to fund the NRC to maintain the licensing process. The federal government would first need to re-assemble a technical team to defend the license application in an ASLB hearing process. Assuming that the contentions noted in the foregoing section can be resolved in the government's favor such that a construction authorization is granted, an additional application would still have to be submitted by the government and approved by the NRC before a license to "receive and possess" SNF and HLW could be granted. The time required to complete these steps and the likelihood of NRC approval at each juncture are uncertain at this time, especially since there are known issues with licensing the site, including transportation, land withdrawal, and water rights issues.

The NRC also found that DOE did not meet regulatory requirements regarding land ownership for the geologic repository operations area. Resolving this issue will require a change in current federal statute governing the site. In addition, the NRC found that DOE has not secured the water rights needed for repository construction and operation. The state of Nevada resisted issuing the water-use permits needed for site characterization studies and could do the same with water-use permits for construction and operation.

Other challenges have also emerged regarding construction of rail infrastructure in Nevada to support the repository. DOE had decided to construct and operate a rail line along an alignment within the Caliente rail corridor.[1] [34]However, there are now significant land-use conflicts associated with this alignment, including the designation of the Basin and Range National Monument, which precludes

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[1] [14]A contention is a technical or environmental challenge to the licensing action from an outside party that is admitted by the Atomic Safety Licensing Board to join the proceeding. Admitted contentions must be resolved or withdrawn before the license can be issued.

[1] [24]The capacity of a repository at Yucca Mountain is currently limited by statute to a quantity less than the nation's existing inventory of SNF. Thus, even if Yucca Mountain were to go forward, an additional repository site would be needed to accommodate the full inventory, or the current statutory limit would have to be changed.

[1] [34]DOE, Record of Decision 73FR602 47; October 10, 2008.

construction of a rail line in that location.[1 44] The National Monument designation can only be modified by another presidential proclamation or by new legislation

Although DOE evaluated other rail corridors and alignments, many of these alternatives may no longer be feasible and, in any case, resolution of land-use conflicts or additional NEPA reviews would likely be required. Another possibility is that the National Monument designation could be modified by presidential proclamation. Finally, the NRC has never completed the licensing process for a geologic repository. Absent an established baseline of experience, schedule projections are subject to significant uncertainty and potential delay—and possibly ultimate failure to gain approval.

It is reasonable to assume that the same general regulatory framework that has been used to advance Yucca Mountain could be used to license a repository at a different location, although the existing regulations governing repositories other than Yucca Mountain might need to be updated.[1 53] From a regulatory perspective (in other words, leaving aside the initial siting challenges), this would obviously require starting over with the technical and scientific work needed to characterize a new site, prepare an environmental impact statement, hold hearings and issue a record of decision, develop a license application, resolve issues in the license application, etc. What site-specific regulatory risks might apply in that case would depend on the site chosen.

Commercial reasonableness

Cost: NWT did not develop cost estimates for this disposition pathway, which—in contrast to the offsite storage alternatives we considered—involves restarting a national program that is already required under law. The costs associated with successfully completing a deep geological repository are certainly substantial, but they are also unavoidable (in the sense that a permanent disposal facility for the nation's inventory of SNF will ultimately be needed under any circumstances)[1 64]—more to the point, the funds required to finance the national repository program have already been collected from nuclear utility customers through the Nuclear Waste Fund mechanism described previously.[1 74]

[1 44] The Public Land Order to withdraw and protect the Caliente Rail Corridor expired in 2015. The Basin and Range National Monument (BRNM) was established by presidential proclamation in 2015 and is managed by the Bureau of Land Management (BLM).

[1 54] 10 CFR 63 governs only licensing a repository at Yucca Mountain. This part, or another part (e.g., 10 CFR 61) of the NRC's regulations would need to be changed or a new set of regulations developed to license a repository in a different location.

[1 64] The Yucca Mountain site was the subject of some 20 years of study; through 2019, DOE had incurred a cost of $11.3 billion (in as-spent dollars) for the repository program and related program support costs. This estimate includes the cost for evaluating the Yucca Mountain site, developing the license application, and initial engineering, procurement and construction activities at the site. It excludes other costs of the Civilian Radioactive Waste Program, such as investigations of other potential repository sites, transportation or balance of program costs. (Details can be found in the *Nuclear Waste Fund Annual Financial Report* for fiscal 2019.) Costs to pursue a different repository site would, of course, also be quite substantial. On the other hand, prolonging the current stalemate in the national program is also extremely costly given the Judgment Fund payments being made to utilities as a result of the federal government's failure to perform on its waste management responsibilities.

[1 74] Once a national program is restarted, the federal government would be required to develop a new estimate of the total system life cycle cost of the repository. In the event that projected expenditures for repository development under the NWPA exceed projected NWF balances, the federal government could re-institute fees on operating

Because the federal government, in this alternative, takes title to the SONGS SNF at the plant-site boundary and assumes full responsibility for shipping the SNF to a repository, costs to the SONGS co-owners and their customers are limited to the costs incurred to continue storing SNF at SONGS in the interim, net of reimbursements from the Judgment Fund for damages related to the federal government's failure to perform on schedule, and costs to prepare the SNF for transportation once the receiving facility is available (as noted elsewhere, these costs are the same in all scenarios).

Thus, the discussion in this section focuses on storage costs at SONGS rather than on the cost to the federal government of opening and operating a repository.

SCE's ability to terminate the SONGS ISFSI license and cease incurring expenses for ISFSI operations, maintenance, and security is directly tied to when a receiving site becomes available and to the allocation of acceptance capacity to support removal of the SONGS SNF. Now that the SONGS ISFSI is fully loaded, annual operating and maintenance (O&M) costs are estimated to be about $17 million per year. After decommissioning of the other plant structures is completed, however, all the costs of site-wide services such as security,[184] maintenance, and utilities will be assigned to the ISFSI—in other words, these costs will no longer be divided among multiple on-site facilities. As a result, ISFSI costs will increase to about $26 million per year (as indicated in Table 7.2; see also footnote 140). Moreover, these costs are largely fixed and will continue to be incurred until the last canister of waste is removed. Only at that point can the ISFSI be decommissioned and site restoration be completed.

Cost estimates and sources of funding for maintaining the SONGS ISFSI until a federal repository is available are summarized in Table 7.2.

Table 7.2 Costs for Continued On-Site Storage Until Transfer to a Federal Repository

Activity	Cost ($ millions)*	Source of Funding
Annual O&M (from period of fully loaded ISFSI through end of decommissioning of other on-site facilities)	$17 annual average cost (2021–2028), drawn from SONGS Decommissioning Plan information	Subject to review and approval for reimbursement from the Judgment Fund as payment of damages. Actual level of approved reimbursement is not made public.
Annual O&M until all SNF is removed, once stand-alone ISFSI is only remaining facility on site	$26 annual average (2029–2045), drawn from SONGS Decommissioning Plan information	Subject to review and approval for reimbursement from the Judgment Fund as payment of damages. Not all costs may be approved for reimbursement.

nuclear reactors (as currently authorized under the NWPA). Prior to the suspension of NWF fee collections in 2014

[174] Once a national program is restarted, the federal government would be required to develop a new estimate of the total system life cycle cost of the repository. In the event that projected expenditures for repository development under the NWPA exceed projected NWF balances, the federal government could re-institute fees on operating nuclear reactors (as currently authorized under the NWPA). Prior to the suspension of NWF fee collections in 2014 the fee was set at 1 mill (one-tenth of one cent) per kilowatt-hour. The NWPA currently does not authorize an assessment of additional fees on shutdown reactors, such as SONGS. The federal government would also have to finalize its policy on funding emergency response training.

[184] NRC-determined security requirements are part of the license for any SNF facility and thus apply to all storage alternatives, whether on-site or offsite. For purposes of comparing alternative disposition pathways for SONGS SNF, we assume that these costs are included in ISFSI or CISF operations and maintenance costs.

Activity	Cost ($ millions)*	Source of Funding
Preparation of site infrastructure to transfer SNF from ISFSI to site boundary for transport and cask loading operations	$62 million	SONGS Decommissioning Trust Fund
Transportation and disposal of SONGS SNF at a permanent geologic repository	TBD	Nuclear Waste Fund
Decommissioning of ISFSI (excludes final site restoration)	$24 (final two years of shutdown)	SONGS Decommissioning Trust Fund

Source: NWT estimates, drawn from data in the SONGS Decommissioning Plan.

* Costs here and elsewhere are given in 2020 dollars unless otherwise specified.

Ability to recover costs: A significant portion of current O&M costs for the SONGS ISFSI are reimbursed from the Judgment Fund.[149] As noted above, once the plant site is decommissioned, these O&M costs increase due to the fact that all costs for security and support services must be allocated to the ISFSI.

Other shutdown plant sites face similar issues in obtaining reimbursement for the full costs of ISFSI maintenance and security at otherwise decommissioned sites. Under current law, the federal government is responsible for the full costs of eventually transporting and disposing of commercial SNF using resources from the Nuclear Waste Fund. While the Fund currently holds over $40 billion for waste management purposes, expenditures from the Fund are subject to annual appropriations which have been historically underfunded and unpredictable. (See Sections 5.2 and 5.3 for additional discussion.)

Regarding the work that needs to be done at SONGS to prepare for SNF transfer and shipment,[150] it is reasonable to assume that the improvements needed to enable the transfer of SNF to the federal government can be undertaken by SONGS personnel given existing expertise and capabilities. Past DOE plans assumed that plant personnel would be responsible for loading SNF into transport casks and delivering the casks "to the front gate" of the plant site. In other words, the federal government would take title and assume transport costs at the plant boundary, not before.[151] In any case, the on-site infrastructure improvements needed to ready SONGS SNF for shipment off site would apply to any alternative being considered in this Strategic Plan.

Reasonable protection against liability. If the current national impasse were resolved and the federal government moved forward on a repository program, the federal government would take title and assume full responsibility and liability for the SONGS SNF. The federal government would also be responsible for providing financial protection and indemnity for transporting and disposing of the SNF, including funding and technical assistance to train emergency responders along the transportation corridor.

Timeliness of offsite disposal

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[149] This is true for costs through 2016. Costs since 2016 are being litigated as of the time of this writing.

[150] "Preliminary Evaluation of Removed Used Nuclear Fuel from Shutdown Sites", Steven Maheras, et al., DOE report SFWD-IWM-2017-0002 / Pacific Northwest National Lab report PNNL-22676 Rev. 10, September 30, 2017.

[151] Article IV, Section 2(a) of the Standard Contract states that "The Purchaser shall arrange for, and provide, all preparation, packaging, required inspections, and loading activities necessary for the transportation of SNF and/or HLW to the DOE facility."

Implementation schedule: SCE cannot complete its license termination and site restoration plans and cease funding the SONGS ISFSI until all the SNF is off site. This includes decommissioning the ISFSI, terminating SONGS's Part 50 license (which would automatically terminate the Part 72 general license), and performing final site-restoration tasks for returning the land to the Navy, in the condition defined by the Navy. Thus, a key question concerns the potential timeframes involved in waiting for a federal disposal repository.

Unfortunately, these timeframes are virtually impossible to estimate. For reasons already discussed, it is extremely difficult to predict whether and when the federal government might resolve the issue of restarting a national repository program focused on Yucca Mountain or on a new site.[152] An additional source of uncertainty concerns federal funding to implement the program.

If work on Yucca Mountain does resume, several key milestones will have to be reached before the repository can begin accepting SNF from SONGS. A first milestone involves licensing and the start of construction. NWT estimates that a decade or more would be needed to complete the licensing process for Yucca Mountain. This includes time needed for:

- Rehiring and retraining personnel and contract staff,
- Restarting activities at DOE and the NRC,
- Completing the adjudication of various contentions admitted by the ASLB,
- Reconsidering the EIS record of decision on the rail alignment from the existing mainline track to Yucca Mountain,
- Obtaining congressional approval for land withdrawal legislation, and
- For the NRC to issue construction authorization.

This estimate further assumes that the various contentions are resolved in favor of the project, the state of Nevada does not litigate the outcome, and the state issues necessary permits. Continued efforts by the state to block construction, on the other hand, could cause significant further delays.

If the federal government instead decides to seek another repository site, additional time will be needed for site identification and characterization studies. That additional time could be offset, at least in part, if a different approach to siting proved successful in gaining both potential host state and community acceptance, and thereby reduced the time required for NRC licensing and possibly other steps in the process.

A second milestone involves repository construction and operation. This involves the following steps:

- DOE to substantially complete construction of the repository and connecting rail line,
- DOE to prepare and submit a request for license issuance to receive and possess, and

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[152] The last schedule for the Yucca Mountain repository was published in July 2008 as part of a DOE report: *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program, Fiscal Year 2007*. That schedule presented a best-case estimate of 7 years for repository construction and opening, followed by a period of 57 years to complete emplacement of high-level waste and commercial SNF, for a total period of 64 years. However, DOE acknowledged that risks and uncertainties, including litigation risk, could significantly extend this schedule."

- NRC to review the DOE submittal and issue the 10 CFR 63 operating license.

Constructing the repository and surface facilities, conducting pre-operational testing, and obtaining an operating license from the NRC, together with completing necessary transportation infrastructure, could require an additional decade or more.[153] This puts the timeframe for initial SNF acceptance at two to three decades from the date that a national decision is reached to restart the Yucca Mountain project.[15] [4] Given the current uncertainty about whether and when Congress might act to restart the repository program, these estimates suggest that a federal disposal facility is unlikely to be available as a destination for SONGS SNF until mid-century or beyond.

A third milestone involves shipping the SONGS SNF to a federal repository. Once a federal repository is opened, the schedule for shipping SONGS SNF will depend upon the established acceptance allocation processes for SNF at shutdown plant sites (see further discussion in Chapter 5, Subsection 6.3.5, and Appendix F). SONGS has a favorable position in the Standard Contract "oldest fuel first" (OFF) queue in terms of being able to initiate SNF shipments because SONGS Unit 1 began operating in 1968.[155] The last DOE-published schedule for shipments to a repository, however, would result in only about one-third of SONGS SNF being shipped within the first decade of repository operations.

Under the current ordering of the OFF queue, *completing* the shipment of all SONGS SNF could take a total of two to three decades. However, as discussed in Subsection 6.3.5, if the federal government exercises its contractual right to give priority to SNF from shutdown reactor sites, it can prioritize the acceptance of SNF from those sites in a way that would allow SNF to be removed from the SONGS site in under ten years once acceptance begins.[156]

Based on the above estimates, even if a decision is made to restart the Yucca Mountain project within the next year or so, it could take more than five decades from the time repository construction begins (and potentially much longer due to various uncertainties) to clear the SONGS site of all SNF and GTCC waste.

As already noted, the timeline for developing a geologic repository at another site is subject to similarly high levels of uncertainty and could take an equivalent amount of time. For example, if Congress authorized the initiation of a new repository program in 2021, and if that program followed the notional schedule milestones outlined

A realistic timeline for a federal repository means that waiting for this disposition pathway to become available could mean maintaining the SONGS ISFSI over a considerably longer timeframe than the current Decommissioning Plan assumes.

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[153] A national transportation system for shipping SNF may not need to be fully operational before some initial shipments to a repository can begin. In practice, however, other factors are likely to control the time frame for initial waste acceptance at a repository.

[15] In addition, funding and time would be required to re-establish the human capital and site infrastructure needed at Yucca Mountain to conduct these activities, given that all of these assets were completely eliminated over the last decade.

[155] The queue is defined in Section B.1.(a) of the Standard Contract. See also discussion in Section 6.3.5 of this report.

[156] See Appendix F in this volume and *Conceptual Transportation Plan for the Relocation of Spent Nuclear Fuel Offsite to an Offsite Storage Facility or Repository (Vol. III)*.

in the 2013 DOE Strategy Report,[157] the time needed to open a facility, after accounting for appropriate consultation and coordination with host states, tribes, and communities, could be three to four decades. In this scenario, clearing the SONGS site could take as long or even longer than in the Yucca Mountain scenario described above.

Thus, absent a more near-term off-site interim storage solution, a realistic timeline for a federal repository means that waiting for this disposition pathway to become available could mean maintaining the SONGS ISFSI over a considerably longer timeframe than the current Decommissioning Plan assumes. The TN ISFSI began operation in 2004 the Holtec ISFSI began operation in 2018. Together, there will be 136 SNF and GTCC canisters in service between the two ISFSIs when the current phase of decommissioning is complete. By the year 2070, the oldest canister at the TN ISFSI and the oldest Holtec canister at the Holtec ISFSI will have been in service for 66 years and 52 years, respectively. This is beyond the horizon of the first 40-year CoC renewal for the TN canisters and approximately at the end of the first 40-year CoC renewal for the Holtec canisters. However, we anticipate that the current cask CoC holders will seek subsequent CoC renewals at the appropriate times. With renewal of the CoCs, the SONGS general license would be automatically renewed for use of those storage systems.

Importantly, SCE has taken a number of steps to assure the safety and integrity of the SONGS ISFSI well beyond these timeframes for CoC renewal (detailed in Section 3.3). In addition, techniques for repairing canisters *in situ* have been developed and tested and regulatory mechanisms for updating the Decommissioning Plan and cost estimates are in place.

Other implementation considerations

Need for statutory change: While current law already approves the choice of Yucca Mountain as a site for a national repository, additional federal legislation is required before the NRC can authorize construction. Specifically, Congress would need to approve a land withdrawal bill to establish jurisdiction and control for the operations area of the repository.

In November 2019, the House Energy and Commerce Committee reported out a bill (H.R. 2699, passed by the House in the previous Congress as H.R. 3053) that would have mandated a restart of the Yucca Mountain licensing process while also providing the necessary land withdrawal (see also discussion and table in Section 5.6) contingent on a finding by the NRC that technical requirements have been met. H.R. 2699 also included provisions for either a federal or non-federal monitored retrievable storage facility under conditions that are still linked to progress on repository licensing, with the key change that construction and operation of a storage facility only required an NRC decision (up or down) about the Yucca Mountain license application, rather than an affirmative decision to approve it. Importantly, the bill would have also reformed the treatment of the Nuclear Waste Fund to provide greater assurance of federal resources to carry out the repository program. A companion bill was introduced in the Senate, but no action was taken. Action on any of the bills proposed in the 116th Congress was held up by members opposed to Yucca Mountain and by concerns about proceeding with interim storage absent consensus on a permanent repository program. And since all of these bills expired at the end of the session, they would have to be re-introduced in the 117th Congress to receive further consideration.

By way of illustrating the complexity of the political dynamics around Yucca Mountain, it is also worth pointing out that several bills were introduced in the 116th Congress, in both the House and the Senate,

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[157] U.S. Department of Energy, "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," January 2013.

that would have made the Yucca Mountain licensing process more challenging. For example, H.R. 1544, the Nuclear Waste Informed Consent Act, would have required DOE to obtain consent from affected state governments prior to making expenditures from the Nuclear Waste Fund. The proposed Jobs, Not Waste Act of 2019 (S. 721/H.R. 1619) would have required DOE to conduct a study of potential alternative uses of the Yucca Mountain site before any licensing activity could proceed. (See Table 5.2 for a summary of legislative proposals in the 116th Congress, including the Spent Fuel Prioritization Act of 2019 (H.R. 2995), which would have established new criteria for prioritizing the transfer of SNF to the federal government.).

To pursue a repository at another location will require action by Congress to appropriate funds for a new siting process and ultimately to amend the NWPA to conduct site-specific studies at a different site. The proposed Nuclear Waste Administration Act of 2019 (S. 1234) would have established a new, independent federal organization to implement a consent-based process for siting SNF storage and disposal facilities. S. 1234 would also have enabled any new fees paid by utilities to be utilized by the new organization without the current restrictions on the Nuclear Waste Fund, although use of the balance of the Nuclear Waste Fund would depend on appropriations subject to the same budget constraints that exist today.

Potential socio-economic-political barriers: The principal barrier to action on a federal repository is the current stalemate in Congress over whether to proceed with the Yucca Mountain repository or initiate efforts to develop an alternative site. Moreover, even if this stalemate is resolved in favor of resuming the Yucca Mountain licensing process, there are significant schedule uncertainties that will have an impact on whether and when the project moves forward. These sources of uncertainty include the need to re-establish a federal waste management program office, the fact that the NRC licensing process is only partly completed, the voluminous contentions that must still be heard by the ASLB, and the likelihood of lengthy litigation absent a negotiated settlement with the state of Nevada.

A significant barrier that applies to all alternatives involving a federal facility (whether for SNF storage or disposal) is the problem of funding. The last DOE cost estimate for the Yucca Mountain repository indicated a need for sustained funding in excess of $1 billion annually for a number of years, reaching almost $2 billion per year during the phase of peak construction funding, in order to implement the program. Although the NWF was established to provide this funding, the treatment of the NWF under current budget rules means that appropriations for the waste management program have to compete with other programs and priorities in the federal budget.

Factors that weigh in favor of the federal repository alternative include the fact that this has long been the preferred disposition pathway for SNF, both as a matter of current law and as a matter of expert opinion in the United States and around the world. Some environmental and citizens groups have also taken the position that SNF should be moved only once, preferably to a geological repository for permanent disposal, so as to minimize any risks associated with SNF shipments. (Other groups, it should be noted, take the view that transportation risks are sufficiently low that this should not be a deciding factor.) Finally, it is worth noting that some recent legislative proposals for authorizing a federal consolidated interim storage facility are contingent on a resolution of the Yucca Mountain issue. These proposals recognize that the viability of any consolidated interim storage program rests on the linkage to an eventual permanent disposal solution. The linkage issue is discussed in greater detail in Section 5.2 and Box 5.1.

Degree to which SONGS co-owners have control over implementation: The initial critical step for implementing a federal repository requires congressional action to either (1) provide funding to restart

the national nuclear waste management program, including to resume the Yucca Mountain licensing process, or (2) authorize a process to begin the search for another permanent repository site. SCE could work with its congressional delegation to push for progress on this issue and to support the authorization and appropriations necessary to restart the national program. SCE could also partner with other utilities (including Pacific Gas & Electric and Sacramento Municipal Utility District, and other co-owners of nuclear plants in California), either directly or through formal and informal industry groups, to influence Congress.

In the event that Congress resumes action on new federal legislation, SCE should advocate for the clarification of criteria for prioritizing SNF removal from shutdown plant sites. Actions by SCE to prepare for SNF transportation once a repository becomes available could also help expedite progress toward clearing the SONGS site in this scenario.

7.3.3 Summary Findings for Federal Repository

- As an offsite disposition pathway for SONGS SNF, disposal in a federal repository would be commercially reasonable, including with respect to issues of title and liability, from the standpoint of the SONGS co-owners and their customers.
- Resolution of a path forward on Yucca Mountain or another repository site is imperative because the necessary disposition endpoint for all SNF is disposal in a manner that provides assurance of isolation over very long timescales. Permanent disposal in a deep geologic repository remains the preferred pathway for ultimate disposition of SNF based on long-standing scientific and policy consensus, in the United States and elsewhere. Progress toward a repository is also important to enable consolidated interim storage alternatives to move forward. Finally, in the United States, implementing a permanent disposal solution for SNF remains the contractual and statutory obligation of the federal government.
- The main schedule uncertainty for this alternative concerns the time to resolve the current impasse and reach a decision to move forward, either with Yucca Mountain or a new site. Once a decision is made, the time needed to reconstitute the federal program, find a new site (if necessary), and license and construct the facility adds additional schedule uncertainty. Finally, once a repository is available, the timeframe for removing SNF from SONGS will depend on the rate at which SNF is accepted by the federal government for disposal, which in turn will depend on whether and how DOE exercises its authority to prioritize the acceptance of SNF from shutdown reactors. Overall, NWT estimates that the time needed to complete the removal of all SONGS SNF in this alternative could be as long as five to seven decades after congressional action to restart the federal program.

7.4 Interim Storage in a Federal Consolidated Interim Storage Facility (CISF)

7.4.1 Synopsis

This alternative envisions transferring SONGS SNF to a federally owned CISF for which the responsible federal agency (e.g., DOE or another federally chartered waste management entity) is the licensee. We assume a federal CISF would be a 10 CFR 72 specific-license ISFSI. The federal government would have responsibility for site selection and acquisition, and for the design, preparation of an environmental impact statement, licensing, construction, and operation of the facility. Some of these functions could be contracted to appropriate private entities, but the federal government would remain the recognized licensee and owner/operator (similar to current arrangements at the Fort St. Vrain ISFSI in Colorado and

the TMI-2 ISFSI in Idaho). Further, our baseline assumption for this alternative is that the federal government would take title and liability to, and assume possession of, the SNF at nuclear power plant sites, and would be responsible for transporting SNF to the federal CISF. We make no assumptions regarding the potential location of a federal CISF.

From a statutory and regulatory risk perspective, this alternative has much in common with the default scenario of waiting for federal action to open a geologic repository as required under current law. In both cases the federal government assumes responsibility for removing the SNF and bears associated costs. And in both cases, it is difficult to predict when the federal facility might actually become available and how the Standard Contract queue would affect the schedule for transferring SONGS SNF and fully clearing the SONGS site. Developing a federal CISF would likely require a change in current law before construction could begin to de-link construction from a repository construction authorization, for reasons discussed in Section 5.2. This adds an element of time and uncertainty associated with the need for congressional action.

In this regard, the current impasse over the future direction of SNF management policy at the national level constitutes a barrier, much as it does in terms of restarting the repository program. Prospects for successfully siting a federal CISF are likewise uncertain, although the technical issues associated with characterizing, licensing, and constructing a storage facility would be much less demanding than for a geological repository.

7.4.2 Assessment

Safety, technical, and regulatory feasibility

Safety: We assume a licensed federal CISF would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

Scientific and technical issues: There are no generic technical or scientific issues associated with constructing and operating a CISF in principle, since a consolidated facility is essentially just a larger ISFSI and several facilities of this type have been licensed and are currently operating throughout the U.S. and elsewhere in the world (including at SONGS). Depending on the site location there could be unique, site-specific scientific and technical issues. Such issues would be addressed as part of site selection process and in the technical and environmental analysis that would be undertaken as part of the license application.

Regulatory feasibility: We assume a federal CISF would be licensed as an ISFSI under the NRC's 10 CFR 72 regulations. After a site is selected, DOE or the responsible federal entity would prepare the license application in accordance with these regulations. The NRC would perform technical and environmental reviews and, if acceptable, issue a Safety Evaluation Report (SER) supporting the issuance of a Special Nuclear Materials (SNM) license to construct and operate the facility. In parallel with the NRC's review, the public would have a window of opportunity to intervene by submitting contentions on the application. Such contentions would be reviewed by the assigned ASLB. The ASLB would deny or admit the contentions in the licensing action based on the standing of the intervenor and the merits of the contentions. The NRC would grant a license for the facility only after all admitted contentions have been resolved.

There is risk inherent in the contention process that can create significant uncertainties in the timing and outcome of the licensing process. In addition, opposition can extend beyond the scope of the licensing process. The experience of Private Fuel Storage (PFS), a utility-led initiative to site a

consolidated storage facility on land leased from the Goshute Indian tribe in Utah in the late 1990s, is instructive in this regard.[158]

The PFS license application was submitted in 1997, but completion of the licensing process took nine years, with license approval issued in 2006. Subsequent state and federal actions to block the project, however, prevented construction and ultimately led to project termination in 2012—six years after the license was issued.[159] In the PFS case:

- An aircraft crash hazard was not considered in the original facility design and license application. This became a major issue later in the licensing process when the aircraft crash hazard was raised as a contention.
- Subsequent to the resolution of the aircraft crash hazard issue and issuance of the license, the Interior Department's Bureau of Indian Affairs denied the land lease needed to construct the facility, and its Bureau of Land Management denied the federal right-of-way needed to construct a rail line to the site.

Resulting delays ultimately caused the PFS members to end their financial backing of the project. By comparison, recent efforts to license a private CISF (discussed in Section 7.5 of this chapter) indicate that it is possible to have all contentions rejected or quickly dismissed with a modest amount of additional work.

The support of host state and tribal governments plays a key role. Not only can states and tribes raise contentions in the NRC licensing process, they also may impose other, non-nuclear regulatory requirements. For example, issuing permits for access to potable water can delay a project even in cases where a federal agency applicant might be very likely to prevail eventually. Thus, building credibility with states and tribes, and promoting acceptance of the facility through effective stakeholder outreach, are crucial to the success of the licensing process.

Commercial reasonableness

From the perspective of SONGS co-owners and customers, commercial reasonableness is assured for a federal CISF for the simple reason that the federal government would bear all costs associated with constructing and operating such a facility and transporting SNF to it. Cost considerations would likely, however, be relevant in any policy decision by the federal government to pursue this pathway, particularly if the costs of developing federal interim storage capability are weighed against the costs of continued Judgment Fund reimbursements for dispersed at-reactor storage over the potentially protracted period of time before a federal repository becomes available. In the section that follows, we therefore offer some observations about cost for a federal CISF, as we do for all the offsite interim storage alternatives included in this assessment, with the aim of providing added context and information that may be helpful to the national-level debate.

Cost: Little information on the potential cost and schedule for a federal CISF is currently publicly available. Cost information from private facility proposals is of limited value in generating an estimate

[158] Southern California Edison is a co-owner of Private Fuel Storage.
[159] Opposition from both Utah senators, as well as from other key stakeholders in the state, such as the Mormon church, was instrumental in ultimately blocking the project.

given differences in various aspects of the siting and licensing process for a federal versus a private facility and given the different revenue requirements of a private facility.[160]

With these caveats, NWT nonetheless developed some rough, order-of-magnitude cost estimates for a federal CISF by applying a simple 20 percent premium to estimates generated by the Electric Power Research Institute (EPRI) for the cost to develop a private CISF (Table 7.3).[161] The 20 percent premium is intended to account for specialized substantive and procedural requirements for a federal contract and project management structure.

Table 7.3 Cost Estimates for a 20,000-MTU Federal CISF

Activity	Cost
Site selection and characterization	$125 million
Licensing (including environmental impact statement) and design	$75 million
Construction	$626 million
Annual Operations and Maintenance	$2 4million

Source: NWT estimates drawn from modeling analysis using assumptions from EPRI.

Funding for a federal CISF could come from several sources. Under existing law, the (now expired) authorization provided under Subtitle B of the NWPA would have funded federal storage through new user fees paid by SNF owners. Funding for an MRS facility, by contrast, can come from the NWF. Under new legislative authority, funding for the federal government to store SNF at a federal CISF could come from General Fund appropriations from the Treasury or from the Nuclear Waste Fund (NWF).[162] (In the latter case, new legislation could also address current limitations on access to NWF resources.) In a 2016 report for DOE, Oak Ridge National Laboratory concluded that there would be a significant net financial benefit to the federal government if a CISF is opened before a repository.[163]

As already noted at the outset of this section, the cost implications of this alternative from the standpoint of the SONGS co-owners and customers are the same as for the federal repository alternative because the federal government assumes title and responsibility, including responsibility for all subsequent SNF storage and disposal costs, at the plant-site boundary. The same analysis with respect to costs for continued interim storage at SONGS and reimbursement of those costs from the federal Judgment Fund would therefore also apply.

Ability to recover costs: None of the above costs for constructing and operating a federal CISF would accrue to the SONGS co-owners or their customers, and as with the repository alternative, the federal government would be responsible for transportation costs to deliver the SNF to the CISF. (As in all disposition alternatives we considered, the SONGS co-owners would be responsible for on-site

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[160] If a federal agency such as DOE submits a license application, both DOE and NRC have to comply with NEPA requirements and an EIS would have to be prepared. On the other hand, the cost of the NRC licensing process, including an NRC environmental impact statement, would likely be comparable between a federal and non-federal facility.

[161] *Cost Estimate for an Away-From-Reactor Generic Interim Storage Facility (GISF) for Spent Nuclear Fuel*, Electric Power Research Institute (EPRI), Palo Alto, CA: 2009, 1018722.

[162] Under the NWPA, funding for an MRS facility is an authorized use of the Nuclear Waste Fund. However, H.R. 2699 would have removed that authorization, and instead authorized use of general fund appropriations.

[163] See: https://www.energy.gov/sites/prod/files/2017/03/f3 4ISF%20Cost%20Implications_final_rev1.pdf.

infrastructure improvements to prepare SNF and GTCC waste packages for shipment, but we assume these costs will generally be covered by the SONGS decommissioning trust funds.) We further assume that if the federal CISF program is funded through the NWF, it would not trigger the need for targeted new fees to utilities (unlike the expired NWPA Subtitle B authority).

Reasonable protection against liability: As with federal acceptance of SNF for disposal in a repository, acceptance for storage at a federal CISF would involve the transfer of title and all liability for the SNF to the federal government at the SONGS site boundary.

Timeliness of offsite storage

Implementation schedule: This disposition pathway requires action by Congress to direct and fund establishment of a new interim storage program. The timeframe to implement a federal storage facility would also depend on how a new interim storage program is linked to the development of a permanent repository.

Once Congress provides necessary appropriations and/or authorization, the federal government would need to take several steps to develop CISF capability. Based on the experience of private CISF developers, NWT estimates the following timeframes:

- Facility development, including site evaluations; consultation with affected state, local, and tribal governments; site characterization; engineering design, and licensing—could take a decade or longer.
- The NRC licensing process could take three to four years, reflecting experience to date with entities that are currently seeking CISF licenses.[16] [4]
- Construction and opening of CISF facilities could take two to three years.

In total, we assume the timeline for site selection, including consent-based process, design, and licensing could take about 10 to 20 years. This is consistent with DOE's 2013 *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, which estimated a timeline of about 8 years to implement a pilot interim storage facility and 12 years to implement a larger CISF with capacity of 20,000 MTU.[165] DOE assumed that once open, the CISF would incrementally increase its storage capacity. Assuming DOE achieved a receipt rate of 3,000 MTU per year, then 22 years after opening, the CISF would be expected to have a capacity of 50,000 MTU.

Once a federal CISF is opened, the likely time to removal of the first and last SNF canisters from SONGS would depend on the number of other SNF owners seeking offsite storage and the order for acceptance

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[16] The process and timeline would depend in part on whether the federal government prepares an environmental report or an EIS. An environmental report would typically be submitted with the license application and the NRC would review it and issue an EIS. But federal government could choose to prepare its own EIS, as described in Section 6.3.7. In that case, it would issue a final EIS and publish a record of decision. The NRC could review the government's EIS for adoptability as part of granting the license. The NRC could be a cooperating agency for completing the EIS, but the NRC would likely decline. All of this would occur in parallel with the technical review and would be enveloped in the three-to-four-year timeframe for licensing (not including time to resolve contentions).

[165] See: https://www.energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf.

of SNF from different sites. Figure 7.1 shows that the inventory of SNF at shutdown plant sites is projected to grow significantly over the next 20 years. Even if authorizing legislation restricts use of a federal CISF to SNF from shutdown sites, SONGS would have to "compete" with a growing number of other sites over the next decade and beyond. Depending on the prioritization process established by the federal government, the time required to ship all SNF from SONGS could take anywhere from significantly less than a decade (the estimate in the current SONGS Decommissioning Plan) to possibly two or more decades. As with the federal repository alternative discussed previously, we estimate that all SNF could be removed from the SONGS site relatively expeditiously (i.e., in less than five years after federal receipt of SNF begins), *if* the federal government adopts an acceptance and transport strategy that is focused on emptying shutdown sites as quickly as possible.

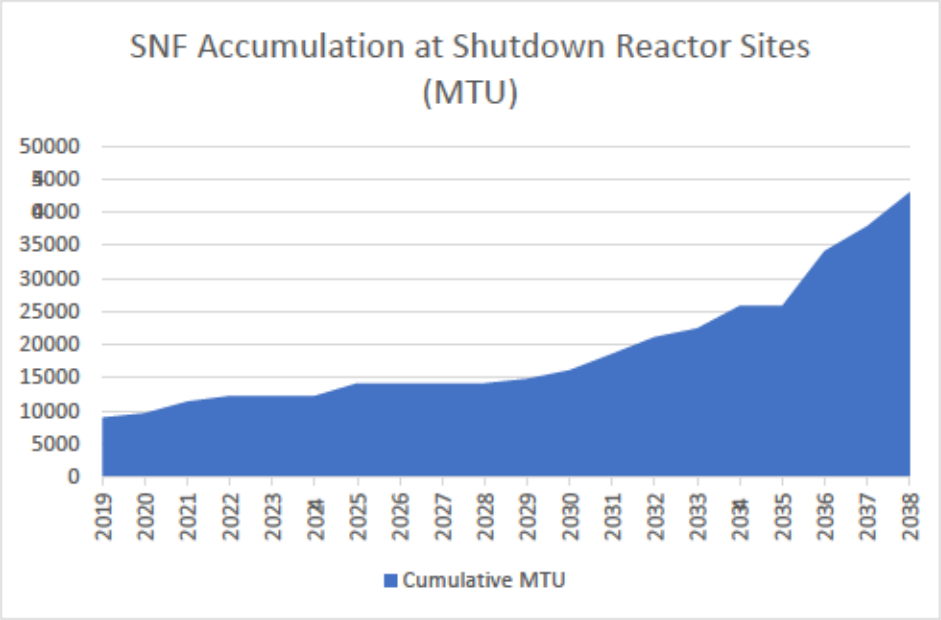
In summary, beginning with establishment of a federal interim storage program and presuming full funding and prioritization of shutdown sites, we estimate that it could take two to three decades, from the time a federal CISF program is initiated, to clear all SNF canisters from the SONGS site.

Other implementation considerations

Statutory changes needed: The NWPA contains two separate authorizations for a federal interim storage facility. The NWPA's Subtitle B authority is extremely limited in scope (e.g., eligibility was limited to operating reactors that did not have adequate on-site storage and capacity was limited to 1,900 metric tons of SNF); moreover, this authority lapsed in 1990. Substantial amendments to the NWPA would be needed before it would provide useful storage capability. The NWPA's provisions for an MRS also are very restrictive (as previously noted, for example, siting is tightly linked to the repository development program). Therefore, under current law, the federal government would only be allowed to site, design, and license an MRS facility. Legislation would be required to proceed to construction and operation of the facility, de-linked from a repository. Alternatively, Congress could provide entirely new authorization for a federal interim storage program. Two key issues would need to be addressed in such legislation:

- How to design a consolidated interim storage program in a manner that would be truly viewed as "interim" in nature – i.e., what provisions would be needed to address linkages to the development of a permanent disposal facility (see Box 5.1).
- What criteria should be used to determine SNF eligibility for transfer to the federal CISF and to prioritize shipments from particular sites (i.e., the OFF queue or prioritization for shutdown sites). We assume that authorizing legislation would limit use of the federal CISF to SNF from shutdown reactor sites, but with the number of shutdown sites likely to increase over time, there will be a need to establish criteria for prioritizing *among* these sites, as discussed in Section 6.3. and Appendix F. Expected growth in the overall inventory of SNF at shutdown sites is shown in Figure 7.1. The figure shows a potential 50 percent increase in SNF at shutdown sites by 2030, and a potential four-fold increase by 2040.

Figure 7.1 SNF Accumulation at Shutdown Reactor Sites



Source: Gutherman Technical Services, LLC (see also further discussion in Appendix D)

In developing new legislation, Congress would also need to address issues of funding and could consider assigning responsibility for developing federal interim storage capability to a new single-mission federal organization.

Comprehensive nuclear waste legislation reported out by the House Energy and Commerce Committee in November 2019 (H.R. 2699, *The Nuclear Waste Policy Amendments Act of 2019*) contained provisions to allow development of an MRS facility through an agreement with a non-federal entity. Specifically, the bill would have required the federal government to update its original study of the need for and feasibility of such a facility required by the NWPA of 1982, and would have authorized the government to site, construct, and operate *one or more* MRS facilities either directly or with non-federal entities. A companion bill was introduced in the Senate, but no action was taken in the 116th Congress.

Potential socio-economic-political barriers: Any timeframe for action by Congress on this alternative is highly uncertain, especially since the issue of linkage between a federal CISF and a permanent repository is likely to provoke intense debate. Even if Congress decides to move forward with a federal CISF and appropriates funds accordingly, political and legal challenges could be expected to emerge in response to any proposed CISF site.

An added siting challenge for a federal CISF, as distinct from a federal repository, could also come from otherwise supportive parties who might worry that with no repository even on the horizon, any CISF will become a *de facto* permanent storage facility. This is why the linkage issue, as we have already noted, is important and would likely need to be addressed as part of any new authorizing legislation to allow this alternative to go forward (see also Bo x5.1).

Degree to which SONGS co-owners have control over implementation: As with the federal repository discussion in the previous section, SCE has limited direct ability to influence progress toward a federal

CISF alternative. But SCE could exercise leadership in creating the political conditions and coalitions needed to break through the current national-level stalemate. Most obviously, SCE could work with California's congressional delegation to push for the legislation needed to authorize and fund this alternative.

As part of this process, SCE should also advocate for legislative provisions to clarify the prioritization of SNF removal from shutdown reactor sites. Actions by SCE to prepare for SNF transportation once a federal CISF becomes available could also help expedite progress toward clearing the SONGS site.

7.4.3 Summary Findings for Federal CISF

- This alternative is similar to the federal repository alternative in that it preserves the federal government's obligation to provide for the offsite disposition of SONGS SNF and protects the SONGS co-owners and their customers from exposure to additional costs or risks associated with the federal government's failure to deliver a timely disposal solution for commercial SNF. Thus, relocation of the SONGS SNF to a federal CISF would be commercially reasonable, including with respect to issues of title and liability, from the standpoint of the SONGS co-owners and their customers.
- We estimate that the complete removal of SONGS SNF could take three to four decades following congressional authorization of a federal CISF. There are many factors that could extend this timeframe; on the other hand, if a facility moves forward, adoption by the federal government of an optimized system for accepting SNF from shutdown sites could reduce the schedule significantly.
- New legislative authority together with sufficient appropriations offers the most reliable path forward for implementing federal consolidated interim storage, although some initial efforts in this direction could be undertaken immediately, under existing MRS statutory authority if Congress provided funds for that purpose.[166] Ideally, a new federal interim storage program would be authorized as part of more comprehensive legislation to also restart the federal repository program, as discussed further in Section 8.5. In addition, legislation to provide the ability to enter into interim storage arrangements with private entities or utilities would give the federal government greater flexibility to meet its SNF management obligations.[167] Such legislation would be most helpful if it allowed for greater flexibility in the kinds of consolidated interim storage arrangements the federal government could enter into, including partnering with non-federal facility developers and/or supporting utility-led efforts, perhaps on a demonstration basis.
- The linkage between federal CISF and permanent disposal capability has been a longstanding issue in U.S. nuclear waste management policy. This is true as well for interim storage solutions that do not involve the federal government, since host communities and states will want to have confidence that a permanent solution will be forthcoming.

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[166] Such funds are provided for in the House Energy and Water Projects appropriations bill for FY2021, but an Energy and Water Senate appropriations bill remains under consideration.

[167] Proposed legislation in the House and Senate would accomplish this; however, prospects for action are very uncertain, as the bills address a comprehensive set of amendments to the national nuclear waste management program.

- The SONGS co-owners can expect that the timeframe for transferring title and responsibility for SONGS SNF to the federal government (for either a federal CISF or repository) will be affected by the Standard Contract queue. This will directly affect the time required to remove all SNF from SONGS in the event that a federal storage or disposal facility becomes available. The Standard Contract explicitly authorizes the federal government to prioritize the acceptance of SNF from shutdown nuclear plant sites but does not specify how acceptance would be prioritized among those sites. As growing numbers of plants are retired across the United States, it will be increasingly important to address this issue if DOE's contractual authority to prioritize shutdown sites is exercised.

7.5 Federal Use of a Non-Federal CISF

7.5.1 Synopsis

In this alternative, a non-federal entity would develop and hold the license for a CISF that could accept SNF from SONGS and other nuclear plants. The non-federal entity would be responsible for site selection and acquisition, and for designing, licensing, constructing, and operating the facility. For our baseline, we further assume that the facility would operate entirely on a commercial basis, establishing contracts with the federal government to store the SNF the government has accepted from utilities for a fee. In this scenario, the federal government takes title to the SNF, removes it from SONGS, and transports it to the private CISF where the canisters are returned to interim storage service. At that point, the private CISF owner would take possession of the material under its 10 CFR 72 license, but the federal government would retain title and pay the CISF owner for storage service until such time as the federal government ships the material to a geologic repository or other permanent disposal facility.

At least two efforts by non-federal entities are currently underway to implement a consolidated interim storage facility for commercial SNF.[168] In both cases, license applications have been submitted and are being reviewed by the NRC. One license application was submitted by Holtec International. It proposes a CISF that would use Holtec's HI-STORM UMAX system at a facility named "HI-STORE" located in Hobbs County, New Mexico. The second license application is from a joint venture called Interim Storage Partners (ISP).[169] ISP proposes to construct a CISF at an existing Waste Control Specialists (WCS) facility in Andrews County, Texas.

For purposes of this assessment, we developed a baseline that draws on information from both facilities, since they are fundamentally similar (although site-specific conditions, storage system designs, and details of commercial arrangements with customers may differ).[170]

The main advantage of the non-federal CISF concept in general, and of the proposed Holtec and ISP facilities in particular, is that these facilities, if successful, could offer an alternative for relocating SONGS

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[168] NWT met with representatives of the two developers on January 9, 2020 and received extensive briefings on their proposed operations.

[169] ISP is a joint venture of WCS and Orano. The original license application for this proposed CISF was submitted by WCS. ISP subsequently took over and restarted the licensing process; it is now the applicant and would-be licensee (with Orano having the lead role). WCS will remain the name of the proposed CISF.

[170] Information pertaining to the Holtec HI-STORE facility licensing process may be found at https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html. Information pertaining to the ISP WCS facility licensing process may be found at https://www.nrc.gov/waste/spent-fuel-storage/cis/wcs/wcs-app-docs.html.

SNF that is available sooner than a federal repository or federal CISF. In the case of Holtec and ISP, the sites are identified and the facilities are currently on a path to receive NRC licenses as early as 2021. However, significant uncertainty remains, both regarding host-state support and acceptance of the two facilities that are currently being proposed and regarding whether the federal government would ultimately authorize federal use of such facilities to help meet its waste management obligations if they do become available.

7.5.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume that federal use of a licensed non-federal CISF would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

Scientific and technical issues: As for the federal CISF alternative, there are no generic technical or scientific issues associated with constructing and operating a non-federal CISF in principle. Issues specific to the proposed Holtec and ISP facilities and sites are being addressed as part of the licensing process.

For a non-federal CISF at another location, scientific and technical issues would depend on the specific site and facility design chosen. Such issues would be addressed as part of site selection process and in the technical and environmental analysis that would be undertaken as part of the license application.

Regulatory feasibility: A non-federal CISF would be licensed under 10 CFR 72. Numerous Part 72 licenses have been issued by the NRC in recent decades. In particular, there are 13 specific-license ISFSIs in operation across the United States. No new NRC rulemaking action is required to license or operate these types of facilities.

One issue emerging from the licensing process of the two ongoing private CISF efforts is the compatibility of the Holtec and ISP facilities with the SNF storage canister designs and systems being used at SONGS. Every ISFSI license specifies the waste characteristics and canister and storage cask designs to be used at the facility. Details and limitations applicable to these canister designs and fuel parameters are spelled out in the license. The canister designs covered in each private facility's license applications are summarized below:

- The current license application for the Holtec International facility in New Mexico proposes to store HI-STORM UMAX system canisters. Some of the SNF from SONGS Units 2 and 3 is stored in Holtec HI-STORM UMAX System canisters at the Holtec ISFSI and would be eligible for storage under these specifications.
- The current license application for the proposed ISP facility in Texas proposes to deploy several versions of the TN NUHOMS® System (including the Advanced NUHOMS® System) and three different NAC International storage technologies. All of the SONGS Unit 1 SNF and some of the SONGS Unit 2 and 3 SNF is stored in the Advanced NUHOMS® System at the TN ISFSI. According to current plans, all of the GTCC generated from the deconstruction of the three SONGS units will also be stored in canisters designed to be emplaced in the Advanced NUHOMS® horizontal storage modules. The SONGS GTCC waste is not currently included in the initial ISP CISF license application.

In sum, neither the current Holtec or ISP license applications currently accommodate all of the canister designs and SNF and GTCC waste at the SONGS ISFSI. Subsequent license amendments would be needed to expand the types of SNF canisters that can be stored at each facility.

For purposes of this assessment, we assume both applicants will submit license amendments in the future that would enable their facilities to receive and store all of the SONGS material. However, if submitting these amendments requires the two parties to share proprietary canister design information, this could create a significant hurdle. The two private CISF initiatives are led by companies that currently have access to only the proprietary design information contained in their respective license applications.

Thus, a pathway for licensing the use of a competitor's canisters is not clear to NWT and could be complicated by intellectual property considerations.[171] (Whether access to proprietary design information would actually be required to successfully amend the licenses remains to be seen.) If neither company is successful in amending its license to add the balance of SONGS material not in the initial application, both proposed CISFs would have to be operational to accommodate all the SNF at SONGS.

Commercial reasonableness

Cost: From the standpoint of the SONGS co-owners and customers, there is no difference between this disposition pathway and one in which the federal government removes SONGS SNF for transfer to a federal facility (whether a federal CISF or a federal repository). In both cases, the federal government assumes title to the SNF and responsibility for transport and all other offsite storage or disposal costs at the SONGS site boundary. Thus, there is also no issue of commercial reasonableness from the standpoint of the SONGS co-owners and their customers.

The cost of utilizing a non-federal facility could, however, have some bearing on the probability that the federal government avails itself of this option if it becomes available. Cost considerations are obviously also relevant in any pathway that involves utility owners contracting directly with a non-federal entity for offsite storage services (this is the next alternative we consider). NWT therefore developed estimates of the cost to develop a non-federal CISF using information from the Holtec and ISP license applications. These estimates are discussed in Section 7.6.

Ability to recover costs: Under this alternative, the federal government would take title to the SONGS SNF and GTCC waste at SONGS and pay to ship this material to the non-federal CISF. The cost for storage services would be negotiated between the federal government and the non-federal facility owner/operator and would be paid from the Nuclear Waste Fund. SONGS co-owners and customers would not incur any costs beyond the SONGS site.

Reasonable protection against liability: Since the federal government takes title to the SNF at the SONGS site boundary in this alternative, just as it would for shipment to a federal repository or federal CISF, there would be no further liability to the SONGS co-owners and customers beyond that point.

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[171] To expand their facilities to receive waste forms beyond the scope of their original license applications, Holtec and ISP would need to submit license amendments. These amendments will need to include information about canister types. For Holtec to store canisters designed by TN or NAC International, Holtec's application for a license amendment will likely require proprietary information about the canister designs, as would ISP from Holtec to do the same at the WCS facility. NWT views it as unlikely that the companies would share intellectual property unless they stand to benefit from doing so.

Timeliness of offsite storage

Implementation schedule: A potential advantage of this alternative is that two non-federal CISF sites are already selected, which obviates the need for the federal government or a different non-federal entity to conduct a siting process, assuming that these projects are successfully completed. The Holtec and ISP license applications state that initial receipt of SNF could begin within several years of NRC license approval. For example, the Holtec application indicates initial waste receipt two years from license approval; assuming license approval in 2021, this would imply initial SNF receipt in 2023. The ISP license application implies initial receipt of SNF in 2024.

NWT's analysis of a model generic facility suggests that the time from license issuance to first receipt of SNF could take longer given the additional time needed to close financing, complete CISF construction, complete near-site rail infrastructure construction, acquire transportation assets, and complete facility start-up testing. This assumes no action by state, local, or tribal governments to seek ways to halt the project post licensing (we return to the issue of state and local acceptance in the next subsection on implementation considerations). This would put the implementation timeline at about a decade, but generally in alignment with the current SONGS site decommissioning program.

In NWT's meetings with Holtec and ISP, both CISF owners projected their facilities would begin receiving SNF in 2023. NWT believes this estimate is optimistic given the financial and socio-political challenges that both developers will have to overcome to complete construction.

While the baseline for the non-federal CISF alternative was drawn from the two currently active CISF projects, it is possible that one or more other non-federal CISFs at as-yet-unidentified locations could emerge over time. For example, county-level governments in Wyoming considered a non-federal CISF in the early 1990s but then Governor Mike Sullivan decided not to support it.[172] More recently (in 2019), the idea resurfaced as a potential subject of study, before being again dropped by the Wyoming state legislature (in 2020).[173]

Other implementation considerations

Need for statutory changes: A non-federal CISF can be licensed and operated under current law and regulations. However, this alternative would require changes to federal law to allow the federal government to transport SNF to a facility that is not currently authorized under the NWPA and to allow the federal government to enter into commercial agreements with CISF owner(s)/operator(s). H.R. 2699 (the Nuclear Waste Policy Amendments Act of 2019), the comprehensive nuclear waste legislation reported out by the House Energy and Commerce Committee, would have provided the necessary authority, although it also would have tied waste acceptance at the CISF to a final NRC decision (either approving or disapproving) on the Yucca Mountain license application.

Potential socio-economic-political barriers: The Holtec and ISP proposals are the most advanced of the consolidated interim storage alternatives. However, both proposals still face significant challenges and uncertainties related to the cost, financing, and indemnification issues discussed previously. Resolution

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[172] Letter from Mike Sullivan, Governor, Wyoming, to Fremont County Commissioners, August 21, 1992.
[173] In July 2019, the management council of the Wyoming legislature authorized the state's Joint Minerals Committee to initiate a new study of the issue (see: https://www.wyofile.com/lawmakers-name-all-gop-nuclear-fuel-storage-study-tesm/). in November 2020, the legislature dropped consideration of the study. See: https://trib.com/news/state-and-regional/govt-and-politics/wyoming-lawmakers-decide-not-to-pursue-nuclear-waste-proposal-though-options-remain-open/article_32481df-f4e-52f7-81d3-6b377b55337a.html

of the question of whether the federal government will be authorized to contract with a non-federal CISF for storage services would provide greater financial assurance for these ventures.

Both these projects also face challenges in terms of socio-political acceptance. The proposed Holtec facility (Figure 7.2), while it has local political support, has struggled to gain broader political support within New Mexico. In a June 7, 2019 letter to then Secretary of Energy Rick Perry and NRC Chairman Kristine Svinicki, New Mexico governor Melissa Lujan Grisham expressed opposition to the Holtec project.[17] A subsequent letter from Stephanie Garcia Richard, Commissioner of Public Lands for the New Mexico State Land Board, to Holtec President and CEO Krishna Singh, expressed concerns about safety and cited the Board's view that Holtec had made misrepresentations to the NRC pertaining to mineral rights below the surface of the facility.[175] According to the Land Board's letter, these misrepresentations are related to Holtec's control of the proposed storage site, as well as agreements that Holtec claimed to have secured from New Mexico State Land Office mineral lessees. The NRC was copied on the letter. In addition, local ranchers, the New Mexico oil and gas industry, and the All Pueblo Council of Governors have taken positions against the Holtec facility.[176]

By contrast, local government authorities in Eddy and Lea Counties have expressed support and the Eddy–Lea Energy Alliance is actively working to help Holtec advance the project. Many of the Holtec supporters are the same local politicians and community leaders who were active in supporting and in some cases, facilitating the opening of the WIPP facility. It is unclear how younger community leaders, who didn't live through the WIPP siting process, will view Holtec's effort.

Figure 7.2 Location of the Proposed ISP and Holtec Private CISFs

[17] See: https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML19183A429.
[175] See: http://nuclearactive.org/wp-content/uploads/2019/06/NM-Governor-Holtec-Ltr-060719.pdf.
[176] Opposition from the oil and gas industry stems from a concern that the presence of a CISF could interfere with oil and gas operations in the Permian Basin.

The ISP site in Texas likewise has supporters and opponents. On April 26, 2019, Texas governor Greg Abbott wrote to then Secretary of Energy Rick Perry and NRC Chair Kristine Svinicki, stating: "At this time, I oppose any increase in the amount or concentration of radioactivity authorized for disposal at the facility in Andrews County, Texas." In a subsequent November 3, 2020 letter to the NRC, Governor Abbott strongly opposed the CISF initiative at the Andrews County site. On the other hand, the Andrews County Commissioners, on January 20, 2015, unanimously adopted a resolution of support for ISP. In addition, the Texas Radiation Advisory Board, an independent commission appointed by the Governor, issued the following statement of support on September 19,2014 "Based upon the following considerations, the Texas Radiation Advisory Board's (TRAB's) position is that the state of Texas should request that the Federal Government consider Texas to be a site for a consolidated Spent Nuclear Fuel (SNF) storage facility. It is advantageous to Texas to have the storage site in the state so the activities can be directly regulated. Since the US is going to establish consolidated SNF storage facilities in the United States, transportation through Texas will occur whether a site is located in Texas or not."

Other interests in Texas, however, are also opposed. The Texas-based Sustainable Energy and Economic Development Coalition has led efforts to stop the facility, citing concerns about the safety of the site and of the transportation of the material through Texas. The Fasken Oil and Ranch Ltd. of Midland, Texas opposes the site and has worked to build opposition within the oil and gas industry and among landowners. Some surrounding counties and cities have adopted resolutions against the plan including San Antonio and Midland. How these concerns are balanced against the potential technical, economic and other benefits of hosting and operating a large nuclear waste facility within the state is yet to be resolved.

Degree to which SONGS co-owners have control over implementation: The SONGS co-owners are not a party to the NRC licensing process for the two private CISF projects and have no direct ability to influence the likelihood that Holtec and ISP succeed in securing relevant licenses and permits to operate their facilities. As with the other federal options, SCE has limited direct ability to influence progress toward this particular federal storage alternative. But SCE could help create the political conditions and coalitions needed to break through the current national-level stalemate, including by working with California's congressional delegation to push for progress.

7.5.3 Other Forms of Public–Private Arrangements

A federal CISF developed as a traditional capital asset acquisition and management project and federal use of a non-federal CISF for SNF storage via a fee-for-service contract mark two ends of a spectrum of institutional arrangements that might be used to implement interim storage for SNF owned by the government in fulfillment of its contractual obligations to Standard Contract holders. Several bills that were proposed in Congress over the course of the last two years suggest that policymakers are open to a wide range of possibilities:

- H.R. 2699 (the Nuclear Waste Policy Amendments Act of 2019), which was passed out of the House Energy Commerce Committee in late 2019, would provide flexible authority for the federal government to store SNF with a non-federal entity through an 'MRS agreement'—broadly defined as "a cooperative agreement, contract, or other mechanism that the Secretary considers appropriate to support the storage of Department-owned civilian waste in one or more monitored retrievable storage facilities…"
- The Senate counterpart bill, S. 1234 calls for establishment of "a storage program to license, construct, and operate through 1 or more non-Federal sector partners, 1 or more government or non-federally owned storage facilities…" without specifying exactly how that is to be done.

Two of the three ISFSIs for which DOE holds the NRC license represent non-traditional alternatives:

- In January 1999, DOE issued a "privatization" RFP for a contractor to design, license, construct, and operate a government-owned ISFSI for government-owned SNF at the Idaho National Laboratory (INL). Known as the Idaho Spent Fuel Facility (ISFF), this project was intended to receive, repackage, and provide interim dry storage for three types of fuel: Peach Bottom fuel elements, Shipping port fuel rods, and TRIGA (Training, Research, and Isotope reactors built by General Atomics) fuel elements. In May 2000, DOE awarded the contract to Foster Wheeler Environmental Corporation (FWENC). FWENC designed the facility, submitted a license application to the NRC in 2001, and was granted a license in 200 4 However, DOE did not proceed with the project and the license was transferred from FWENC to DOE in November 2009.
- DOE currently holds title to and is storing SNF in an ISFSI at Fort St. Vrain, Colorado at a site owned by Public Service Company of Colorado (PSCo). While PSCo held the original NRC license for the ISFSI, the license was transferred to DOE in 1999 and renewed by the NRC in July 2011 to extend through November 2031. DOE manages and operates the facility through a private contractor.

Other public–private SNF storage arrangements have been suggested:

- A public–private partnership (PPP) with federal participation. The federal government would become an "equity partner" with one or more non-federal entities in a PPP and in the context of CISF funding and financial relationships. At the same time, the federal government would retain separate responsibility for eventual disposal of the SNF and its attendant transfer, storage, and disposal costs.[177]
- An "airport authority" analog in which an authority involving federal, state, and local governments would manage a site, including not only a storage facility but also other associated facilities that could contribute to the development of the region around the site.[178] This model is similar to the CISF complexthat is being planned in Spain, which includes a storage facility, a research and development center, and an industrial park to foster regional development.

NWT did not evaluate these concepts in detail. To the extent any of them could offer a means for the federal government to store SNF accepted from utilities pursuant to the Standard Contract, they would entail no additional costs or liabilities for the SONGS co-owners and customers. This suggests that it could be beneficial to the objectives of this Strategic Plan if any new legislation adopted for purposes of restarting the national nuclear waste management program also included flexible authority to pursue

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[177] A version of this alternative was proposed to DOE by Holtec in its "Response to RFI on Private Initiatives to Develop Consolidated SNF Storage Facilities," January 27, 2017. https://www.energy.gov/sites/prod/files/2017/02/f34/Jan%2027%2C%202017%20-%20Joy%20Russell%20-%20Response%20to%20the%20RFI%20on%20Private%20Initiatives.pdf

[178] Airport Authority. Forsberg, Charles, "Integrating Repositories with Fuel Cycles: The Airport Authority Model," Proceedings of ICAPP '12, Chicago, Ill.: American Nuclear Society, paper 12007, June 2012.

different CISF models, including a federal facility, federal use of a non-federal facility, or any other approaches that the federal government considers to be appropriate.[179]

Alternatively, if DOE were directed to initiate a siting process under the existing MRS provisions of the NWPA, it could solicit proposals that include various institutional arrangements for the development and operation of proposed facilities, along with identification of any legislative changes that might be needed to authorize those arrangements.

7.5.4 Summary Findings for Federal Use of a Non-Federal CISF

- This alternative provides another potential option for the federal government to perform on its fundamental obligation to implement a disposition pathway that enables the removal of SNF from the SONGS site in a way that protects the SONGS co-owners and customers from exposure to further costs and risks. Thus, as an offsite disposition pathway for SONGS SNF, federal use of a non-federal CISF would be commercially reasonable, including with respect to issues of title and liability, from the standpoint of the SONGS co-owners and their customers.
- Two non-federal efforts to develop consolidated storage facilities are well underway and, if successful, could potentially offer a nearer-term option for relocating SONGS SNF accepted by the federal government than a federal facility. However, both projects face opposition, including at the governor level, and other obstacles.
- We estimate that the SONGS SNF could be completely removed within a timeframe of approximately two decades once one or more non-federal facilities that can accept all of the SNF have been fully licensed and operational and once the federal government has been authorized to contract with those facilities for storage services. However, the timing of federal authorization to enter into such contracts and the schedule for federal acceptance of SNF from different shutdown sites if such authorization is granted and contracts with the facility owners are successfully negotiated, remain key sources of uncertainty.
- Greater flexibility to enter into various forms of public–private arrangements for SNF storage would be a valuable feature of any new legislation designed to restart and reset the federal waste management program.

7.6 Non-Federal Consolidated Interim Storage Facility

7.6.1 Synopsis

In this alternative, a non-federal entity would develop and hold the license for a CISF that could accept SNF from SONGS and other nuclear plants. The non-federal entity would be responsible for site selection and acquisition, and for designing, licensing, constructing, and operating the facility. We further assume that the facility would operate entirely on a commercial basis, establishing contracts with the current SNF title holders (utilities) and storing the SNF for a fee. This is similar in most respects to the alternative discussed in the immediately preceding section (7.5), "federal use of a non-federal CISF", except that there is no federal involvement and the business relationships are directly between the facility owners and the utilities.

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[179] Proposed legislation in the House and Senate would accomplish this; however, prospects for action are very uncertain, as the bills address a comprehensive set of amendments to the national nuclear waste management program.

Our baseline assessment for this alternative is based on the ISP and Holtec proposals described in detail in Section 7.5. Use of these particular facilities is specifically noted as an option that should be considered in the Settlement Agreement that triggered the development of this Strategic Plan. We do not repeat the information provided in Section 7.5 here except where a specific distinction exists between a scenario in which the federal government contracts for storage services at a non-federal facility and a scenario in which the utility owner(s) of SNF (in this case, the SONGS co-owners) directly contract for storage services at the non-federal facility.

7.6.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume that a licensed non-federal CISF would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

Scientific and technical issues: These are the same as for the "federal use of a non-federal CISF" alternative discussed in Section 7.5.2).

Regulatory feasibility: As discussed in 7.5.2, a non-federal CISF could be licensed under 10 CFR 72 with no new NRC rulemaking action required. However, the license applications for both the Holtec and ISP facilities include conditions that could present obstacles to the use of either facility to provide storage for SONGS SNF under a direct arrangement between the SONGS co-owners and the facility owners. The first issue concerns the compatibility of the Holtec and ISP facilities with the SNF storage canister designs and systems being used at SONGS and applies equally if the federal government is the party contracting for storage services with Holtec and ISP. This compatibility issue is discussed at length in Section 7.5.2.

The second issue concerns title and liability; it does not arise if the federal government first takes title to the SONGS SNF but could constitute a significant impediment to the use of either facility if the federal government is not involved. This is because both draft license applications require that title to the SNF be retained by the client contracting for storage service. A separate draft license condition requires the licensee (Holtec or ISP) to allocate legal and financial liability between the licensee and the client. Because transfer of title and liability is a critical factor in determining the commercial reasonableness of any offsite storage option for SONGS SNF, we return to this issue in the next portion of our assessment for the non-federal CISF alternative.

Commercial reasonableness

Cost: This section discusses NWT's detailed assessment of the cost of a non-federal CISF based on available information about the proposed ISP and Holtec facilities. In contrast with the alternative where the federal government contracts with a non-federal storage facility (discussed in the previous section, Section 7.5), the cost of storing SNF at a non-federal offsite facility would be of direct concern to the SONGS co-owners and customers, since the co-owners would be contracting directly with the CISF owner/operator. In this scenario, as in all the alternatives that do not rely on the federal government to play a central role, transportation costs, which are discussed in Section 6.5 of this Plan and in more detail in the CTP, would also be an important factor.

The Holtec application estimated capital expenditures at $223 million for its first-phase facility, which is designed to store 500 canisters of SNF, or about 8,680 MTU. ISP provided a more detailed cost breakdown, estimating $1.6 billion in development costs for a 40,000-MTU facility. The Holtec

application does not detail the specific assumptions behind its estimate; presumably the estimate is based on Holtec's experience in developing ISFSIs. ISP's estimates are derived from a cost study of a generic CISF performed by the Electric Power Research Institute (EPRI).

The estimates provided in the Holtec license application place the total lifecycle (undiscounted) cost of Holtec's proposed facility (including design, licensing, construction, 40 years of operation, and a decommissioning fund) in a range beginning at $1.5 billion (for the initial phase of 8,680 MTU of storage capacity) and ultimately reaching $8.5 billion (for a fully developed 100,000-MTU facility). The reported life-cycle cost estimate in the ISP license application totals $5 billion (for a 40,000-MTU facility).

NWT's review of the Holtec and ISP cost estimates identified cost elements (Table 7. 4) that were either not addressed or discussed in only qualitative terms in the license applications, including:

- Benefits payments—A non-federal CISF developer would likely enter into some form of benefits agreement with the host state and local governments. These costs would need to be recovered in storage fees.
- Taxes—The non-federal CISF operation, if it is a commercial enterprise, would be subject to federal corporate income tax
- Transportation—The two CISF applications assume that the current SNF owner would be responsible for all shipping arrangements and costs to move the SNF to the CISF site. Capital cost recovery and financial risk protection—Storage fees at a non-federal CISF would have to cover the cost of facility financing, including debt service and equity return. These costs, in turn, would be affected by perceived risk, in terms of the overall financial viability of the enterprise, from the point of view of potential investors. If the project is perceived to be risky, investors may seek a risk premium or other forms of financial assurance, such as bankruptcy insurance. Total project cost also would have to take into account any financial assurance required by the NRC.

Table 7.4 Major Cost Elements and Sources of Estimates for NWT Cost Analysis

Cost Elements	Subcategories	Source
Land Acquisition		Holtec license application
Licensing and Design	Pre-License Phase, License Application Review Phase, Initial Construction/Pre-Operations Phase	EPRI
Construction	Transportation Infrastructure Improvements, CISF Buildings, Fuel Storage Facility, Overpack Costs	EPRI (excluding dual-purpose canister costs)
Operations and Maintenance	Administrative Costs, Labor Costs, Other O&M	EPRI (excluding transportation-related costs)
Decommissioning Fund		EPRI
Cost of Debt and Equity		Industry-standard assumptions
Income Tax		Industry-standard assumptions
Credit Risk Instrument		NWT expertise
Payments to Host Communities		Derived from WCS low-level waste payments

NWT developed a more complete cost estimate for a generic non-federal CISF with a capacity of 5,000 MTU, drawing from cost information in the EPRI study and in the Holtec and ISP license applications, but also including additional costs that we believe would need to be factored into the pricing of non-federal storage services.

Our analysis also considered economies of scale. A 5,000-MTU generic facility was chosen as the initial size for the analysis because it is comparable to the initial phase of the Holtec and ISP license applications (the Holtec Phase I license application is for 8,680 MTU and the ISP application is for 5,000 MTU). Both private developers propose to expand capacity in later phases to a final size of 100,000 MTU for Holtec and 40,000 MTU for ISP. Thus, expansion to 60,000 MTU was chosen to develop our CISF cost estimates.

The results of NWT's analysis are summarized in Table 7.5.

Table 7.5 NWT Cost Analysis for Generic 5,000-MTU and 60,000-MTU Non-federal Storage Facility

Cost Elements	5,000 MTU Capacity	60,000 MTU Capacity
Licensing and Design	$63 million	$63 million
Construction	$130 million	$1,566 million
Annual average operations and Maintenance (averaged over 40-year license period)	$33 million	$126 million
Funds set aside for future CISF decommissioning	$20 million	$239 million
Total Undiscounted Life Cycle cost (40 years license period)	$ 1088 million	$15,806 million
Source: NWT estimates from modeling analysis using assumptions from CISF license applications and EPRI.		

Our analysis yielded a cost estimate of approximately $200 million to design, license, and construct a generic 5,000-MTU CISF. This figure is consistent with NWT's internal estimates for such a facility. To what extent Holtec and/or ISP will need to seek debt and equity funding to complete the first phase of construction, begin operation, and plan for expansion is unclear at this time. How, and under what terms Holtec and/or ISP could raise these funds, if necessary, without commercial arrangements in place with several customers, or a contract with the federal government for SNF storage services remains uncertain.

NWT's total life-cycle cost estimate is higher than the estimates in the Holtec and ISP license applications because it includes estimated costs for federal and state income taxes, potential payments to host communities, a credit risk instrument, debt service, and equity return.

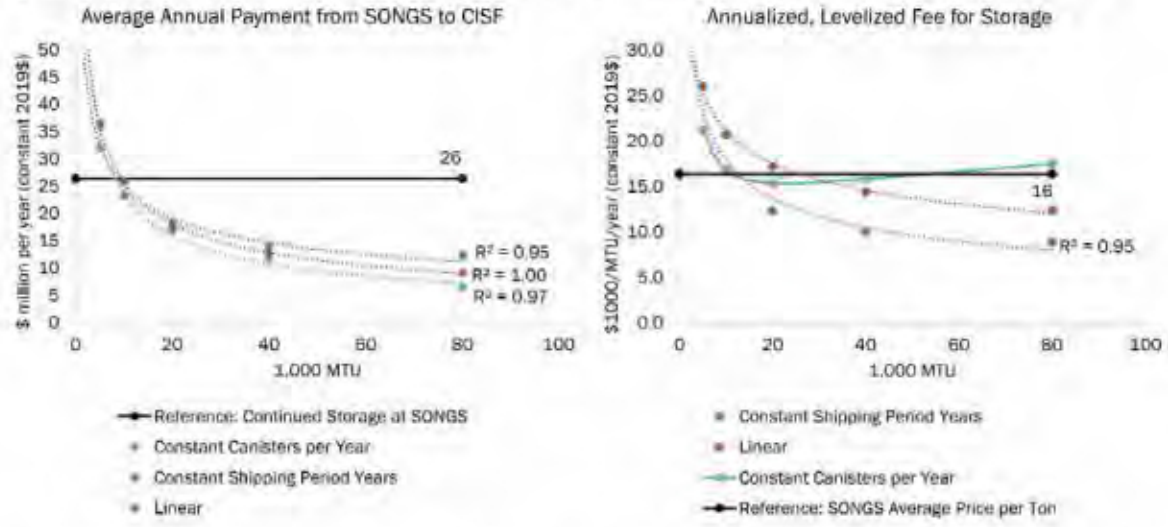
Using our cost analysis for a generic 5,000-MTU facility and assuming that storage costs would be allocated to the SONGS SNF on a pro rata basis, we estimate that the total, undiscounted cost to store all SONGS SNF and GTCC waste at this hypothetical facility for a period of 40 years would be about $1.3 billion. Neither Holtec nor ISP has articulated its business model in terms of charging for storage services, so it is not clear whether storage fees would be assessed as a lump-sum, up-front payment, an annual levelized storage fee, or some combination.

To provide additional insight on potential cost differences between continued on-site storage at SONGS and offsite storage at a non-federal CISF, NWT developed a model that compares costs in terms of an annualized, levelized fee for storage services for different sizes of a CISF. Annual levelized fees could vary based on the rate of shipping and loading of the CISF, so the model examined different scenarios for shipping rates and loading of the CISF based on a fixed number of canisters shipped per year, a scenario based on a fixed period for SNF acceptance at the CISF, and a scenario where acceptance rates varied linearly with CISF size (i.e., a larger CISF would have a higher acceptance rate).

A comparison of the modeling results, shown in Figure 7.3, indicates that there are significant potential economies of scale for a larger facility, and that the economies of scale are comparable for different loading rates to the CISF. For example, the cost to store SNF at a 5,000-MTU non-federal CISF would be higher than the cost to operate and maintain the current SONGS ISFSI, regardless of the CISF loading rate. Similarly, the cost to store SONGS SNF at a facility with ten times the capacity, or 50,000 MTU, would be lower than the cost of continued storage at SONGS regardless of the CISF loading rate. (These economies of scale, it is important to note, would reduce system-level costs, but not necessarily costs to individual SNF owners. Costs to the SONGS co-owners for storing SNF at a non-federal CISF, for example,

would depend on commercial arrangements and on the extent to which offsite storage costs would be reimbursed through the Judgment Fund, among other factors.)

Figure 7.3 Estimated Economies of Scale in Storage Costs at a Non-Federal CISF



At a larger, 20,000-MTU CISF, however, where costs are averaged over the entire facility at full capacity, economies of scale would result in storage costs that are at or lower than the cost of the current SONGS ISFSI. Note that while this analysis considers different shipping rates, it does not account for the costs of shipping. Including transportation costs would move the breakeven point to the right of the curves.

An important question is whether there would be enough other SNF owners willing to contract with a CISF in order to achieve an acceptable price point. Different SNF owners will require different price points to break even, since the cost to maintain an ISFSI at an existing plant site and other pertinent cost considerations are likely to vary for each owner, depending on their circumstances. (This analysis also does not consider that a CISF might take a phased approach to contracts, offering different prices at different stages of filling the facility's capacity.)

Finally, there is an issue of performance guarantees to be resolved if the SONGS co-owners' contract for storage services at one or more private CISFs. In that case, SCE's ability to complete decommissioning of the SONGS site would become dependent on the private developer's ability to execute its business plan for developing the CISF. As currently contemplated, transporting the SNF to the CISFs remains the responsibility of the SNF title holder at the originating site. Selling the SONGS assets, including the SNF, to an affiliate of the CISF owner would avoid this problem (some of the variants considered in Subsection 7.6.3 address this possibility).

Ability to recover costs: Until the federal government remedies its partial breach of contract by performing on its obligation to take title to the SONGS SNF and remove it for disposition, the federal government will remain liable for damages due to its breach of contract.

Thus, if the SONGS co-owners were to contract directly for offsite storage services, without the federal government taking title, their costs for offsite storage might be eligible for reimbursement from the Judgment Fund. However, this is an area of considerable uncertainty. The terms of the current settlement template might require amendment (these terms are legally protected and not publicly available), particularly with respect to the scope and level of costs for private CISF storage that might be

eligible for reimbursement from the Judgment Fund. In particular, if SONGS should enter into such a settlement, the current template specifically precludes recovery of costs paid for the development of off-site storage initiatives. Whether transportation costs, which could be substantial, would also be eligible is another highly consequential issue from a commercial reasonableness standpoint. In a scenario where the SONGS co-owners sell the SONGS SNF to a private third party, such as the CISF owner or an affiliate of the CISF owner, settlement agreements could transfer with the sale, and the purchasing entity would be responsible for renegotiating the terms of Judgment Fund reimbursement. In both cases, the entity with title to the SNF would incur upfront costs before the eligibility of these costs for Judgment Fund reimbursement is necessarily known.

Recent transfers of assets at shutdown plant sites to affiliates of Holtec and ISP suggest that the SONGS co-owners' rights and obligations under the Standard Contract are assignable to a subsequent owner of the SNF (with prior DOE approval). The federal government could take the position that the reimbursable cost for SNF storage at a private CISF would need to be cost-effective relative to the current reimbursable cost for storage at the SONGS ISFSI. It is not clear whether the net cost of storage at a private CISF would be lower than the cost of storage at the SONGS ISFSI since the operating cost savings from economies of scale at a consolidated storage facility could be more than offset by the costs of taxes, benefit payments, debt service, and return on equity to the CISF owner.[180] In addition, transportation costs would have to be considered.

As indicated above, storage fees could depend on the size of the facility and its ability to find willing clients to fill that capacity. Fees might also be affected by expectations about the duration of storage before SNF can be transferred to a federal facility for final disposition, since this would have implications for the rate of needed cost recovery at a private storage facility. In any case, the SONGS co-owners would have to make a determination that the costs of shipping and storing SNF at an offsite facility, including resolving the potentially significant title and liability issues discussed below, meet the test of commercial reasonability taking into account questions of eligibility for continued recovery of storage costs from the Judgment Fund.

Reasonable protection against liability: As we have already noted, conditions in the draft NRC licenses for the Holtec and ISP facilities create substantial issues of title and financial and legal liability for a scenario in which the SONGS co-owners contract directly with either facility owner for offsite SNF storage. Specifically, the draft license conditions require clients of the facilities (in this case, the SONGS co-owners) to retain title to SNF while it is in storage at the facility and to continue as "the Purchaser" under the co-owners' Standard Contracts with DOE.

Further, the draft licenses require that legal and financial liability for the SNF be allocated between the CISF licensee (in this case Holtec or ISP) and the client. This creates a situation in which the SONGS co-owners retain ownership of the SNF, and associated liabilities, but their authority over storage operations at the CISF would be limited. In addition, the requirement to retain title is problematic in light of the stipulation (as part of the Settlement Agreement that triggered this strategic planning process) that any relocation of SONGS SNF to an offsite facility must result in the transfer of liability for and title to the SNF to a third party *unless* SCE can obtain contract terms from the third party that offer commercially reasonable protection from these liabilities (see discussion in Section 6. 4. In short, the

[180] Costs for the current SONGS ISFSI have already been reimbursed from the Judgment Fund. To the extent that storage fees at a private CISF include recovery of facility design and construction costs, it seems doubtful that the Judgment Fund mechanism could be used to cover that portion of the private storage fee.

SONGS co-owners would have to negotiate business arrangements with the CISF owner that satisfy the license conditions for the CISF, are acceptable to the CISF owner/operator, and provide liability protection on commercially reasonable terms. In addition, these arrangements would have to cover a potentially considerable length of time. Alternatively, the SONGS co-owners could potentially negotiate different business arrangements with the CISF owner, particularly related to title transfer, the recovery of storage costs, legal liability, and third-party oversight of storage operations. However, any arrangement involving transfer of title to the SNF from the SONGS co-owners to either CISF owner would, require an amendment to the respective CISF license to allow that transfer.

At this point, it is unclear how the license condition to allocate legal and financial liability between the CISF licensee and its clients would be implemented through storage agreements with clients or how this license condition would be enforced by the NRC. This raises a potential concern that the SONGS co-owners and customers could be exposed to some risk of financial impairment if the private storage facilities fail at some point in implementation. The SONGS co-owners would have to ensure that the CISF licensee has the financial means, if not independence, to continue to operate regardless of financial circumstances and progress (or lack thereof) by the federal government toward fulfilling its statutory and contractual responsibilities.

The draft Holtec and ISP CISF licenses include two additional conditions that will have to be included in future service contract provisions with users of these facilities. First, customers (in this case, the SONGS co-owners) will periodically have to provide credit information and, where necessary, additional financial assurances such as guarantees, prepayments, or payment bonds. Second, the licensee (in this case Holtec or ISP) is not to terminate the license prior to furnishing storage services covered by the contract. How all of these license conditions might be addressed in any commercial agreement between the private CISF owners and the SONGS co-owners would be a key issue in terms of ensuring that the SONGS co-owners and customers are adequately protected against risks and liabilities stemming from the storage of SONGS SNF and GTCC waste at a private facility.

One way to handle credit risk concerns would be through a credit risk instrument. For example, the CISF facility owner could buy such an instrument before SCE enters into a contractual relationship for SNF storage. Broadly, the annual cost of such insurance is up to 10 percent per annum of the insured amount. Alternatively, SCE could require a private CISF vendor to present some other form of surety or remedy to preclude the consequences of bankruptcy. Another possibility would be for the federal government to provide some form of backstop protection, for example through a loan guarantee for the debt financing. This would conceptually remove any credit risk issues.

Variants of this alternative (discussed below) address scenarios in which another, non-federal third-party entity acquires SONGS SNF. If, for example, the SONGS co-owners were to sell the SONGS facility, including the SNF, to an ISP or Holtec affiliate and if title transferred at the existing SONGS ISFSI, the license conditions discussed in this section would not present a problem.

This type of business arrangement has in fact evolved in situations where the private CISF developer (or its affiliate) owns the assets at a shutdown plant site, including the SNF.[181] In this business model, the CISF owner would effectively be shipping SNF that it already owns to itself (or to a corporate

[181] An affiliate of Holtec owns Oyster Creek and Pilgrim and will soon own Palisades, Big Rock Point, and Indian Point. Both North Star, Inc. and WCS are owned by J.F. Lehman Company. North Star is also affiliated with Accelerated Decommissioning Partners, which owns Vermont Yankee and Crystal River Unit 3.

affiliate). We expect affiliates of both Holtec and ISP to use this model to expand their ownership to additional shutdown plant sites over time.

Typically, however, these arrangements have been brokered at the beginning of decommissioning efforts and the full decommissioning fund has been transferred to the new entity. Since the SONGS co-owners have already contracted for separate decommissioning services with SONGS Decommissioning Solutions and since expenses have been incurred against the decommissioning fund, this option is less likely to be viable for SONGS than for other shutdown sites that are just beginning the process of decommissioning.[182]

Timeliness of offsite storage

Implementation schedule: Schedule considerations for the proposed Holtec and ISP facilities are discussed in Section 7.5.2. More generally, the timeframe in which a non-federal CISF could become available does not necessarily depend on whether the user of the facility will be the federal government or SNF owners. While our baseline assessment for this alternative was drawn from the two currently active private CISF proposals, it is possible that one of more other non-federal CISFs at as-yet-unidentified locations could emerge over time.

In a scenario where the SONGS co-owners are able to access a non-federal CISF on commercially reasonable terms, including commercially reasonable resolution of title and liability issues, NWT estimates that transferring all SONGS SNF to such a facility could be completed in about a decade, based on the current SONGS decommissioning plan[183] and the likely acceptance rate of a private facility. This rate of transfer away from SONGS would be highly dependent on the number of customers each CISF has, and when the fuel from each originating site is scheduled for removal (all of which is commercially negotiable).

We also expect Holtec and ISP to prioritize shipments of SNF from sites where they have an ownership stake over shipments from other sites, such as SONGS, where they do not have an ownership stake. Table 7.6 shows the total amount of SNF currently owned by affiliates of Holtec and ISP.

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[182] In addition, because these types of arrangements are relatively new, important issues with respect to residual reputational risk and liability to the original owner of the SNF would have to be explored.

[183] The SONGS Decommissioning Plan conservatively projects that shipping all SONGS SNF off site could take up to 21 years once a receiving facility is open and available to accept the SNF. This projection reflects uncertainties in the rate of acceptance of fuel at an off-site CISF or repository. With greater certainty in transportation arrangements, NWT estimates that the period for shipping SONGS SNF off site could be significantly shortened, by about half, to a schedule of approximately a decade. Thus, our analysis, here and elsewhere, assumes that moving the SONGS SNF off site *once a receiving facility is available to accept the SNF* could take approximately a decade.

Table 7.6 Inventory of SNF Owned by Affiliates of Holtec and ISP and CISF Capacity

Affiliate	MTU	SNF Canisters	Initial CISF Capacity[184]	Remaining Available Capacity
Holtec Decommissioning International	4228	326	HI-STORE* 8,680 MTU 500 Canisters	HI-STORE 4 452 MTU 17 4Canisters
Accelerated Decommissioning Partners (ISP affiliate)	1,280	110	WCS** 5,000 MTU	WCS** 3,720 MTU

* Planned capacity via amendments in the out years is 100,000 MTU and 10,000 canisters.
** Number of canisters is not specified. Planned capacity via amendments in the out years is 0,000 MTU.

The amount of SNF currently held by the two affiliates represents about 50 percent or less of the initial storage capacity in their respective Phase I license applications. This leaves more than ample room for the SONGS co-owners to contract with either CISF to ship SONGS SNF during the first phase of storage. What is interesting about the current holdings of the two affiliates is that much of their SNF is in canisters that are not covered by the initial license applications. While this leaves even greater flexibility for either CISF to accommodate SONGS SNF in its initial operations, the problem of one of the CISFs being able to accept all of the SONGS SNF and GTCC waste canisters remains.

Other implementation considerations

Statutory changes needed: A non-federal CISF can be licensed and operated under current law and regulations. Moreover, the SONGS co-owners can either contract for storage services at a private CISF while retaining title to the SNF, or the SONGS co-owners can sell and transfer title to the SNF to a private CISF owner/operator under current law. While not necessary, new federal legislation could nonetheless be helpful in several respects. For example, if funding from the federal government is involved (either direct or reimbursed beyond the current Standard Contract litigation), authorizing legislation would be required. Finally, new federal legislation would be required for the federal government to provide transportation assets or services, or to provide liability protection under the Price Anderson Act for SNF shipments. (See the discussion of variants in Subsection 7.6.3.)

Potential socio-economic-political barriers: The Holtec and ISP proposals are the most advanced of the consolidated interim storage alternatives. However, both proposals, as discussed under the "federal use of a non-federal CISF" alternative, still face opposition. These challenges are described in Subsection 7.5.2.

Degree to which SONGS co-owners have control over implementation: The SONGS co-owners are not a party to the NRC licensing process for the two private CISF projects and have no direct ability to influence the likelihood that Holtec and ISP succeed in securing relevant licenses and permits to operate their facilities. The SONGS co-owners might be able to help the private CISF developers strengthen their business models, and thus their ability to secure financing, by entering into discussions regarding a possible term sheet agreement. Such discussions could also allow the SONGS co-owners to gain greater

[18] Information taken from the respective Draft Environmental Impact Statements for the facilities (NUREG-223 4 for Holtec and NUREG-2239 for ISP).

clarity about the issues associated with transferring either possession of the SNF, or title, or both to the CISF. Specific issues that could be clarified include:

1. How could the licenses, once granted, be amended to include all types of SNF and GTCC waste canisters in use at SONGS?
2. What are the alternatives for transportation responsibility?
3. How would pricing for storage services be structured?
4. What types of performance guarantees could be arranged, both for initial shipping and to preclude the return of SNF once shipped?
5. What mitigation measures are proposed to address public, worker, and environmental risks and credit risks?
6. If the SONGS co-owners retained title to the SNF at the CISF, how would liability be determined and how could adequate protection against liabilities and risks be secured on commercially reasonable terms?
7. Under what terms could title be transferred to the CISF owner or the federal government?
8. What actions, if any, by the federal government (legislative, administrative, funding) would be required to ensure successful performance of any contractual arrangement?

Addressing the first issue, for example, could require the canister vendors (Holtec and TN) to share information that would allow both private CISF developers to modify their initial licenses to accommodate all types of SONGS canisters. This could be challenging given the incentives against sharing proprietary information, especially with a potential competitor in providing storage services. If the SONGS co-owners were able to reach agreement with a private entity (or entities) to contract for offsite storage services under commercially reasonable terms, this would almost certainly be viewed as a significant and potentially precedent-setting development in the evolution of nuclear waste management options and practices in the United States.

7.6.3 Variants of the Non-Federal CISF Concept

The SONGS co-owners sell the SONGS assets: Both Holtec and ISP have indicated to NWT that the title holder of the SNF would need to arrange to transport the fuel to the CISF. (The ISP draft license explicitly recognizes that the federal government could be the title holder; the Holtec draft license is silent on this possibility but does not preclude DOE being the title holder. The possibility that the federal government would take title and contract for storage services at a non-federal facility is considered as a separate alternative in Section 7.5.) The draft licenses also require the title holder to *retain* title to the SNF while in interim storage at the CISF.

Another possibility NWT considered is that the SONGS co-owners could choose to sell the SONGS assets, including the SNF and some portion of the decommissioning trust funds, to a private company affiliated with one of the private CISFs (similar transfers have been completed for a number of shutdown plant sites, including Oyster Creek, Pilgrim, Vermont Yankee, and Crystal River). The new owner would take title and possession of the SNF at the SONGS plant site, ship the SONGS SNF to the CISF, and retain title while possession transfers to the company that owns the CISF.

As noted elsewhere, however, the SONGS decommissioning trust funds are subject, under IRS rules, to constraints on how the funds may be used. In addition, purchases of other shutdown plant sites have

customarily been consummated before substantial decommissioning activities commence. SONGS decommissioning has already been awarded to SONGS Decommissioning Solutions and is underway. A further issue is that the California Public Utility Commission would likely need to approve the transfer of decommissioning trust funds to a new owner. These considerations could limit the value and feasibility of the above approach from the perspective of a potential buyer.

In this variant, the SONGS co-owners would have no responsibility for the SONGS site or SONGS SNF after the sale, and no influence over the cost or schedule for removing SNF from the site (for this reason, a sale of assets—if it did not provide greater certainty about the timeframe to removal—might also fail to win support from local stakeholders). The need to amend the license for either the Holtec or ISP facility to accommodate all the SONGS SNF and GTCC waste creates one immediate complication. A second set of potential uncertainties and risks pertains to any perceived SONGS co-owner responsibility for the SNF while it remains at SONGS before it is shipped. Indeed, reputational risk could be an issue for the current SONGS co-owners even after title transfers. Finally, based on the legal precept that a superior party cannot delegate liabilities to an inferior party, there may be a question as to whether the transfer of SONGS SNF to a private entity would actually remove the SONGS co-owners' liability, particularly if the private CISF operation failed.

CISF owner takes possession of SNF at SONGS and transports the SNF to its storage facility: In the baseline concept for a private CISF, the SONGS co-owners retain title to the SNF and are responsible for shipping. In this variant, the SONGS co-owners retain title but are not responsible for transportation. The Part 72 licenses for the private CISFs will not authorize Holtec and ISP to take possession of SONGS SNF outside their facilities. This variant would require the SONG co-owners to acquire, on commercially reasonable terms, third-party protection against risks and liabilities associated with retaining title to the SNF when it is off site. It would also require Holtec and ISP to acquire new licenses or amendments to their CISF licenses that allow them to take possession of SNF at SONGS in its packaged configuration for shipment back to their respective CISFs. One possible avenue would be to acquire a narrowly tailored 10 CFR 70 special nuclear materials license for just this specific purpose. In this variant, the SONGS co-owners and customers would either pay Holtec and ISP for transportation services separately or these services could be built into the fee for storage. The SNF canisters would need to be packaged in full compliance with applicable 10 CFR 71 CoCs when Holtec or ISP take possession at SONGS under their Part 70 licenses for the transportation segment. Management and storage of the SNF would then be governed by the applicable Part 72 license upon arrival at the CISF. There is related industry precedent for this arrangement.[185]

Other private or non-federal CISF: This variant recognizes that one or more other private or non-federal entities could decide to develop a CISF at another yet-to-be-determined site.

7.6.4 Summary Findings for Non-Federal CISF

- As with all disposition pathways that are not predicated on the federal government's performing on its statutory and contractual obligation to take responsibility for removing SNF from the SONGS site, this alternative exposes the SONGS co-owners and customers to uncertain cost and liability risks. These costs and risks would depend on the specific terms and conditions that could be negotiated with a non-federal provider of offsite storage services, not only with respect

[185] NRC Special Nuclear Materials License SNM-1270, GE Hitachi Nuclear Energy Americas, LLC, Vallecitos Nuclear Center, Docket 70-1220.

to ongoing storage costs but also with respect to title and liability. Costs and risks to transport the SNF are another critical consideration.

- It is difficult to speculate but based on the information that is currently available for the Holtec and ISP projects, significant issues would have to be resolved to make use of either of these facilities commercially reasonable from the standpoint of the SONGS co-owners and their customers.
- The Holtec and ISP projects face challenges in terms of resolving issues of financing, political acceptance, and liability and indemnification. In addition, there are questions as to whether either facility could accept all of the SONGS SNF in the canisters in which the SNF is currently stored. Reaching a mutually agreeable arrangement for the use of these facilities could entail extensive negotiations with the private vendors.
- Other key issues from the perspective of the SONGS co-owners and customers include the extent to which storage fees at a non-federal offsite facility and transportation costs to ship SNF to the facility can be reimbursed through the Judgment Fund mechanism, and whether the federal government might in other ways support or facilitate the use of non-federal storage services.
- If SCE were to succeed in reaching a commercial arrangement with a non-federal consolidated storage facility, this would have potentially significant, industry-wide implications. We estimate that the SONGS SNF could be completely removed within a timeframe of approximately two decades once a non-federal facility that can accept all of the SNF, on commercially reasonable terms, is fully licensed and operational.

7.7 California-only Consolidated Interim Storage Facility

7.7.1 Synopsis

This alternative is one of two multi-utility CISF alternatives included in our assessment. It contemplates a specific-license 10 CFR 72 interim storage facility for potentially all California SNF and GTCC waste at another, as-yet-unidentified site in the state of California. The baseline concept assumes that the new CISF is designed to store SNF from all four California commercial nuclear power plant sites: SONGS, Diablo Canyon, Humboldt Bay, and Rancho Seco (Box 7.1). Together these sites encompass seven reactors, five of which are currently shut down (the remaining two operating reactors are expected to permanently shut down in 2024 and 2025). We further assume that a California-only CISF would be operated cooperatively by the three main utility owners of these sites: SCE, Pacific Gas & Electric (PG&E), and the Sacramento Municipal Utility District (SMUD). (It should be noted that none of the other utility owners have expressed a position on this concept.) This group would control site selection, design, licensing, construction, and operation of the CISF. Over time, all of the SNF and GTCC canisters from each company's individual ISFSIs would be shipped to the CISF, allowing the existing plant sites to be decommissioned and re-purposed. Based on current and projected inventories at the four plant sites (Table 7.7), we estimate that a California-only CISF would have a total SNF storage capacity of approximately 3,811 MTU.

Compared to an SCE-only facility, a California-wide approach could offer meaningful advantages in terms of the potential to leverage economies of scale, reduce per-utility costs, and garner a broader base of stakeholder support, including a greater likelihood of funding assistance, from the state itself and possibly even from the federal government. Storing all of California's commercial SNF at a single location, managed by a single organization that is focused on nuclear waste management, and with a

common security system and one set of programs and procedures, could have safety and security benefits but might also present new or different risks—the specific tradeoffs involved would depend on the site chosen and other factors.

Box 7.1: Nuclear Facilities in California

SONGS is one of four nuclear power generating stations built in California from the 1960s to the 1980s. The other three are Humboldt Bay and Diablo Canyon (both owned by Pacific Gas & Electric and located near Eureka and Avila Beach, California, respectively), and Rancho Seco (owned by the Sacramento Municipal Utility District and located in Herald, California). Like SONGS, the Humboldt Bay and Rancho Seco generating stations are no longer operating, leaving the two reactor units at Diablo Canyon as the only remaining operating nuclear generators in the state. In addition to California's four commercial nuclear plant sites, there are eight other facilities licensed by the U.S. Nuclear Regulatory Commission, including reactors and complex materials facilities that were generally built for research or defense purposes. Smaller NRC-licensed facilities also exist in significant numbers throughout the state.

Nuclear Facilities in California

Table 7.7 Inventory of Commercial SNF and GTCC Waste in California

Site	SNF Canisters	SNF Assemblies	Approximate SNF Mass (MTU)	GTCC Canisters	SNF Storage Technology
Humboldt Bay	5	390	29	1	Holtec HI-STAR HB (MPC-HB)
Rancho Seco	21	493	228	1	TN NUHOMS (2 PT DSC*)
Diablo Canyon**	1 2	4528	1,9 5	4	Holtec HI-STORM (MPC-32)
SONGS-1	17	395	1 6	1	TN Advanced NUHOMS (2 PT1 DSC)
SONGS-2/3	33	792	336	12	TN Advanced NUHOMS (2 PT 4DSC)
	73	2,668	1,127	0	Holtec UMAX (MPC-37)
Totals	**291**	**9,266**	**3,811**	**19**	

* The 2 PT designation is a simplification based on similarity of design. Rancho Seco's canister designations are FO, FF, and FC DSCs for "Fuel Only," "Failed Fuel," and "Fuel with Control Components," respectively.
** Estimated based on 202 /2025 permanent shutdown of Units 1 and 2, respectively.

Siting, on the other hand, would be a formidable challenge—for all the same reasons discussed in connection with an SCE-only facility. Provided state political leaders support this approach, a facility in California for California SNF only would at least avoid the objection that the state is being asked to host waste that it did not generate. (This has been a potent source of opposition to past siting efforts for nuclear waste facilities, which have often encountered strong resistance at the state level even in cases where there is local community support for a particular facility.)

Using an existing nuclear plant site could offer significant siting and other advantages.

Even with state support, however, gaining local and tribal acceptance for a California CISF could still be extremely difficult, as the experience with Ward Valley (Box 7.2, in Section 7.9.2 of this chapter) amply demonstrates. Persuading other utilities to join the effort could also be a challenge. Finally, cost (including transportation cost) and issues of title and liability are likely to present significant hurdles.

7.7.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume that a licensed CISF for California SNF would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment. Any safety and security risks associated with a consolidated site would be dependent on the characteristics of the site and would be assessed as part of the licensing process. Risks associated with transporting the SNF would be assessed separately as well.

Scientific and technical issues: This alternative presents no unique technical or scientific challenges distinct from the other CISF alternatives considered in this Strategic Plan. The SNF canisters stored at a California-only CISF would be shipped and returned to storage service in the same cask or storage module designs for which they are already certified by the NRC.

Regulatory path and risk: A California-only CISF away from any existing power plant site would most likely need to be licensed by the NRC under the specific license provisions of 10 CFR 72 (such a facility could qualify for a general-license ISFSI if it was co-located with an existing Part 50 facility). The NRC has

issued several Part 72 licenses for ISFSIs that are not co-located with nuclear power plants, so ample precedent exists for this process.[186]

Commercial reasonableness

Cost: NWT estimates the development costs for a California-only CISF—including costs for site characterization and for facility design, licensing, and construction (but excluding costs for transportation and site operations)—to be similar to the costs estimated previously for a generic 5,000-MTU private CISF. A breakdown of several major cost elements is shown in Table 7.8.

It should be noted that several of the cost elements shown in the table encompass subcategories of cost that are subject to substantial uncertainty, including costs for public engagement and to support the participation of affected communities, as well as possible costs for land acquisition or to implement needed transportation infrastructure improvements (e.g., upgrading or constructing new rail lines to serve the CISF). Different assumptions concerning these kinds of costs could have a significant impact on the ranges shown in Table 7.8.

Table 7.8 Cost Elements for a California-only CISF

	Total Costs	SONGS Share of Costs
Initial Feasibility Study	$2 million	$0.9 million
Site identification and characterization	$30 million	$13 million
Design and Licensing	$63 million	$27 million
Construction	$101 million	$ 44million
Annual Operation and Maintenance	$23 million	$10 million
Source: NWT estimates.		

Assuming operating costs for a California CISF would be allocated on the basis of each utility's share of the combined canister inventory, the SONGS co-owners' estimated cost share would be 43.7 percent. PG&E and SMUD would be responsible for 49.1 percent and 7.2 percent, respectively. Our estimates exclude transportation costs because these would depend on the location chosen for the facility, commercial arrangements with railroads, the need to procure rail assets, and cost-sharing arrangements for such assets and other transportation costs between the utilities.

Ability to recover costs: Any potential federal contribution to the capital costs of developing a California-only CISF would depend on how the project is viewed by the federal government. At one extreme, the federal contribution could be zero. In that case, funding would have to come entirely from the participating utilities, possibly with some additional state contribution (perhaps in the form of a grant or through debt financing backed by state bonding authority).

At the other extreme, the federal government could play a much more substantial role if it viewed a California CISF as a potentially valuable model for other states and regions—in essence, an "interim regional solution" to SNF management. As such, a California facility could follow the approach provided under the Low Level Radioactive Waste Policy Amendments Act, which allows for the formation of

[186] A California CISF, provided it is located at a sufficient distance from the coast, would not require a coastal development permit from the CCC.

regional compacts approved by Congress. In an ideal case, the federal government could provide some level of cost sharing for development costs, including costs for construction—perhaps on a demonstration project basis. Such support would have to be authorized by Congress and could be provided as an appropriation from general funds (as is the case with current DOE nuclear waste management R&D activities) or from the Nuclear Waste Fund. Another issue that would need to be addressed through negotiation is whether federal funding could be used to cover a portion of costs associated with benefit payments to local or tribal governments that provide a host site.

Each utility participant would need to perform its own cost-benefit analysis to determine the feasibility of this alternative given its particular SNF management circumstances and plant site considerations. However, a rudimentary analysis is provided here to illustrate potential savings from the economies of scale offered by this alternative. Replacing four stand-alone ISFSIs with a single CISF for all California SNF would allow the California utilities to combine storage costs, yielding O&M cost savings and in turn reducing their claims for reimbursement from the federal Judgment Fund. The average annual O&M cost for spent fuel management at all four plants in California is around $5 4million during the years between plant decommissioning and dismantlement and ISFSI decommissioning and dismantlement and site restoration.[187]

We estimate the annual O&M costs for a consolidated CA CISF at appro ximately $23 million—a savings of about $31 million annually. This potential for savings applies to overall storage costs only, however. The commercial reasonableness of this alternative from the perspective of individual utility owners is at best uncertain at this time, taking into account the total investment required, including to transport the SNF.

Reasonable protection against liability: Since the baseline assumption for this alternative is that the SONGS co-owners would retain title to the SNF during transport and while the SNF is in storage at a California CISF, third-party protection against any risks and liabilities associated with retaining title while the fuel is being stored at a consolidated facility off site would have to be obtainable on commercially reasonable terms. As with the other non-federal disposition pathways we considered, this presents a potentially significant hurdle in terms of viability and commercial reasonableness.

Timeliness of offsite storage

Implementation schedule: NWT estimates that developing and opening a California CISF could take well over a decade from the time a decision is made to pursue this approach. Any major delays or obstacles in the siting, licensing, and construction of the facility could e xtend the timeline considerably. Our "decade-plus" estimate includes several key elements:

- Initial discussions with other utilities and state officials result in an agreement to conduct an initial feasibility study within one to two years. During this same period, the utilities and state enter into discussions with the federal government to e xplore the feasibility of a federally supported demonstration project. This process could take two to three years.
- The process to site a new CISF, characterize the site, develop agreements with affected government entities, form a corporate entity to be the applicant (which itself would entail a number of decisions about roles, responsibilities, and authorities), design the facility, and

[187] Based on an analysis of decommissioning cost estimates from SONGS, Diablo Canyon, and Humboldt Bay, as well as information on recent e xpenditures at Rancho Seco.

develop a license application takes four to six years. Again, this is a best-case scenario that assumes active and supportive stakeholder engagement and no significant opposition. Siting challenges and other obstacles could add significantly to this timeframe.

- Once a license application is submitted, the NRC licensing process takes three to four years.
- Following license approval, constructing and opening the CISF takes two to three years.

As discussed in connection with the non-federal CISF alternative, we estimate that a campaign to transfer all SNF and GTCC off site could be completed in approximately 10 years once an offsite facility becomes available. The exact schedule in this alternative would depend on the coordination of shipments from all four California plant sites.

Other implementation considerations

Need for statutory change: No changes in federal statute are needed to enable a coalition of California utilities to pursue a new California-only CISF. If the utilities were to seek federal support for this undertaking (separate from any reimbursement they might be entitled to under the Judgment Fund)—for example, in the form of support for a demonstration project—congressional action would be needed to enable use of NWF funds or otherwise appropriate federal resources.

Potential socio-economic-political barriers: A major challenge for this alternative, in addition to issues of cost, liability, and commercial reasonableness, would be winning local as well as broader public (and state government) support for the selection of a site, the construction of a new facility, and the shipment of SNF from existing plant sites to the new facility. Key factors in this regard include the state's degree of interest in and motivation to develop solutions for California SNF, and the public's confidence in the safe and secure operation of a California-only interim storage facility.[188] This alternative assumes that the state and the three utilities would organize a proactive public engagement effort to build support for the plan. Absent effective public engagement and state-government support, opposition and intervention would likely delay the licensing process and make the endeavor costly.

To be viable, support and leadership from the state government (both the governor and the legislature), and active engagement from the other California utilities would be essential. If there is utility interest and political support, the next major challenges center on siting and cost sharing. On the cost side, the nature and potential extent of the federal role is obviously extremely important. In an optimistic scenario, a state-wide approach would carry enough weight to shift the political dynamics in Congress in ways that would allow for actively supportive federal participation. If, for example, a California CISF were viewed as a more cost-effective means to satisfy the federal government's obligations under the NWPA, a case could be made that the federal government should take title to the SNF and contract with the California CISF to take and maintain possession until the SNF can be removed for final disposal. As

[188] Multiple studies have demonstrated that public confidence in nuclear facilities is strongest when the facilities are subject to independent oversight and when that oversight is conducted openly and transparently. In describing the challenges of siting storage or repository facilities for SNF, the BRC, for example, noted that it is "essential to affirm a role for states, tribes, and local governments that is at once positive, proactive, and substantively meaningful." The Atomic Energy Act of 1954 provides for exclusive federal jurisdiction over high-level nuclear waste, which includes SNF. Establishing some form of oversight role for state, local, and tribal governments would require, at a minimum, a voluntary agreement among all the parties. Some stakeholders might seek statutory provisions for oversight, raising the prospect of changes in the AEA as part of the calculus.

with the "federal use of a non-federal CISF" alternative discussed in Section 7.5, legislative authorization would probably be required.

Another factor that might alter the dynamic in terms of support for this alternative at the state level involves the potential for a federal role under the auspices of a demonstration or research project for California fuel. This concept envisions the federal government playing a leadership or major support role based on the national interest in demonstrating a viable interim storage approach that could meet the needs of multiple utilities and reduce overall costs to taxpayers relative to the status quo. Presumably, federal support would also greatly increase the appeal of a California-only CISF from the standpoint of SCE and other utility partners. The concept of a California-only CISF is new and untested. Although it was raised in several of NWT's stakeholder outreach discussions (see also Box 5.3), it has to date received little to no attention from state government entities or other California nuclear utilities.

Degree to which SONGS co-owners have control over implementation: SCE could initiate the process of developing a California-wide solution through engagement with the shareholders/owners of PG&E and SMUD. Experience suggests that this should be pursued in a stepwise manner. Early engagement with the appropriate state government entities and key political leaders would also be critical to assess the potential level of state government support and involvement. State involvement could range from passively monitoring actions by the utilities to taking a leadership role in the effort. Engagement will be most effective if it includes careful attention to trust building and a high level of communication and coordination with potential partner utilities. Finally, sustained engagement with the public regarding the advantages of moving all of the California-generated SNF to one site would be essential.

7.7.3 Variants of the California-only CISF Concept

Utilities form a new company to take title to the SNF upon receipt at the CISF: This variant posits that a new company is formed by the three utility owners of SNF in California to site, design, license, construct and operate a CISF in the state, as otherwise described in the baseline concept. The CISF would be situated at a new site, and subject to the siting and licensing processes and issues described elsewhere in this chapter. SCE, PG&E, and SMUD would be responsible for shipping their SNF and GTCC canisters to the new CISF. Either the new company or the current utility owners could hold title to the SNF (in the latter case, the SONGS co-owners would need to be able to obtain third-party protection, on commercially reasonable terms, against risks and liabilities associated with retaining title to the SNF).

The new company is responsible for transportation (only if taking title), including acquiring or contracting for necessary transportation assets and conducting transport operations. The new company takes possession of SNF at the originating plant sites: In this variant, the new company has complete responsibility for the SNF meaning that it would have to acquire a Part 72 license for the CISF. It would also need to put in place other NRC license provisions (e.g., a Part 70 license as described in the variants of the non-federal CISF concept described in Subsection 7.6.3) to be able to pick up the packaged material at the four nuclear plant sites in California and transport the material to the CISF.

The state of California leads siting, develops the facility, takes title, or some combination: This variant proposes that the three utilities engage the state of California to collaborate on CISF site selection, financing, and development and provide other support for the construction and operation of a facility for the consolidated storage of SNF from the four California sites. Becoming the "purchaser" of the SNF under the Standard Contract with DOE would allow the state to recover the operating costs of the CISF until the federal government removes the material for interim storage or final disposal at a federal

facility. A state-led effort also may increase California's leverage to access a portion of its customers' cumulative contributions to the Nuclear Waste Fund for waste management purposes.

Other NRC licensees in California beyond SCE, PG&E, and SMUD are enlisted to participate: This variant expands the base of interested parties to include other NRC licensees in the state that generate or manage radioactive waste, including SNF. One candidate for collaboration is GE-Hitachi, which manages radioactive materials at the Vallecitos research facility. This variant may allow for more efficient management and oversight of nuclear waste management activities on a state-wide basis but is not likely to yield significant cost savings.

7.7.4 Summary Findings for California-only CISF

- As with all disposition pathways that are not predicated on the federal government's performing on its statutory and contractual obligation to take responsibility for removing SNF from the SONGS site, this alternative exposes the SONGS co-owners and customers to uncertain cost and liability risks. Therefore, this alternative is unlikely to meet the test of commercial reasonableness for the SONGS co-owners and their customers.
- A California-based approach requires the active support and participation of state government and other California utilities. With such support, this alternative could have greater appeal and offer a wider range of cost-sharing opportunities than an SCE-only option. The program could also encompass other nuclear wastes within the state.
- Siting will be a key challenge for any new facility. Partnership with the other California utilities and state agencies could help overcome these challenges relative to action by SCE alone. Also, the use of an existing plant site in California could offer significant advantages from a cost, siting, and licensing standpoint.
- Expanding on the first bullet, the commercial reasonableness of a utility-led approach, as for any of the non-federal storage alternatives, would depend on costs (including for transportation), ability to secure adequate protection against risks and liabilities, eligibility for Judgment Fund reimbursement, and cost-sharing opportunities with the federal government and other potential partners. A statewide solution may attract federal interest and support as a model demonstration.

7.8 Multi-utility CISF at Another Nuclear Power Plant Site

7.8.1 Synopsis

This alternative contemplates SCE reaching an agreement with one or more other nuclear power plant owners to store SNF at a nuclear power plant site outside California. Such an effort could become a model for creating a network of regional consolidated storage facilities throughout the country.

To analyze this alternative, NWT used an expanded or separate storage facility at the Palo Verde Generating Station (PVGS) near Tonopah, Arizona, west of Phoenix, as an example, based on the fact that the SONGS Settlement Agreement specifically directed SCE to inquire with the co-owners of PVGS. The PVGS co-owners responded to this inquiry by indicating that they have no interest in accepting SONGS waste for storage at PVGS, so we do not consider the PVGS site to be a viable candidate for achieving the offsite relocation of SONGS SNF. However, this general approach could be explored with other potential utility partners who may be interested in consolidating SNF storage at a common site. In

that case, ownership of the CISF and title to the SNF could be controlled by a consortium of utilities or by a new company formed by participating utilities.

For purposes of our assessment, we assume that the SONGS co-owners would be responsible for shipping SNF to a storage facility at another plant site and would retain title to the SNF. The plant site owner/operator would take possession of the fuel and return the canisters to storage service at an expansion of its existing on-site ISFSI.

7.8.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume that a licensed storage facility at another nuclear plant site would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

Scientific and technical issues: This alternative presents no unique technical or scientific challenges distinct from the other CISF alternatives considered in this Strategic Plan. Conceptually, an expanded ISFSI at another plant site would utilize the same storage systems and technologies currently deployed at both SONGS and the host site. At PVGS, as an example, this would likely entail developing a new storage pad and facility in a separate area.

Regulatory path and risk: We assume that an ISFSI at another existing plant site would be operating under a 10 CFR 72 general license, which would require no additional application to, nor specific approval by, the NRC. Taking PVGS as an example, APS uses the NAC-UMS and MAGNASTOR systems to store PVGS SNF. Under a 10 CFR 72 general license, APS would simply need to use a cask design approved by the NRC and comply with other conditions of the general license specified in 10 CFR 72. One of those other conditions is that SNF stored at the ISFSI must be authorized for possession at the site under a specific 10 CFR 50 (or 52) license. The owner/operator of the host site can use different storage technologies at the same ISFSI, if it so chooses.

To store SONGS SNF at an expanded storage facility at PVGS under the APS 10 CFR 72 general license, for example, APS would need to amend one or more of the three Palo Verde 10 CFR 50 licenses to allow receipt and possession of the SONGS materials.[189] Note that the SONGS GTCC waste could be stored at PVGS under one of the Palo Verde 10 CFR 50 licenses because cask CoCs do not cover storage of material other than SNF at a general-license ISFSI. The public would have an opportunity to submit contentions to the 10 CFR 50 license amendment; if so, hearings might be required to resolve these contentions. NWT expects that there could be significant public and state opposition to a license amendment to allow an existing plant site to store SNF from other states where the local utility's customers did not benefit from the associated electrical generation.

Commercial reasonableness

Cost: Using the PVGS case, again as an example, NWT estimates that constructing an expanded storage facility at the site would cost between $75 and $100 million. This is significantly less than a new stand-

[189] This is not unprecedented. The license for the Harris plant was amended several times in the 1990s and early 2000s to receive and possess SNF from the Robinson and Brunswick plants. However. these were intra-utility transfers.

alone ISFSI or CISF.[190] The incremental annual O&M costs to store SONGS SNF at an existing plant site with an existing ISFSI can be expected to range between $10 and $15 million—again, a significant savings relative to a stand-alone storage alternative. As described further below, sharing these cost savings could provide significant benefits to the host site owner/operator.

In the PVGS example, if a HI-STORM FW CoC amendment were required to add the SONGS SNF to the allowed contents, the cost would be minimal given that SONGS SNF is already certified for storage in the MPC-37 canister design in the UMAX system.

Any owner of an existing nuclear power plant that might consider entering into an arrangement to store SONGS SNF would need to be persuaded that doing so delivers net benefits in the form of cost savings in the management of its own SNF. The consolidation of the SONGS ISFSI would likely achieve economies of scale in operation. There would, however, be additional one-time costs for the planning, design, license amendment, and construction of additional ISFSI storage at the host utility site (including potential litigation and other costs) and to transport SNF to the site. In addition, the owners of the host site may seek impact fees or other benefits payments from the SONGS co-owners.

Ability to recover costs: As with all alternatives, the potential role of the federal government is critical to the benefit/cost calculation. Federal cost sharing for some portion of the capital costs, on the other hand, could shift the benefit/cost assessment. If Congress can be persuaded that consolidation of SNF storage on a regional, interstate level represents progress for the national waste management program, support for some share of capital costs could come from other federal funding sources.

Reasonable protection against liability: Since the baseline assumption for this alternative is that the SONGS co-owners would retain title to the SNF during transport and while the SNF is in storage at a multi-utility CISF, third-party protection against any risks and liabilities associated with retaining title when the fuel is off site would have to be obtainable on commercially reasonable terms.

Timeliness of offsite storage

Implementation schedule: For purposes of this assessment, NWT estimates that the development of a joint ISFSI could take up to a decade. This estimate is based on the following assumptions:

- Discussions between SCE and the owners of the host utility site, including agreement to conduct a joint feasibility study as an initial step, take two to three years to produce agreement on a path forward.
- If the decision is made to proceed, amending the existing ISFSI license and designing and constructing an expanded or new storage facility at the host site takes another four to six years.

As discussed previously in connection with the non-federal CISF and California-only CISF alternatives, we assume a schedule of approximately ten years to complete a campaign to transfer all SNF and GTCC off site once an offsite storage or disposal facility becomes available. Adding this ten-year figure to the ten years estimated above to develop a joint ISFSI, we estimate that the complete timeline for removing all SONGS SNF to a new facility at a host-utility site could take up to two decades. Depending on how quickly agreement could be reached with regard to a host plant site, this is a timeframe that could be consistent with current SCE decommissioning plans.

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[190] The cost ranges noted are based on broad industry indicators.

Other implementation considerations

Statutory changes needed: No changes in federal statute are needed to enable a coalition of utilities to pursue a CISF. (Indeed, there is precedent for this approach: In the 1990s, eight utilities funded a project, known as Private Fuel Storage (PFS), to construct a CISF on land leased from the Goshute Indian tribe in Utah. The NRC licensed construction of the proposed facility in 2006, but the project was strongly opposed by the State of Utah and abandoned in 2012 after the U.S. Department of Interior declined to approve the lease and needed rights-of-way.)

As with the California-only CISF alternative discussed previously, if a group of utilities were to seek federal support for a utility-led CISF (separate from any reimbursement they might be entitled to under the Judgment Fund)—for example, in the form of support for a demonstration project—congressional action would be needed to enable use of NWF funds or otherwise appropriate federal funds.

Depending on the site chosen, actions could be required by other host-state permitting agencies, but these would be location specific.

Potential socio-economic-political barriers: To implement this alternative, support from the host utility and from state and local government, local communities, and the host state utility commission would be essential. As we have already noted, such support does not exist for the PVGS option, since the PVGS co-owners have stated, in writing, that they are not interested in taking the SONGS waste for storage.[191] Thus, success with pursuing a new or expanded storage facility at an existing plant site would require surmounting several challenges, in addition to the cost and title/liability challenges already noted:

- Utility shareholders (and regulators, if applicable) would have to agree to a commercial framework for expanding an existing ISFSI or building a new storage facility at an existing plant site.
- State and local stakeholders would have to become participants in the development process.
- The capital and other resources needed to complete the task would have to be sourced and deployed.

Degree to which SONGS co-owners have control over implementation: The decision to pursue storage of SONGS SNF at another nuclear plant site would involve shareholders of the host site owner/operator. It would also require discussion and coordination with the host utility on a strategy for engaging with the host-state governor, legislators, and public utility commission, as well as affected customers and stakeholders. A feasibility study, conducted jointly by the participating utilities, could, as an early step, provide an assessment of costs and benefits so that stakeholders can carefully weigh the merits of consolidation. Such a study could also provide the basis for exploratory discussions with the federal government on possible federal cost sharing. Clearly, this alternative would require a strong but flexible commitment to seeking potential partners and achieving win-win outcomes.

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[191] Palo Verde Administrative Committee Decision Regarding Southern California Edison Company's (SCE) Request to Solicit an Agreement Regarding the Development of an Expanded Independent Spent Fuel Storage Installation (ISFSI) that Would Store Spent Fuel from the San Onofre Nuclear Generating Station (SONGS) at the Palo Verde Nuclear Generating Station (PVNGS) Site. Signed 11/1/2017.

7.8.3 Variant of the Multi-Utility-CISF-at-Another-Nuclear-Plant-Site Concept

A separate company is formed to construct and operate a specific-license CISF under 10 CFR 72 on the PVGS site and take title to the SNF and GTCC waste: This variant posits a new company that sites, designs, constructs, and operates a separate, specific-license CISF.[192] This approach would add time to the design and licensing process compared to a general license at an existing plant site. It would also add to development costs. In this variant, the host utility would be expected to charge a fee to the new company to lease the land and for other support, and revenues from this fee would be returned to that utility's customers and/or shareholders.

7.8.4 Summary Findings for Multi-Utility CISF at Another Nuclear Power Plant Site

- As with all disposition pathways that are not predicated on the federal government's performing on its statutory and contractual obligation to take responsibility for removing SNF from the SONGS site, this alternative exposes the SONGS co-owners and customers to uncertain cost and liability risks. Therefore, this alternative is unlikely to meet the test of commercial reasonableness for the SONGS co-owners and their customers.
- Consolidation of SONGS SNF with SNF at another existing nuclear plant site would need to offer economies of scale to the owners of both facilities. Analyzing the magnitude of potential benefits would require further detailed feasibility studies. Other issues that would have to be carefully considered include costs for transportation and to obtain adequate protection against risks and liabilities, eligibility for Judgment Fund reimbursement, and cost-sharing opportunities with the federal government and other potential partners.
- Action on this alternative requires willing partners. In the case of PVGS, the co-owners have indicated that they are not interested. Other potential utility partners would need to be willing to enter into a joint process with the SONGS co-owners to further evaluate the benefits, costs, and risks of consolidation.

7.9 Relocate SONGS SNF to a New ISFSI

This alternative contemplates moving the SONGS SNF and GTCC canisters to either (a) another location within the existing SONGS site or (b) a 10 CFR 72 specific-license ISFSI at another offsite location. In either case, the facility would be owned and operated by the SONGS co-owners and would provide storage for SONGS SNF only (hence we characterize this facility as a new ISFSI, not a CISF). Moving SNF within the existing site presents fewer regulatory and technical difficulties and avoids certain siting challenges that would be associated with a new site, but would also be of limited benefit—presumably such a move would be implemented only if no preferable offsite location were available and changing site conditions warranted placing the storage modules at a higher elevation and further from the coastline. Moving SONGS SNF off site, by contrast, would be considerably more involved: the SONGS co-owners would have to select and characterize a new site, apply for and receive a 10 CFR 72 specific license, and construct the facility. In this scenario, the SONGS co-owners would move SNF canisters from SONGS to the new ISFSI in Part 71-certified packages, and then return the canisters to Part 72 storage modules for continued interim storage at the new location.

[192] The PVGS site was originally contemplated for more than the three operating reactors it currently has.

7.9.1 Synopsis

In the baseline concept for this alternative, the SONGS SNF and GTCC canisters would be moved to higher ground within the existing plant site, after the deconstruction of the Unit 2 and 3 reactors and other structures is completed. The SONGS co-owners are required, as a special condition of the 2015 coastal development permit for the Holtec ISFSI,[193] to analyze this option in case climate-related threats compel a change in the placement of the current storage facilities. As noted in the 2015 coastal development permit, locations will be available elsewhere on the SONGS site, once the space formerly occupied by the reactors and other structures is cleared, that are up to 900 feet farther from the shoreline at elevations from 30 to 80 feet.[19] A relocated ISFSI within the SONGS site would fall under the NRC's 10 CFR 72 general license process because it would remain on the site governed by SONGS's three 10 CFR 50 licenses. Thus, the objective of moving the canisters farther from the Pacific Ocean could potentially be met without incurring the incremental costs of acquiring a new site and a new NRC site-specific license (although other cost reimbursement issues similar to those for other alternatives would still apply). However, this alternative would still incur non-trivial costs and would not achieve the objective of removing nuclear waste from SONGS to enable the full decommissioning of the site.

The challenges to relocating and operating a new SONGS-only ISFSI in a different, *offsite* location are significant. Moving the fuel to another site within the Camp Pendleton boundary would require Navy approval, which has been denied by the United States Marine Corps Base Installations Command.[195] Another site, even one relatively close to SONGS, would have distinctive characteristics (with respect to seismic hazard, soil, hydrology, etc.) that would have to be fully characterized as part of the NRC licensing process. Moving the ISFSI to a new site would also entail significant facility construction and transportation costs. It is unclear where the resources to cover these costs might come from, as between the federal government, utility customers, and company shareholders. Finally, a site elsewhere in California would have to be acceptable to state authorities, nearby communities, and a broader group of stakeholders.

A site elsewhere in California would have to be acceptable to state authorities, nearby communities, and a broader group of stakeholders.

In the assessment that follows, we discuss key factors for both options: moving the SONGS SNF within the current SONGS site and moving the SONGS SNF to another ISFSI location, off site.

7.9.2 Assessment

Safety, scientific and technical issues, and regulatory feasibility

Safety: We assume that a licensed storage facility for the SONGS SNF at another site would meet all applicable regulatory requirements for protecting the health and safety of workers and the public, and for protecting the environment.

California Coastal Commission permit No. CDP 09-15-0228. SCE is also required to update its assessment of coastal hazards at the site and to develop a plan for managed retreat if that updated assessment reveals a need to move the ISFSI.

[19] The existing TN and Holtec ISFSIs are located at elevations of 19.75 feet and 31 feet, respectively.

[195] Letter from Lieutenant General Michael G. Dana, Deputy Commandant for Installations and Logistics, U.S. Marine Corps, to the Honorable Kristine Svinicki, Chairman of the U.S. Nuclear Regulatory Commission, May 8, 2018.

Scientific and technical issues: From a scientific and technical standpoint, moving the ISFSI within the boundaries of the current SONGS site would be relatively straightforward, although the specific characteristics of the new location would have to be studied to assure that it is not only suitable, but offers sufficient advantages—relative to the concerns that might motivate such a move—to warrant the effort and cost involved.

By contrast, Identifying and characterizing a new ISFSI location away from SONGS would present the typical challenges associated with any site selection process. This includes considering various environmental factors, with seismic characterization and qualification being the most significant.[196] A new ISFSI identical to the current SONGS ISFSI would entail, in addition to a new UMAX facility and a new NUHOMS storage pad, the design and construction of a new physical security system, maintenance facilities, administrative offices, and some degree of transportation infrastructure.

The new ISFSI could also differ in some respects from existing storage arrangements at SONGS to accommodate Holtec SNF and GTCC canisters without re-packaging. Specifically, the Holtec MPC-37 canisters currently stored in the underground HI-STORM UMAX System are already certified for use in the HI-STORM FW System, which is a traditional ventilated vertical storage cask design. The NUHOMS canisters would be moved to horizontal storage modules of the same design at the new ISFSI. New horizontal storage modules could be constructed, or the existing modules could be moved in pieces and re-assembled at the new ISFSI.

Regulatory path and risk: From a regulatory standpoint, relocating the ISFSI within the existing SONGS site would be relatively straightforward. As already noted, the relocated ISFSI would fall under the NRC's 10 CFR 72 general license process and would not require a new, site-specific license.

By contrast, a new SCE ISFSI away from SONGS would need to be licensed by the NRC under the specific-license provisions of 10 CFR 72, the same licensing provisions applicable to a CISF. The licensing framework would be different from that for the current ISFSI, which is a general-license ISFSI co-located on the site of a Part 50 facility. On the positive side, the NRC has issued several Part 72 licenses for ISFSIs not co-located with power plants, so precedent exists for this process. For example, the Private Fuel Storage facility in Utah (which was effectively a CISF) received a license in 2007, although the facility was never constructed. The CISF facilities being proposed by Holtec and ISP are currently proceeding through the NRC's Part 72 specific licensing process.

Commercial reasonableness

Cost: The cost of relocating the ISFSI within the current SONGS site would have to be analyzed, taking into account the specific placement of the new facility and associated requirements for physically transferring waste canisters. However, these costs can be assumed to be lower than for a new SONGS-only ISFSI away from the current site, given the additional siting challenges, regulatory compliance requirements, and transportation demands that would come with developing a new offsite facility and shipping SNF to it.

The exact costs of constructing a new ISFSI at an unspecified offsite location would depend on specific site and facility characteristics, but would certainly be substantial, especially if the sole purpose of the

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[196] After consulting with an expert who is experienced in California seismic investigations for nuclear facilities, NWT concluded that an evaluation of seismic risks at Camp Pendleton or any other California site could be completed in less than a year.

facility is to store SONGS SNF. As a bounding exercise, NWT estimated the development cost (including costs for site characterization, design, licensing, and construction, but excluding transportation and storage operations) for a 1,600-MTU CISF to be about $135 million. Annual O&M costs are estimated to average approximately $21 million, just below O&M costs for the current SONGS ISFSI once the other remaining SONGS facilities are decommissioned. This estimate does not consider the cost to move the fuel, financing costs, or any additional site-specific costs.

Ability to recover costs: Because the current ISFSI is in compliance with NRC requirements, and because the federal government has already reimbursed the SONGS co-owners for the cost of constructing both the SONGS TN and Holtec ISFSIs, the cost to design, license, construct and operate a new ISFSI would likely not be eligible for federal reimbursement unless a regulatory requirement or other compelling reason necessitated this step. For example, a future NRC finding that the current ISFSI no longer meets federal requirements and needs to be replaced might make the costs to design, license, construct, and operate a new ISFSI at a location away from the SONGS plant site eligible for reimbursement from the Judgment Fund. However, this is very unlikely.

In sum, cost to the SONGS co-owners and customers will be a critical and likely disqualifying consideration for this alternative.[197]

Of course, support from the federal government, for example, as a "demonstration project" to provide "proof of concept" for safely transporting SNF to new storage sites—or from the state of California, if the state sees intrinsic value in moving SNF away from its shoreline—could alter the cost/benefit calculus. But this is true of all the non-federal disposition pathways we considered.[198]

Reasonable protection against liability: A new ISFSI for SONGS SNF only, by definition, does not involve transfer of title or liability to a third party. This raises no new issues of protection against liability if the ISFSI is relocated within the current site. However, relocation to a new offsite ISFSI could require the SONGS co-owners to obtain additional private insurance on commercially reasonable terms.

Timeliness of offsite storage

Implementation schedule: NWT estimates that relocating the ISFSI within the existing SONGS site could be accomplished within a several-year timeframe (i.e., less than 10 years). By contrast, we estimate that moving the SONGS SNF to a new ISFSI at an offsite location could require closer to 20 years. This includes approximately 10 years for a new facility to become operational and another 10 years to complete a campaign to transfer all SNF off site once the offsite facility is available.[199] Our estimate of the time required to design, license and construct a new facility off site, in a best-case scenario, is based on several assumptions:

- We assume the time required to site a new ISFSI at another location in California, design the facility, and submit a license application to the NRC under 10 CFR 72, is three to four years. This represents a best-case scenario in that it assumes no delays due to public or stakeholder

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[197] As we note in Section 6.2, the use of SONGS decommissioning funds for these purposes could be subject to a concern about violating IRS rules for qualified trusts.
[198] Arguably, federal or state support would be *less* likely to be forthcoming (relative to the other multi-utility CISF alternatives) for any offsite storage proposal that offered a solution only for SONGS SNF.
[199] See discussion of schedule for the non-federal CISF alternative (Subsection 7.6.2) for further details, including footnote 183.

opposition and court challenges. Realistically, such issues could add significantly to the timeframe for siting a new ISFSI.

- We assume the NRC licensing process for a new SCE ISFSI takes another three to four years.
- Following successful licensing, the time required to construct the new ISFSI and begin receiving SNF from SONGS is two to three years.

As discussed for other alternatives, NWT's estimate of a 10-year timeframe to move all the SONGS SNF and GTCC waste once a receiving facility is available is based on the SONGS Decommissioning plan and NWT's expert judgment.[200] The implementation timeframe could be substantially longer if the effort to identify an alternative site, or the transportation plan for moving the SNF, encounter serious opposition.

Other implementation considerations

Statutory changes needed: No changes in federal statute are needed to enable SCE to pursue a new ISFSI for SONGS SNF, whether on or off site. If, however, SCE were to seek federal support for this undertaking (separate from any reimbursement it might be entitled to under the Judgment Fund)—for example, in the form of support for a demonstration project—congressional action would be needed to enable use of NWF funds or otherwise appropriate federal resources.

A new location at the existing SONGS site or within Camp Pendleton also would require no changes to statute at the state or tribal level. The situation at a location elsewhere in California, however, could be different (we discuss the possibility of pursuing a site elsewhere in the state as a potential variant of this alternative). In that case permits for certain site activities may be required from other state-level permitting bodies and agencies, such as the California Environmental Protection Agency.

An executive order issued by California governor Gray Davis in 2002 has sometimes been cited as potentially constraining the storage of radioactive materials within the state.[201] Upon review, however, NWT concluded that neither the order, nor subsequent regulations, prohibit the storage of SNF in the state of California.[202] Instead, the executive order addresses the disposal of certain decommissioned radioactive materials in landfills. The 2002 order also led to the California Department of Health Services' Division of Radiation Safety and Environmental Management assuming inspection and enforcement authority under certain state laws and regulations that apply to the control and use of radioactive materials. None of this, however, is directly relevant to offsite storage options for SONGS SNF.

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[200] This estimate further assumes that efforts to site a new ISFSI would be restricted to locations that are either already on a connecting rail line or sufficiently close to a rail line that developing needed near-site transportation infrastructure is not an impediment to the overall schedule.

[201] Executive Order D-62-02, by Gray Davis, Governor of the State of California, September 30, 2002.

[202] The order itself came about in response to revelations that the California Department of Health Services was allowing residual radioactive waste from medical, commercial, educational, and other facilities to be disposed of in municipal solid waste landfills. To halt this practice, the order established a moratorium on the disposal of decommissioned radioactive materials into Class III landfills until the state's Department of Health Services promulgated regulations establishing dose standards for these materials. Prior to issuing the executive order, Governor Davis vetoed legislation that would have barred the disposal of all radioactive materials in municipal landfills. The California Department of Health Services' Division of Radiation Safety and Environmental Management now enforces state laws and regulations associated with administering a radiation control program, including licensing the use of radioactive materials and equipment, inspecting facilities that use radioactive materials, investigating radiation incidents, and monitoring radioactive contamination in the environment.

Potential socio-economic-political barriers: The chief barriers to this alternative involve cost and, in the case of a new offsite facility, siting challenges. From a cost perspective, pursuing a new SONGS-only storage facility would commit the SONGS co-owners and customers to an expenditure of several hundred million dollars or more. This level of expenditure would be difficult to justify absent a compelling reason to relocate the SNF.

If SCE were to explore the feasibility of a new ISFSI site other than Camp Pendleton, political factors could severely constrain the ability to proceed. The experience of attempting to site a low-level waste facility in California's Ward Valley several decades ago is instructive, particularly as relates to tribal lands (Box 7.2).

Degree to which SONGS co-owners have control over implementation: SCE can initiate a process to pursue a new SCE ISFSI at any time in the future if and when such action is considered to be warranted. However, the hurdles are formidable, for reasons outlined throughout this discussion.

Box 7.2: Ward Valley

California's failed effort to site a disposal facility for low-level nuclear waste in the 1980s and 1990s shows that the challenges described throughout this Strategic Plan are not unique to the national SNF waste management program. In 1982, the California legislature—responding to a 1980 federal directive that gave states responsibility for handling low-level radioactive waste—directed the California Department of Health Services (DHS) to find a site for a disposal facility and a company to operate the facility. The company DHS eventually selected, U.S. Ecology, in 1988 proposed a site at Ward Valley, in the Mojave Desert of southeastern California, on land owned by the federal Bureau of Land Management.

Although the plan to open a facility at Ward Valley initially won support from the federal government, which agreed to transfer the land, the project never came to fruition. Controversy about the site's suitability and about the completeness of the accompanying Environmental Impact Statement, which was finalized in 1991; questions about the track record of U.S. Ecology, which owned several other low-level waste disposal facilities; changing political dynamics at the state and federal levels; and multiple legal challenges all played a role.

Central to the project's failure, however, was a decade of strong opposition—not only from several environmental and anti-nuclear groups but also, and perhaps most importantly, from a coalition of local tribes, including members of the nearby Chemehuevi and Mojave tribes, as well as other Colorado River tribes including the Quechan and Cocopah. Tribal elders began holding vigils at Ward Valley in the 1990s; by 1998, local media accounts described "a full-fledged occupation," with protesters maintaining a continual presence at the project site for 113 days. In November 1999, the Interior Department terminated all activities related to Ward Valley, effectively ending the effort to open a low-level nuclear waste disposal facility at that location.

Sources: https://www.kcet.org/redefine/they-kept-ward-valley-nuclear-free-part-1; https://www.kcet.org/news/the_back_forty/commentary/the-hidden-desert/they-kept-ward-valley-nuclear-free-part-2.html; http://www.mohavedailynews.com/needles_desert_star/fight-against-nuclear-waste-dump-remembered-at-ward-valley-spiritual/article_90eb72d6-389e-11e9-b47-9f6fab40ac1.html.

7.9.3 Variants of the Relocate-SONGS-SNF-to-a-New-ISFSI Concept

NWT has identified two variants of this alternative that involve SCE moving SONGS SNF to another ISFSI within California (but not on Camp Pendleton) and moving it to another location within Camp Pendleton. These variants are summarized below.

Another site within California: This variant posits a solution similar to the baseline concept, but at a different site in the state. The advantage of this variant would be to move the SNF farther from the Pacific Ocean and allow the oceanside site to be returned to the Navy.

Other ideas have been advanced for potential storage sites, including at other military bases in California. For example, NWT received a detailed submission (via the SONGS website) from a member of the public who proposes consideration of the 456,000-acre Chocolate Mountain Gunnery Range in the Colorado Desert of southern California as a potential alternative ISFSI site (presumably the ISFSI site would be located far from the impact area of the gunnery range). According to this commenter, the Chocolate Gunnery range has several advantages in terms of proximity to SONGS, geographic isolation, seismic stability, and existing use as a military facility (which includes experience transferring nuclear materials). NWT did not analyze this specific proposal; we note it here primarily by way of highlighting the range of possibilities that could be considered and the potential contribution of engaged stakeholders in helping to identify promising and perhaps innovative solutions.

Another site at Camp Pendleton: Some local stakeholder groups have advocated for moving the SONGS SNF "across I-5" to a site at Camp Pendleton that is colloquially known as "the Mesa." SCE currently leases property on the Mesa, which is east of Interstate Highway 5 and relatively close to SONGS. This new storage facility could, in its simplest form, be identical or very similar to the existing SONGS ISFSI but would be located farther away from the Pacific Ocean. The SONGS co-owners would retain title and possession of the SNF and would be responsible for all aspects of transportation to the new site and for returning the canisters to storage service. However, the Navy has declined to entertain this alternative and is clearly opposed to any approach that leaves SNF in storage within the Camp Pendleton area. In addition, this approach would almost certainly fail the test of commercial reasonableness, and would likely not be acceptable to surrounding communities.

7.9.4 Summary Findings for Relocating the SONGS SNF to a New ISFSI

- This alternative presents large cost and liability risks and therefore does not meet the test of commercial reasonableness for the SONGS co-owners and customers.
- Even relative to other disposition pathways that likewise do not involve the federal government, moving the SONGS SNF to another SCE-owned ISFSI has a number of significant additional disadvantages—in terms of overall cost, economies of scale, and ability to attract partners. These considerations reinforce our conclusion that this alternative is not commercially reasonable.
- As part of its 2035 application for a renewal of the coastal development permit for the Holtec ISFSI, SCE is required to update its assessment of coastal hazards at SONGS and assess options for moving the SONGS SNF and GTCC waste to another location within the current plant site. Moving the SNF to another site within Camp Pendleton would require support from the U.S. Navy, which is on record as being opposed to this approach. The Navy's expressed interest is in having all of the base area that is leased to SCE and SDG&E, including the current SONGS site and the mesa, returned for its own use.
- Federal reimbursement for building a new SONGS-only ISFSI could require a finding by the responsible regulatory authorities that the current ISFSI is not acceptable for storage. While the federal government may not reimburse the cost of building a new ISFSI, or the cost of moving the fuel to a new site, the operating costs of a new ISFSI may be eligible for reimbursement under similar terms and conditions as the current ISFSI.

- For these reasons, the SCE-only alternative is unlikely to merit serious consideration unless circumstances change so as to create a more urgent reason to move the SONGS SNF and progress toward other alternatives remains slow or in doubt.

7.10 Other Concepts for Permanent SNF Disposition

7.10.1 Synopsis

Although geologic isolation in a mined repository has been the preferred disposal concept for SNF in the United States and other countries for several decades, it is possible, over the timeframes contemplated in this Strategic Plan, that other concepts for geologic isolation could emerge as viable options. Various disposition alternatives have been proposed, and in some cases studied, in the past but are not currently under active consideration. Technological innovation, in the United States or elsewhere, may lead to new concepts. The fact that Congress provided funding for DOE to initiate new R&D efforts in SNF management (as part of the FY 2020 Energy and Water Development Appropriations Act) suggests that there is interest in supporting continued work in this area.

In this section we note several other disposition alternatives that were identified in the course of developing the Strategic Plan. None of these alternatives met the criteria identified in Chapter 2 to merit detailed analysis at this time. The point of including a short discussion about other concepts here is primarily to underscore the need to monitor changing external circumstances and technical developments and remain alert to new opportunities, as warranted. Accordingly, this section is organized differently than the previous sections: rather than identifying a baseline and variants, and applying our seven assessment factors, we provide a summary discussion of several other alternatives for SNF disposition that were identified during the course of this study. Others may emerge over time. The Strategic Plan can continue to provide a durable framework for evaluating changing circumstances that can advance or impede the various disposition alternatives.

7.10.2 Deep Borehole Disposal

Deep boreholes represent an alternative concept for SNF disposal that has received some study and is being pursued by at least one private company at present. The idea of isolating nuclear waste in cased holes drilled deep into bedrock was investigated by DOE in the 1980s; other countries reviewed this concept also. In general, the conclusion at the time—in the United States and elsewhere—was that the mined geological repository concept offered the preferred path forward. Consequently, a mined geological repository is the disposal concept that became the basis for the current regulatory framework in the United States.

Advances in drilling technology, including widespread commercialization of horizontal drilling technology in the oil and gas industry, have prompted some renewed interest in borehole disposal. Within DOE, Sandia National Laboratory has been studying the concept of deep vertical boreholes. And recently, a company called Deep Isolation has put forward a commercial proposal for SNF disposition in horizontal boreholes formed by directional drilling technology. The Deep Isolation concept involves vertical holes drilled up to one mile deep below the surface of the Earth and then turned in a horizontal direction over a large radius of curvature. A limitation on this horizontal borehole concept concerns the diameter of the boreholes that can be drilled at significant depths, which in turn constrains the diameter of a borehole canister to a size that would accommodate only a single fuel assembly. This would require the re-packaging of SONGS SNF into smaller canisters at the deep borehole site, which would be costly and would require specialized facilities (i.e., a spent fuel pool or dry transfer facility). Other significant technical and scientific issues would need to be addressed. In addition, no regulatory framework exists

for licensing this technology for SNF disposition. To date, the NRC has not developed guidance on how it might approach the licensing of a deep borehole facility.

7.10.3 Sub-Seabed Disposal

The concept of burying containers of radioactive waste in deep ocean floor sediments was investigated in the 1970s and 1980s. Specifically, Sweden and the United Kingdom looked at constructing a repository below the seabed and, in the 1980s, the Organization for Economic Co-operation and Development (OECD) studied different techniques for implementing this concept. While these early studies concluded that sub-seabed disposal could offer some potential technical advantages, this concept is not currently under active consideration by any country. Among the principal challenges is alignment of sub-seabed disposal strategies with the regulatory frameworks in current international agreements: for example, the practice of disposing of radioactive waste in international waters is prohibited by the London Protocol of 1996.

7.10.4 International Repository

As discussed in Section 5.4, a number of countries are working on developing geological repositories for SNF and other forms of radioactive waste. A number of these efforts, notably in Finland and Sweden and a few other countries, have advanced well beyond the U.S. repository program. In concept, a repository could accept SNF from more than one country. However, several of these countries have explicit promises to not consider importing spent fuel from other countries and in most cases are opposed to the consideration of an international repository at this time as they are concerned that such an initiative may undermine progress in their national repository programs. One the other hand, Russia is proposing SNF take-back provisions as an incentive as it seeks to export its nuclear power plant technology to other countries. In any event, developments over the next century could change the current calculus and potentially open new opportunities for this alternative.

7.10.5 Conversion, Recycling, and Reuse

A number of concepts have been proposed over time to process SNF in various ways, for example by chemically reprocessing SNF to recover plutonium and unused uranium that could be used as new fuel. The economics of reprocessing, however, have not been advantageous relative to a once-through fuel cycle and current national policy in the United States does not support reprocessing.[203,20] There also have been proposals to transmute or recycle SNF into fresh fuel, or to "burn" certain radioisotopes in SNF, such as actinides, to reduce the radioactive profile of SNF. More recently, several advanced nuclear technologies have been proposed that would mix used SNF directly with fresh fuel to generate power.

From a waste management perspective, it is important to note that all of these approaches still produce high-level waste in some form that would still need to be disposed of.

Having described these technologies for the sake of a comprehensive consideration of possible solutions to SONGS SNF, we also dismiss them as not pertinent to this Strategic Plan. Beyond national

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[203] Between 1996 and 2005, the U.S. government maintained various constraints, from a moratorium to an outright prohibition, on reprocessing activities due to proliferation concerns related to the separation of plutonium during reprocessing. *Nuclear Fuel Reprocessing: U.S. Policy Development*, Congressional Research Service, 2008.
[20] Starting in 2005, the George W. Bush Administration pursued the construction of a demonstration commercial reprocessing plant. This decision was subsequently cancelled by the Obama Administration. See: https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-fuel-cycle.aspx

proliferation policy considerations, the value of SNF in the current national inventory is very small. As a 2011 Oak Ridge National Laboratory study found, only 2 percent, at best, of today's SNF inventory has value, and that is because of its research and development utility.[205] We conclude that reprocessing and related technologies are unlikely to occur and thus will not be considered in evaluating the challenges with moving SONGS SNF to another location.

7.10.6 Summary Findings for Other Concepts for Permanent SNF Disposition

- One concept for geologic isolation that has been studied in the United States and by other countries involves deep boreholes. A specific variant of this concept that involves horizontal drilling technology is currently being developed by a private company (Deep Isolation). Significant technical, regulatory, and financing hurdles would need to be overcome to advance this concept, however. For example, the NRC does not even have guidance in place yet as to how it would accept and review a license application for a deep borehole facility.
- Other disposition concepts such as sub-seabed disposal, international repository, and SNF reprocessing are noted for the sake of completeness but are not likely to have relevance for SONGS SNF for reasons of policy, cost, or practicality.
- Congress has directed DOE (in the FY 2020 Energy and Water Development Appropriations Act), to initiate new R&D efforts for SNF management. These initiatives may provide opportunities to help advance a disposition pathway for SONGS SNF.

[205] A 2011 Oak Ridge study found that "....98% of the total current inventory [of SNF] by mass, can proceed to permanent disposal without the need to ensure retrievability for reuse or research purposes." *Categorization of Used Nuclear Fuel Inventory in Support of a Comprehensive National Nuclear Fuel Cycle Strategy*, John C. Wagner, Joshua L. Peterson, Don E. Mueller, Jess C. Gehin, Andrew Worrall, *et.al.,* Oak Ridge National Laboratory, 2011,

Table 7.9 Summary of Assessment Results for Alternative SONGS SNF Disposition Pathways

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
Offsite Disposal Alternative				
Federal Repository Baseline: Yucca Mountain Variant: • Another location.	• YM program has been defunded and therefore suspended for more than a decade. • Though major licensing milestones have been passed, contentions remain and project infrastructure and technical staff have been dismantled. • While Yucca Mountain has had support at the county level, the state of Nevada has strongly opposed the project. • Leaders of both political parties are on record as opposing restart of project over Nevada's objections. • Starting over at another site will require congressional action, siting process, lengthy characterization studies.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport and disposal from that point. • Costs to transport and dispose of SONGS SNF would be covered by the federal government out of the NWF using funds already collected from nuclear utility customers. • Until repository is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	• Depends on congressional action to restart and potentially restructure the federal repository program. • Opening YM likely to take additional decades even after decision to restart. • Schedule for shipping SONGS SNF to a repository would depend on whether and how the federal government prioritizes acceptance of SNF from shutdown reactors. • Full removal of SONGS SNF could take five to seven decades after congressional action if the federal government fails to implement an efficient approach. • Pursuing another site could take as long or longer.	• Difficult to predict an end to the current political impasse. • Program management organization needs to be rebuilt and changes to budgetary treatment of NWF are needed to provide assured funding. • Siting will continue to be a challenge if decision is to pursue a new location. • SCE has limited leverage to influence progress.
Federal Offsite Storage Alternatives				
Federal CISF	• Existing statutory authority for Federal consolidated interim storage is limited and heavily constrained. It is also linked to construction authorization for a repository.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport, storage, and eventual disposal at that point.	• Requires appropriations and eventual legislative action, including resolution of linkage to repository. • Acceptance schedule would likely be affected by whether	• Significant public and political resistance to initiating a storage facility program absent linkage to a permanent repository.

Table 7.9 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
	• With appropriate direction and funding, initial steps to design and site a facility could be taken before the NRC authorizes repository construction under existing authority. However, new legislation would be needed for construction and operation.	• Costs for a federal CISF and to transport and store SNF would be covered by the federal government out of the NWF, once the necessary legislative changes were in place. • Until CISF is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	and how the federal government prioritizes acceptance of SNF from shutdown reactors. • Full removal of SONGS SNF could take three to four decades after congressional authorization, assuming no priority given to shutdown reactors.	• Siting a facility could be challenging. • SCE has limited leverage to influence progress.
Federal Use of a Non-Federal CISF Baseline: Federal government contracts for use of one or both of the proposed Holtec and ISP facilities Variants: • Federal government contracts for use of another as-yet-unidentified non-federal facility. • Other public–private partnership arrangements.	• NRC is currently reviewing Holtec and ISP license applications. Barring delays due to opposition or other factors, license approval is expected in 2021. • Vendors express confidence that projects will move forward, but a number of hurdles remain. • Federal government would need new legislative authority to contract with a non-federal entity for storage services.	• Federal government would take title to SNF at SONGS site boundary and assume all liability for transport and storage fees at that point. • Depending on storage fees and other contract terms, this option might be more or less attractive to the federal government than a federal CISF. • Until CISF is available and all fuel is removed, the SONGS co-owners can continue to seek recovery of O&M costs for storage at SONGS through Judgment Fund.	• Timeframe to either facility being available depends on issuance of license, completion of funding and pre-construction requirements and finalization of contractual arrangements between CISF and possible clients, including (in this case) federal government. • Depends on action by Congress to authorize and fund federal contract for storage at a non-federal facility. • Schedule for SNF transportation and acceptance would also be influenced by whether and how the federal government prioritizes acceptance of SNF from shutdown reactors.	• Private storage facilities face challenges in terms of public and host-state acceptance. • From federal government standpoint, use of a non-federal facility may face additional political and budgetary hurdles. • SCE has limited ability to influence successful completion of non-federal facilities or federal government decision to use such facilities. • More flexible authorization for federal storage program could

Table 7.9 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
			• Full removal of SONGS SNF could require two to three decades after facilities become available and Congress authorizes use, assuming no priority given to shutdown reactors.	open the door to a variety of arrangements.
Non-Federal Offsite Storage Alternatives				
Non-Federal CISF Baseline: SONGS co-owners contract directly for storage services at proposed Holtec and/or ISP facilities and are responsible for SNF transport to storage facility Variants: • SONGS co-owners sell SONGS assets and transfer title to another private entity affiliated with private storage provider. • Non-federal CISF owner/operator takes possession of SNF at SONGS boundary and provides transport services.	• NRC currently reviewing Holtec and ISP license applications. Barring delays due to opposition or other factors, license approval expected in 2021. • Vendors express confidence that projects will move forward, but a number of hurdles remain.	• Storage fees for a private facility are not yet known, but will depend on financing arrangements, insurance requirements, benefits payments, and other factors. • Current draft licenses for both the Holtec and ISP facilities require the client (in this case, the SONGS co-owners) to retain title to SNF. This means SONGS co-owners and customers would have to seek protection for risks and liabilities of retaining title from a third-party entity on commercially reasonable terms. • Neither Holtec nor ISP is currently proposing to provide SNF transport. Rather, both applicants have indicated that SNF owners would be responsible for acquiring transportation assets and covering operational costs to ship SNF to their facilities.**	• Depends upon issuance of license, completion of funding and pre-construction requirements and finalization of contractual arrangements between CISF and SNF owners. • Full removal of SONGS SNF could be completed two decades after licensing and financing complete and commercially reasonable contract terms are reached. Transportation arrangements, including schedule, are uncertain and subject to negotiation.	• Private storage facilities face challenges of public and host-state acceptance. • Resolution of contract terms and conditions that are commercially reasonable, including cost, cost reimbursement, and title/liability protection would be required. • SCE has limited ability to improve private vendors' ability to obtain licenses or to address host-state concerns.

Table 7.9 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
• Another private or non-federal vendor.		• Availability of Judgment Fund reimbursements to pay for transportation and private storage costs – in all non-federal offsite storage scenarios – is uncertain.		
CA-only CISF Baseline: All CA utilities form cooperative agreement to consolidate SNF storage within the state, with some form of sanction/support from state government. Variants: • CA utilities form a NEWCO to take title to SNF at CA CISF. • NEWCO takes title to SNF at plant sites and is responsible for transport to CA CISF. • CA state gov't and CA utilities partner to share responsibilities for SNF storage, with division of roles and responsibilities to be negotiated.	• Idea has not been explored but would require engagement with other CA utilities and state officials to assess interest. • Could avoid the problem of seeking host-state support for a storage facility elsewhere in the U.S. that is being asked to take SNF from California and other states.	• SONGS co-owners would retain title to the SNF, creating need to obtain third-party protection for co-owners and customers from financial and other risks on commercially reasonable terms. • Costs to site, design, and license a new CISF could be substantial; consolidation of SNF, however, could provide some economies of scale and cost-sharing opportunities because costs to build facility and some transport costs would be shared with other utility partners. • Availability of Judgment Fund reimbursements to pay for transportation** and other costs associated with developing a new facility is uncertain. • Storage O&M cost savings, if any, would accrue to both the utilities and to the Judgment Fund. • Could potentially benefit from state support or as a federally supported demonstration project.	• Depends on time needed to enlist partners, find acceptable site, and characterize, license, and construct facility. • Full removal of SONGS SNF could take two decades after siting agreement reached.	• Interest among other CA utilities or within state government is currently unknown; continued impasse on federal program and impediments to CISF implementation could prompt interest. • Siting remains a key challenge, even if presented as a California solution to a California problem.

Table 7.9 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
• Other non-utility NRC licensees in the state join the effort.				
Multi-utility CISF At Another Plant Site Baseline: SONGS co-owners partner with one or more other nuclear utilities to consolidate SNF storage at another site. Note that an expanded or new storage facility at Palo Verde Generating Station (PVGS) was used to generate rough cost estimates, but the Palo Verde owners have rejected the idea of storing SONGS SNF at this site. Variants: • Utility participants form a NEWCO to own and operate private storage facility at an existing plant site.	• PVGS co-owners have been approached and have indicated (by letter) that they are not interested. • Other partners and sites have not been explored. • Use of an existing plant site could offer siting and licensing advantages.	• Expansion of an existing ISFSI to host SONGS SNF may offer economies of scale and cost-sharing opportunities. • SONGS co-owners would retain title to the SNF, creating need to obtain protection from financial and other risks from a third-party entity on commercially reasonable terms. • Availability of Judgment Fund reimbursements to pay for transportation** and other costs of developing and using a new facility is uncertain. • Storage O&M cost savings, if any, would accrue to both the utilities and to the Judgment Fund. • Could potentially benefit from federal support, perhaps as a demonstration project or regional CISF.	• Depends on time needed to enlist partners, find acceptable site, and characterize, license, and construct facility. • Full removal of SONGS SNF could take two decades after siting agreement reached.	• Possible interest among other utilities in the Western states region is currently unknown. • Socio-political acceptance could be a major challenge since the host state and community would have to be willing to accept SNF from out of state.

Table 7.9 (continued)

	Status/Necessary Steps	Cost and Liability Considerations	Timeframe*	Key Uncertainties & Challenges
Relocation of SONGS SNF to a New ISFSI Baseline: Another location at the SONGS site at higher elevation. Variants: • A new site in California. • Another location at Camp Pendleton.	• The current on-site ISFSI has been completed and is operating under NRC and state regulation and oversight. • SCE is required to update its assessment of coastal hazards and examine options for moving the ISFSI within the current licensed plant site when it applies for renewal of the coastal development permit for the SONGS ISFSI in 2035. • Navy wants all SNF off Camp Pendleton. • Other possible sites for relocating the current ISFSI have not been explored.	• Developing a new offsite ISFSI would entail substantial cost and time to complete site identification, licensing, construction, and operation. • SONGS co-owners would retain title to the SNF, potentially creating need to protect co-owners and customers from liability issues and additional insurance costs if SNF is moved to a new offsite location. • SCE-only approach does not meet test of commercial reasonableness because of the cost of relocation and because it provides no economies of scale and little opportunity for cost sharing. • Availability of Judgment Fund reimbursements to pay for costs to move the SNF to another ISFSI location is uncertain.**	• For an offsite location, depends on siting difficulty and time to characterize and license site. • The same challenges don't apply if the ISFSI is moved within the existing plant site, but that option also doesn't achieve the objective of clearing the site. • Full removal of SONGS SNF if the new location is off site could be completed two decades after initiation of development.	• Navy is opposed to continued SNF storage anywhere on Camp Pendleton. • Moving SONGS SNF to a new site in CA would present major challenges in terms of public and host location acceptance. • Coastal development permit renewal in 2035 will require assessment of new information.

* Where a timeframe is given, it represents the North Wind team's expert judgment using reasonable estimates of the time required for discrete steps to implementation. In all cases, delay or opposition could extend these timeframes. See Chapter 7 for the full report for more detail.

** SNF transportation costs for all non-federal disposition pathways could be substantial and would likely fail the test of commercial reasonableness absent significant federal support and/or cost sharing with other entities. North Wind estimates that costs to ship all the SONGS SNF, if the necessary equipment had to be procured for SONGS alone, would be well over $100 million for a private (non-federal) shipper. More precise estimates cannot be generated without knowing the specific parameters of a future shipping campaign. See further discussion in Section 6.5 of the full report and in the Conceptual Transportation Plan (Vol. III).

8. OVERALL FINDINGS AND CONCLUSION

This chapter highlights overarching findings from NWT's assessment of disposition pathways that would allow for the safe and commercially reasonable removal of SNF from the SONGS site. These findings, together with the findings from our assessment of specific disposition pathways in Chapter 7, inform the actions identified in the Action Plan. Before presenting these findings, we briefly revisit the Plan's objectives and the chief challenges to achieving those objectives, suggest a few overarching strategic priorities, and summarize some key context-setting points. Findings relevant to transportation are presented in the Conceptual Transportation Plan.

8.1 Meeting the Challenge

The long-term objective of the Strategic Plan calls for the safe and commercially reasonable relocation of SONGS SNF to an offsite facility, the full decommissioning and restoration of the plant site, and the return of the land currently occupied by the site to the Navy. As previous chapters have made clear, achieving this objective will not be straightforward or quick: the SONGS co-owners will have to pursue multiple pathways; work hard to engage stakeholders and potential partners; and remain flexible and open to new opportunities, while also taking concrete steps to make progress in the near and medium term. All of this will require sustained commitment over years and probably decades. It also will require sustained engagement and support from interested stakeholders.

Achieving the Strategic Plan's objectives will require sustained commitment over years and probably decades.

Addressing the dysfunction in the federal nuclear waste management program, in particular, will be challenging given the many factors that have combined to bring about the current impasse. Nonetheless, a national-level solution will ultimately be needed, not only for SONGS but for the much larger number of nuclear plant sites across the country that are facing or will eventually face the prospect of storing SNF for the indefinite future absent other consolidated storage or disposal options.

Foregoing chapters have also made clear, however, that even if Congress and the administration act soon to revive the Yucca Mountain project or to pursue another repository site, significant regulatory, technical, and socio-political hurdles still have to be overcome. At the same time, critical institutional and personnel capacities in the federal program that have been allowed to atrophy over the last decade will have to be rebuilt. This puts the timeframe for implementing a permanent disposal option for SONGS SNF well beyond the mid-century mark, even under optimistic assumptions.

Against this backdrop, the rationale for seeking a safe and commercially reasonable offsite storage option that would allow for earlier removal of the SONGS SNF comes into clearer focus. Also clear is the need for a nuanced and multifaceted approach to achieving the Plan's objectives. A few core strategic priorities can help guide future efforts:

- Taking the steps needed to plan for and be ready to move SONGS SNF as soon as a commercially reasonable offsite facility becomes available;
- Supporting efforts to develop and open one or more consolidated storage facilities that could accept SONGS SNF within a timeframe that is more consistent with SONGS decommissioning plans;

- Working with other stakeholders and policy makers to prompt a needed overhaul of the federal program and restart progress toward an effective nuclear waste management program that includes a permanent disposal solution for all SNF; and
- Increasing and maintaining trust and confidence in the integrity of SNF storage at SONGS as long as these materials remain at the site.

Put simply, NWT believes that concerted effort in each of these areas will be important to achieve the Strategic Plan's overarching objective with respect to the safe long-term disposition of SONGS SNF and the full decommissioning of the SONGS site.

8.2 Key Context-Setting Points

The findings that follow, as well as the overarching strategic priorities offered above, are shaped by a few key points and observations:

- **Protection of human health and safety, for workers and the public, together with protection of the environment remains the core imperative for all policies, activities, and facilities involved in the management, storage, and ultimate disposition of nuclear materials.** Thus, any pathway for the disposition of SONGS SNF must be implementable in accordance with the regulatory frameworks that exist to provide assurance of these protections.
- **The federal government retains ultimate responsibility for the permanent disposal of SNF.** This central tenet of U.S. nuclear waste policy dates back to the earliest days of commercial nuclear power generation in this country and was foundational to the development of the nuclear energy industry. Although the federal program has stalled and achieved virtually no progress for the last decade, the federal government's ultimate responsibility to find a national solution for SNF disposition has never been seriously questioned. Nuclear utilities and their customers have not only relied on this commitment, customers have already paid to cover the costs of the federal repository program.
- **The problem of implementing a safe, commercially reasonable strategy for the disposition of SNF is not unique to SONGS.** This problem exists because of the federal government's failure to deliver on its longstanding statutory obligation to provide a permanent disposal facility and begin taking title to SNF. The costs and risks associated with this national-level failure will continue to grow as increasing numbers of nuclear power plants retire in the coming decades.
- **Success in implementing a solution for SONGS SNF will have benefits that extend beyond SONGS and its co-owners.** This point is a corollary of the previous one. The successful development and implementation of a safe and commercially reasonable offsite disposition pathway for SONGS SNF would benefit other utilities and the national waste management program—both because of the specific learning that would occur in the process and by creating "existence proof" that progress is possible.

Success in implementing a solution for SONGS SNF will have benefits that extend beyond SONGS and its co-owners.

- **Socio-political support is critical to the success of all efforts in this domain, particularly when it comes to siting new facilities.** Experience in the United States and around the world shows that the management of nuclear waste is governed not only by technical and scientific considerations, but also by potent socio-political factors. Any effort to pursue an offsite solution for SONGS SNF will be far more likely to succeed if it adopts best practices from siting

experience in the United States and elsewhere and if it has strong support from a wide array of stakeholders.

- **The time needed to implement a disposition pathway for SONGS SNF will almost certainly take longer than many stakeholders and the SONGS co-owners would prefer.** Long timeframes create larger uncertainties but also increase the likelihood that new opportunities will arise. In this environment, the challenge is to provide the corporate commitments and focus needed to proactively identify and pursue potential solutions, remain nimble and vigilant to new possibilities as they develop, and sustain the relationships and broader socio-political engagement on these issues that will be necessary to make progress.
- **The safety of on-site dry storage and the long timeframes this affords to implement permanent disposal has made it more challenging to muster the political momentum needed for a long-term solution.** A greater sense of responsibility and priority among decision makers and key stakeholders is needed to re-invigorate the nation's spent fuel management program and collaborate on viable solutions.
- **In the context of long timeframes, success in achieving some defined, early milestones can help build momentum for continued progress.** An important test of this Plan will be the ability to identify and work toward nearer-term goals and objectives, from building coalitions to (at some point) moving the first shipment of SONGS SNF. Success can breed further success and can provide a foundation for the program to build from.
- **The trust and confidence of local communities and other stakeholders is fundamental to the successful management of SNF as long as it remains at SONGS.** It is also critical to building political support for storage and disposal solutions that would allow for the removal of SNF to another community that also will need to have trust and confidence in the operation of the facility they are being asked to accept. Input from stakeholders throughout the course of the Strategic Plan development process underscores the importance of regular communication with local communities and public officials, transparency about SNF management plans and challenges, and willingness to invite and consider outside input.

8.3 Site Safety and Preparedness for Future SNF Shipments

This section focuses on the steps needed at SONGS to (1) continue its robust program for the safe storage and monitoring of SNF until an offsite facility is available, and (2) bolster site readiness and prepare for future SNF shipments.

As discussed in Section 3.3, the SONGS co-owners have implemented a number of enhancements aimed at ensuring the integrity and safety of the canisters being used for SNF storage at SONGS over the timescales required before SNF can be shipped off site. In addition, the SONGS ISFSI will be subject to ongoing oversight and periodic license review and renewal in future years, with near-term milestones for renewal of storage system CoCs occurring in 2023 and 2035. In addition, the California Coastal Commission permit for the TN ISFSI must be renewed by 2022 and the Holtec ISFSI is due for renewal in 2035. The ISFSIs will also continue to be subject to periodic NRC regulatory oversight until the site is fully decommissioned and all SNF is moved off site.

Summary of Findings:

- On-site storage of SONGS SNF will be subject to ongoing NRC oversight and requirements for permit or CoC renewals while offsite disposition plans are finalized.
- Planning to manage canister aging and to analyze and prepare for the potential need for canister repairs will be important if progress toward an offsite solution continues to be slow.
- Until SONGS SNF can be moved to an offsite storage or disposal facility, SCE will retain administrative control and security responsibilities for the ISFSI and incur associated costs. In addition, the site cannot be fully decommissioned and returned to the Navy for use for other purposes.

As they seek to advance offsite storage solutions for SONGS SNF, the SONGS co-owners must continue to implement robust programs for the safe storage and monitoring of SONGS SNF on site. Contingency plans should also be developed to extend safe storage beyond the current schedules in the SONGS Decommissioning Plan. Specific follow-on actions are described in the Action Plan (Vol. I of this compendium).

8.4 Stakeholder Trust and Engagement

As we note among our key points in Section 8.2 and throughout this document, improving upon and maintaining a strong relationship of trust and transparency with stakeholders is important for as long as SNF is present at the SONGS site and in building the sociopolitical support needed to develop and implement offsite solutions. The stakeholder engagement process NWT undertook as part of its contribution to the Strategic Plan elicited a number of themes that will be important for the SONGS co-owners to consider as they look for ways to keep stakeholders engaged and informed in the coming years.

Summary of Findings:

- Most local stakeholders NWT interviewed express a strong desire to see the SNF removed from SONGS as soon as possible. Many of them regard the site as being particularly vulnerable to various risks that could increase in likelihood and severity over long timeframes. The site's proximity to major population centers was also frequently mentioned. At the same time, many interviewees expressed an understanding of the challenges the SONGS co-owners confront in finding an offsite solution, and an appreciation for the fact that no immediate option exists to remove the fuel.
- The CEP has played a valuable role as a conduit for communicating with local community members and other stakeholders. A number of CEP members are also highly engaged and have demonstrated the interest and ability to join with the SONGS co-owners in advocating for federal action to remove the SNF. However, in interviews with NWT, a few local public officials said they perceived a decline in the level and frequency of communication with SCE and SONGS management since the permanent closure of SONGS was announced in 2013. A few local public officials also expressed concern that they were not aware of an emergency plan for SONGS now that it was no longer operating as a generating station.
- Siting a new facility that can receive the SONGS SNF presents another critical and arguably even more difficult engagement challenge. Many SONGS stakeholders are well aware of this challenge and would not want a new facility imposed on another community if that community were unwilling. Future siting efforts will be more likely to be successful if they are pursued in a

manner that emphasizes consent and collaboration—with potential host communities, states, and other stakeholders.

Strengthened stakeholder engagement is critical for at least two reasons: First, as we have noted, broad community support for moving SNF off site will help build local coalitions and a political base of support for action. Second, communities that might be interested in hosting a storage facility or repository will look to current operating and decommissioned reactor sites for models of community engagement and to be reassured that the industry commitment to public health and safety is broad and deep.

Finally, maintaining strong channels of communication will allow the SONGS co-owners to respond more effectively to common concerns (such as about emergency planning) and can help promote greater public awareness and understanding of issues and challenges related to nuclear waste management more broadly, not only at SONGS but around the nation.

Specific actions the SONGS co-owners will undertake to maintain and strengthen their engagement with local, regional, and national stakeholders are described in the Action Plan (Vol. I).

8.5 Restarting the National Nuclear Waste Management Program

Of the disposition pathways considered in this Strategic Plan, those in which the federal government performs on its long-standing statutory and contractual obligations for nuclear waste management are the most likely to offer a commercially reasonable and practically viable solution for SONGS SNF. All offsite disposal or storage alternatives require some form of federal action to succeed. Many require Congress to pass new legislation; those that do not nonetheless require some form of action by executive-branch agencies such as the NRC and DOE.

Unfortunately, the current federal program for nuclear waste management has been dismantled and needs to be rebuilt. The nuclear utility industry, meanwhile, has been largely shielded from any adverse impacts in the near term as a result of successful litigation that stopped the collection of Nuclear Waste Fund fees and resulted in the payment of damages from the Judgment Fund to cover utilities' costs to maintain SNF storage at reactor sites. Similarly, the unravelling of federal nuclear waste management efforts has not affected the NRC's continued storage ruling, further insulating owners of operating reactors from the negative impacts of federal inaction.

Summary of Findings:

- California is significantly affected by the lack of federal action. Within the next five years, California will have seven permanently shuttered commercial nuclear power reactors at four locations, California customers have paid over $2 billion (with interest) to the federal treasury for SNF disposal services, and California ranks sixth in the country in the amount of commercial SNF awaiting federal government disposal.
- The current default situation, in which utilities are reimbursed for ongoing SNF storage costs at nuclear plant sites out of the Judgment Fund, may be politically expedient in the near term. But it will grow increasingly costly for U.S. taxpayers as time goes on. Besides being inefficient from an overall cost standpoint, allowing the status quo to continue is unfair to communities that never consented to host *de facto* long-term SNF storage facilities, to utilities that never intended to be in the long-term nuclear waste management business, and to customers who have already paid for waste management capabilities and services that the federal government has failed to provide.

- Action by Congress is needed to restart the federal nuclear waste management program. For each alternative, the resolution of major uncertainties and the implementation of key steps will require some form of action by Congress, or further policy action by the executive branch.
- Creating the political pressure for Congress to pass legislation requires a concerted push from the wide range of interests that have a stake in fixing the broken federal nuclear waste management program.

The Action Plan describes concrete steps the SONGS co-owners intend to take as part of their ongoing efforts to advance progress toward a resolution of SNF management and disposal challenges. These include actions to:

- Help build the coalitions needed to exert and sustain political pressure on Congress to restart an effective national program, and
- Work with other stakeholders to articulate and advocate for the specific changes that are needed, in legislation and agency policy, to get the national program back on track.

While the immediate objective is to obtain the authority and funding to enable the offsite interim storage alternatives described in this plan, successful implementation of any new federally sponsored interim storage program will require a more comprehensive set of reforms to the national program. Specific provisions and reforms are needed to:

- Authorize a CISF program, linked to permanent disposal but with greater flexibility, and with broad authority to enable multiple forms of business models (including contracting for private storage, implementing a federal CISF, or forming arrangements between the federal government and a non-federal public or private entity).[206]
- Resolve the path forward on a permanent geologic repository by reaching a decision on whether to resume the licensing process for Yucca Mountain or start work toward the development of an alternative geologic repository for the final disposal of all commercial SNF.
- Direct the federal government to develop an efficient framework for prioritizing the shipment of SNF from shutdown reactor sites to either a CISF or a geologic repository, using its authority under the Standard Contract to do so.
- Provide the national program with dependable access to the financial resources needed to execute a large, multi-year capital investment program, subject to appropriate oversight.
- Establish a new single-purpose organization with mission responsibility to implement an effective national program for the safe management and final disposition of nuclear waste in the United States. Several previous reviews of the DOE nuclear waste management program have concluded that this responsibility should be placed in a separate entity outside of DOE.

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[206] Several expert studies, including the BRC report, have concluded that consolidated interim storage capacity would be an important asset for the national nuclear waste management program. The Decommissioning Plant Coalition, a nationwide group of owners of shutdown plant sites, recently echoed this point in testimony before Congress that called for legislative action to authorize the development of federal consolidated interim storage and broader efforts to fix the failures in the federal program. Statement for the Record before the House Subcommittee on Environment and Climate Change, Committee on Energy and Commerce, by Arlen Orchard, CEO of the Sacramento Municipal Utility District, on behalf of the Decommissioning Plant Coalition, June 13, 2019.

- Implement approaches to siting any new waste management facilities that are consistent with best practices based on outcomes in the United States and internationally. This should include establishing a new mechanism for consultation and collaboration between the national program and the state, local, and tribal authorities that have an interest in the location of SNF storage and disposal facilities, or in the transportation of SNF from current reactor sites to these facilities. As the WIPP example demonstrates, efforts to provide for independent health and safety oversight and to affirm a defined, partnership role for states, tribes, and local governments, that includes the ability to reject or veto a site proposal, can be pivotal in gaining support for a facility. Further, incentives for affected jurisdictions to accept the burden of SNF storage or permanent disposal should be both substantial and responsive to those jurisdictions' specific economic and quality-of-life aspirations.
- Clarify the conditions and eligibility criteria that would apply to the recovery of costs from the Judgment Fund in situations where the SNF is moved to an offsite storage facility without the federal government taking title. This clarification also would apply in cases where title to the SNF is transferred from the current owner to a new owner at the CISF facility.

It is worth emphasizing that the above recommended reforms are not new, nor are they unique to SONGS. Broad support already exists for most of these changes. For example, the Nuclear Energy Institute (NEI), the national trade association that represents nuclear utilities, has recently advocated for resolution of the Yucca Mountain repository licensing issue, the authorization of a new interim storage program, and efforts to address the need for a new organization and funding reforms.[207] Industry representatives have also supported changes in the queue to assign priority to moving SNF from shutdown reactor sites.[208] Finally, many of these reforms are reflected in legislation that has already been introduced in Congress. To a large extent, the lack of consensus over whether to proceed with licensing of the proposed Yucca Mountain repository has been the stumbling block to action.

8.6 Conclusion

This Strategic Plan has focused on specific options and opportunities for relocating the SNF and GTCC waste that is currently being stored at the SONGS plant site. Together with the Action Plan and Conceptual Transportation Plan for relocating SONGS SNF (Volumes I and III of this compendium, respectively), it aims to help the SONGS co-owners, and the many stakeholders who have an interest in this issue, achieve the overarching and widely shared objective of removing all nuclear waste so that the SONGS site can be fully decommissioned and returned to the U.S. Navy.

The necessity for this Plan arises from the simple fact that no offsite facility currently exists that could accept the SONGS SNF. Nor is there an obvious path to develop such a facility that is commercially reasonable, fully within the control of the SONGS co-owners, and certain to achieve the relocation of SONGS SNF in a timeframe that aligns with the preferences and expectations of surrounding communities and the SONGS co-owners themselves.

In that context, our findings stress the importance of flexibility, persistence, continued corporate commitment, and vigorous engagement with a range of stakeholders and potential partners to keep

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[207] Statement for the Record before the Senate Energy and Natural Resources Committee, by Maria Korsnick, President and CEO, Nuclear Energy Institute, June 27, 2019.
[208] Testimony of Henry Barron, President and CEO of Constellation Energy Nuclear Group, LLC, before the Senate Energy and Natural Resources Committee, 2012.

pushing for progress—not only in terms of pursuing specific offsite storage or disposal alternatives for the SONGS SNF, but to address the larger breakdown in the federal nuclear waste management program that is at the root of the current impasse.

Fortunately, history suggests that possibilities for change can emerge quickly, even in seemingly intractable situations, when motivated leadership converges with a broader appreciation of the costs and liabilities of maintaining the status quo. Compared to other shutdown plant sites where the continued presence of SNF storage installations has not attracted much attention, SONGS is unique—in part because of its oceanside location, but also because the Navy's desire to have its land back for other uses adds impetus to the quest for offsite storage or disposal alternatives. But in other important respects SONGS is not unique and the issues detailed in this Strategic Plan can be expected to resonate for growing numbers of utilities and host communities as additional nuclear plants retire in the years to come. All of which means that the stakes in persevering to find a solution are higher—and the prospects for success perhaps also greater—than they would be if the lack of an effective, long-term strategy for managing and safely disposing of spent nuclear fuel were a problem for SONGS alone.

GLOSSARY

Alternative: Solutions for moving the SONGS spent nuclear fuel that receive some level of evaluation in the Strategic Plan, roughly distinguished by receiving facility owner (DOE or private) and type (interim storage or repository). Seven alternatives are considered in the Strategic Plan.

Bare Fuel Cask (BFC): A non-canister-based spent fuel transportation cask design comprising a segmented basket for accommodating individual fuel assemblies. This transportation technology was the basis for the DOE Standard Contract.

Canister: A seal-welded steel vessel designed for containing spent fuel assemblies. The canister provides the storage confinement boundary that limits the escape of radioactive material, as required by 10 CFR 72. The canister also provides internal structures that preclude criticality and support heat transfer to the shell.

Carrier: An entity that transports passengers or property for compensation, e.g., trucking company, railroad, or barge company.

Consolidated Interim Storage Facility (CISF): A facility that provides interim storage of spent nuclear fuel and GTCC waste awaiting development of a final repository. Distinct from an ISFSI in that it would store material from multiple nuclear plant sites (hence "consolidated").

Certificate of Compliance (CoC): Certificates of Compliance confer NRC approval of a used fuel storage cask design (under 10 CFR 72) or radioactive material transportation package (under 10 CFR 71).

Code of Federal Regulations (CFR): The codification of the general and permanent rules and regulations (sometimes called administrative law) published in the Federal Register by the executive departments and agencies of the federal government of the United States.

- 10 CFR 50 – Production and Utilization Facilities (e.g., reactor)
- 10 CFR 60 – Disposal of high-level radioactive wastes in geologic repositories
- 10 CFR 63 – Disposal of high-level radioactive wastes in a geologic repository at Yucca Mountain, Nevada
- 10 CFR 71 – Packaging and Transportation of Radioactive Material
- 10 CFR 72 – Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste
- 10 CFR 73 – Physical Protection of Plants and Materials

Consignment: Each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

Disposal: Permanent emplacement and isolation of spent nuclear fuel, high-level waste, and GTCC waste.

Dry Shielded Canister (DSC): The TN brand name for the canister design used in the NUHOMS dry spent fuel storage system technology. The 24PT1 DSC model is used to store all SONGS Unit 1 fuel and the 24PT4DSC model is used to store some SONGS Units 2 and 3 fuel in the Advanced NUHOMS System at the on-site ISFSI.

Dual Purpose Canister (DPC): A canister designed for certification by the NRC for storage in a concrete/steel storage cask or module and transportation in a robust steel shipping cask, respectively. All canisters storing fuel at the SONGS ISFSIs are DPCs.

Final Safety Analysis Report (FSAR): A document that describes the power plant, storage facility, or storage cask design, presents the design bases and the limits on its operation, and presents the safety analyses of the structures, systems, and components. The term "FSAR" is used in the context of 10 CFR 50 and 10 CFR 72 licenses and CoCs.

Freight Forwarder: A person or entity which holds itself out to the general public to provide transportation of property for compensation and in the ordinary course of its business. A freight forwarder:

- Assembles and consolidates, or provides for assembling and consolidating, shipments and performs break-bulk and distribution operations of the shipments
- Assumes responsibility for the transportation from the place of receipt to the place of destination
- Uses for any part of the transportation a rail, motor, or water carrier subject to the jurisdiction of either the Federal Motor Carrier Safety Administration (FMCSA) or the Surface Transportation Board

Greater Than Class C (GTCC) Waste: Low-level radioactive waste exceeding the Class C limits for radioactive content. This typically comprises non-spent fuel components exposed to irradiation in the reactor during operation, such as reactor structural components and in-core instrumentation.

HI-STAR: The Holtec brand name for their spent fuel transportation package. The HI-STAR 190 is the package associated with the Holtec MPCs used at SONGS.

HI-STORE: The Holtec brand name for the CISF being developed in eastern New Mexico.

HI-STORM UMAX: The Holtec brand name for the underground, canister-based, vertical, dry spent fuel storage system used at the SONGS Holtec ISFSI.

Holtec International (Holtec): The company that owns the design for the SONGS dry spent fuel storage technology used at the Holtec ISFSI (HI-STORM UMAX). This is also the company that is developing a CISF at the HI-STORE facility in eastern New Mexico.

Horizontal Storage Module (HSM): A reinforced concrete structure for storage of a loaded DSC at a spent fuel storage installation in the horizontal orientation. HSMs are part of the Advanced NUHOMS® System used at the SONGS TN ISFSI.

Independent Spent Fuel Storage Installation (ISFSI): A complex designed and constructed for the interim storage of spent nuclear fuel, solid reactor-related greater than class C waste and other radioactive materials associated with used fuel and reactor-related waste storage. An ISFSI which is located on the site of another facility licensed under part 72 or a facility licensed under Part 50 and which shares common utilities and services with that facility or is physically connected with that other facility may still be considered independent.

Interim Storage: A temporary, off-site spent fuel storage solution that allows full decommissioning of the power plant site and NRC license termination while a permanent spent fuel repository is developed by the federal government.

Interim Storage Partners (ISP): The entity that is developing a CISF at the Waste Control Specialists (WCS) facility in west Texas. ISP is a joint venture of Orano and WCS.

License: A license issued by the Nuclear Regulatory Commission for the operation of a power plant, ISFSI, or other facility.

Licensee: The holder of an NRC license who is authorized to conduct activities under a license issued by the Commission.

Monitored Retrievable Storage (MRS) facility: A federal CISF subject to design requirements and limitations defined and authorized in the Nuclear Waste Policy Act. An NWPA MRS facility is currently the only facility other than a geologic repository that DOE could use for storage of SNF accepted from utilities.

MPC: The Holtec brand name for their Multi-Purpose Canister design. The MPC-37 is used to store about three-quarters of the SONGS Units 2 and 3 fuel in the HI-STORM UMAX System at the Holtec ISFSI[a].

NUHOMS: The TN brand name for its horizontal, canister-based dry spent fuel storage system. At SONGS, the Advanced NUHOMS® System is used at the TN ISFSI.

Private Shipment Model: A transportation plan that does not involve the Department of Energy. Title to the fuel will be retained by a private corporation and not transferred to DOE. This means the movement of the fuel does not satisfy DOE's obligations under the Nuclear Waste Policy Act or otherwise invoke any specific provisions of the Act. Shipper is likewise not obligated to any other commitments DOE may have made regarding transportation.

Queue: In the context of the Standard Contracts, the Department of Energy has established an order for federal acceptance of SNF for disposal based on "oldest fuel first" (OFF), where the age of the fuel is based on date of discharge from a reactor. There are options in the Standard Contract for utilities to exchange their place in the queue for other fuel assemblies at the same plant, or at another nuclear plant. This creates the opportunity for a marketplace for acceptance positioning. There is also the option for DOE to assign priority to acceptance of SNF from sites where there is no longer an operating reactor, independent of the OFF queue, which creates the opportunity for such sites to be cleared of SNF substantially faster than would be the case under the OFF queue.

Repository: A facility for permanent geologic disposal of spent nuclear fuel, high-level waste, and GTCC waste.

Safety Analysis Report (SAR): A document that describes the transportation package design, presents the design bases and the limits on its operation, and presents the safety analyses of the structures, systems, and components. The term "SAR" is used in the context of 10 CFR 71 CoCs.

Shipper: The entity offering a consignment for transport. In the context of this Strategic Plan, the shipper is either the licensee for the spent fuel at SONGS or the Department of Energy, depending on the alternative being discussed.

Stakeholder: Any entity that is affected by, or that is interested in, the movement of spent fuel from SONGS to an offsite storage location.

Transfer Cask: A shielded cask used for on-site loading of the canisters in a spent fuel pool and facilitating transfer of the canisters to the HSM or VVM for storage. A transfer cask is also required to move the Holtec canisters from the storage VVMs to the transport cask.

Transport Cask: A shielded cask used for offsite shipment of SONGS DPCs. The transport cask contains the canister during shipment. Also known as a "shipping cask."

Transportation Package: The packaging together with its radioactive contents as presented for transport. With respect to SONGS SNF more specifically, the transport cask, canister, and impact limiters certified by the NRC under 10 CFR 71. The Orano TN MP187, Orano TN MP197, and the Holtec HI-STAR 190 transportation package designs are associated with the 24PT1, 24PT4 and MPC-37 canisters used at SONGS, respectively.

Transportation Packaging: The assembly of components necessary to ensure compliance with the packaging requirements of this part. Packaging may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging.

Variant: A concept within an alternative that differs from the baseline concept in some way that requires unique discussion within the assessment of an alternative. For example, the private CISF alternative includes variants for SNF ownership and for transportation.

Vertical Ventilated Module (VVM): The Holtec brand name for a vertical, ventilated underground storage module containing an MPC that is part of the HI-STORM UMAX System used at the SONGS Holtec ISFSI.

Waste Control Specialists (WCS): Owners of a disposal facility for low-level radioactive waste located in west Texas and a party to the ISP joint venture.

Yucca Mountain: The location selected by Congress in 1987 as the only site for evaluation of suitability for a national repository for the disposal of spent nuclear fuel, high-level waste, and GTCC waste. Yucca Mountain is in the state of Nevada, and entirely on land owned by the federal government.

ACRONYMS

AEA	Atomic Energy Act
BFC	bare fuel cask
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BRC	Blue Ribbon Commission on America's Nuclear Future
CCC	California Coastal Commission
CEC	California Energy Commission
CEP	Community Engagement Panel
CEQA	California Environmental Quality Act
CISF	consolidated interim storage facility
CFR	Code of Federal Regulations
CoC	certificate of compliance
CPUC	California Public Utilities Commission
DFC	damaged fuel can (or canister)
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DSC	dry shielded canister
DFM	Division of Fuel Management (NRC)
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ER	environmental report
FSAR	final safety analysis report
GTCC	greater than Class C
HB	Humboldt Bay
HBU	high burnup
HI-STAR	Holtec International Storage, Transport and Repository
HI-STORM	Holtec International Storage Reinforced Module
HI-TRAC	Holtec International Transfer Cask
Holtec	Holtec International
ISFSI	independent spent fuel storage installation
IWMS	integrated waste management system
MTHM	metric tons heavy metal

MTU	metric tons uranium
MWd/MTU	megawatt-day per metric ton uranium
JF	Judgment Fund
MPC	multi-purpose canister
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NEWCO	new company (generic and unnamed)
NGO	non-government organization
NRC	U.S. Nuclear Regulatory Commission
NUHOMS	Nutech Horizontal Modular System
NWF	Nuclear Waste Fund
NWPA	Nuclear Waste Policy Act
NWT	North Wind team
NWTRB	U.S. Nuclear Waste Technical Review Board
O&M	Operations and maintenance
OMB	U.S. Office of Management and Budget
PAA	Price-Anderson Act
PG&E	Pacific Gas and Electric
PILT	payment in lieu of taxes
PWR	pressurized water reactor
PVGS	Palo Verde Generating Station
SAR	safety analysis report
SCE	Southern California Edison
SER	safety evaluation report
SFP	spent fuel pool
SMUD	Sacramento Municipal Utility District
SNF	spent nuclear fuel
SONGS	San Onofre Nuclear Generating Station
TC	transfer cask
TN	Transnuclear (now Orano-TN)
VVM	vertical ventilated module
WGA	Western Governors' Association
WIEB	Western Interstate Energy Board
YM	Yucca Mountain
YMP	Yucca Mountain project

APPENDIX A

NORTH WIND TEAM BIOGRAPHIES

BIOGRAPHIES: NORTH WIND TEAM

ABOUT US

North Wind, Inc., founded in Idaho Falls, Idaho in 1979, is a nationwide small business leader in the engineering, environmental, construction, and technical services industries providing creative and practical solutions to complex problems. North Wind provides innovative and comprehensive solutions to complex hazardous and radiological remediation, D&D, and waste management challenges. The experience we bring includes past performance of nuclear facility and system engineering evaluation, facility design, project cost and schedule reviews. It also includes the analysis and evaluation of proposed nuclear facilities and reactors, independent technical reviews and recommendations for the implementation of future nuclear programs, storage cask manufacturing, nuclear regulatory reviews, and actual code development.

North Wind brings together for this work a team of highly experienced and nationally recognized professionals, many of whom affiliated with North Wind specifically to support finding a solution to spent nuclear fuel disposition. EJM Associates, for example, is a Washington D.C.-based advisory firm launched in 2017 by its founder, Dr. Ernest Moniz, former Secretary of Energy. Dr. Moniz will serve as senior advisor to the project.

THE TEAM

Elizabeth Helvey, PMP | Project Manager

Elizabeth Helvey has over 25 years of experience designing stakeholder engagement strategies related to the transportation of SNF. Ms. Helvey specializes in working with state and tribal governments to prepare emergency responders, elected officials, and the general public along the routes used for shipments of SNF. She has supported the U.S. Department of Energy's (DOE) efforts with the National Transportation Stakeholder Forum, the Transportation Core Group comprised of state and tribal officials who advise DOE on transportation issues related to SNF, and the Tribal Radioactive Materials Transportation working group. She has also supported DOE's recent consent-based siting effort and the Office of the Nuclear Waste Negotiator's work to site an interim storage facility.

Phillip Niedzielski-Eichner | Senior Project and Policy Advisor

Mr. Niedzielski-Eichner has over 40 years of experience in government and corporate strategic, policy, program, and project leadership with a particular focus on the nuclear fuel cycle, including spent fuel and nuclear materials management, nuclear clean-up, and environmental stewardship. He is an expert on the social and political challenges and opportunities for siting storage and disposal facilities for spent nuclear fuel (SNF) and defense high-level nuclear wastes (HLW). He served communities designated as candidate sites for hosting a SNF Monitored Retrievable Storage facility (Oak Ridge site) and a SNF/High-Level Waste deep geologic repository (Deaf Smith and Yucca Mountain sites). Following the Report of the Blue Ribbon Commission on America's Nuclear Future, Mr. Niedzielski-Eichner led the crafting of the Obama Administration's response and implementation strategy for the management and disposal of SNF and HLW. He served as Chief of Staff to the Chairman of the Nuclear Regulatory Commission (NRC).

Ernest Moniz, PhD | EJM Associates | Senior Advisor

Ernest J. Moniz is a nuclear physicist and President and CEO of EJM Associates and the Energy Futures Initiative. Professor Moniz served as the 13th U.S. Secretary of Energy. In that role, he advanced energy technology innovation, nuclear security and strategic stability, cutting-edge capabilities for the American scientific research community, and environmental stewardship. A key architect of the Paris Agreement on climate change and Mission Innovation at COP 21, Professor Moniz championed international initiatives that placed energy, science, and technological innovation at the center of the global response to the climate crisis. He also negotiated the historic Iran nuclear agreement alongside Secretary of State John Kerry. He is CEO of the Nuclear Threat Initiative, MIT Cecil and Ida Green Professor of Physics and Engineering Systems Emeritus, Founder of the MIT Energy Initiative, and Director of the Laboratory for Energy and the Environment.

Brian Gutherman, PE | Regulatory and Licensing Specialist

Brian Gutherman has over 36 years of experience in the nuclear energy field, the last 20 of which involve 10 CFR 72 and 10 CFR 71 regulatory matters governing SNF storage and transportation. Mr. Gutherman is a nationally recognized expert in dry spent fuel storage cask design, licensing, and operation including deep knowledge with the two suppliers and storage technologies used at SONGS. Mr. Gutherman is recognized as an expert in the field by the NRC's Division of Spent Fuel Storage and Transportation and has authored industry guidance documents used nationwide by Independent Spent Fuel Storage Installation licensees and Cask Certificate of Compliance holders and provided training on their use. He has also consulted to both Nuclear Energy Institute and DOE in evaluating the cost of designing, constructing, licensing, and operating a spent fuel interim storage facility under the NRC's 10 CFR 72 regulations.

Joseph Hezir | EJM Associates | Strategic Planning and Option Analysis

Joseph Hezir served as Chief Financial Officer and Senior Advisor to the Secretary of Energy and OMB Deputy Associate Director for Energy and Science. He was a key contributor to the First and Second Installments of the Energy Department's Quadrennial Energy Review. He was Research Engineer and Senior Advisor with the MIT Energy Initiative. As senior advisor to the BRC on America's Nuclear Energy Future, Mr. Hezir was also Managing Partner with the EOP Group, where he advised on nuclear waste management issues.

Mary Woollen, LCSW | Stakeholder Engagement

Mary Woollen has unparalleled knowledge of historical attempts to site radioactive waste facilities in the U.S. and internationally. She has expertise in stakeholder relations as it relates to the management and storage of SNF, including personal relationships with key individuals and leaders within U.S. environmental and advocacy groups and government agencies. She has more than 15 years of experience developing strategic plans guiding organizational and agency approach to stakeholder concerns such that a program continues to move towards successful outcomes. She has a proven track record working productively with people of differing viewpoints and values.

James Voss, EURING, FNUCI, CENG | Engineering and Operations

James Voss is a nuclear engineer with over 40 years of experience in major nuclear and environmental projects. He has supported the development of strategic plans for SNF and radioactive wastes management in the U.S., Japan, Australia, Germany, the United Kingdom, and elsewhere. He has extensive experience in all aspects of planning for SNF management. Mr. Voss has conducted dozens of economic and commercial analyses for major nuclear programs, including for commercial development of SNF storage facilities in the U.S. and public private partnerships for radioactive waste treatment and disposal. As a Senior Executive, Mr. Voss has developed and successfully raised over $1 billion in equity, tax equity, debt, and sovereign wealth for nuclear and environmental projects, each requiring in-depth economic and commercial assessments.

Marika Tatsutani | Writer and Editor

Marika Tatsutani has more than 30 years of experience in energy policy and more than 20 years of experience as a technical writer and editor on energy and environmental issues. She was the lead author of the Blue Ribbon Commission on America's Nuclear Future report and the U.S. Department of Energy's Final Report on Designing a Consent-Based Siting Process: Summary of Public Input. Ms. Tatsutani has worked on major reports with a range of organizations, including the MIT Energy Initiative, the Bipartisan Policy Center, the Nuclear Energy Institute, and the Harvard Project on International Climate Agreements, among numerous others.

Dr. Thomas Cotton | Senior Policy Advisor

Dr. Thomas Cotton has over 45 years of experience in Washington, D.C. analyzing technical and policy issues and supporting decisions by Congress and the Executive branch, with the last 40 years focused on management and disposal of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). Beginning in 1978 he directed the Congressional Office of Technology Assessment's (OTA) comprehensive 7-year long project covering all key technical and institutional aspects of management of SNF and HLW that supported Congressional passage, and subsequent oversight of the implementation, of the Nuclear Waste Policy Act of 1982. Since 1987 he has supported the efforts of the Department of Energy (DOE) to implement the Act, focusing on SNF storage and disposal issues. He has supported SNF strategic planning, legislative/regulatory analyses, SNF system analyses, decision analyses, strategic communication, and relations with external technical and stakeholder groups. He supported the BRC and the DOE Management and Disposition Working Group established to recommend a strategy for implementing BRC recommendations. Since then he has supported DOE's efforts to design a consent-based siting process and other SNF Storage and Transportation program activities.

Tom Hassenboehler | Legal Analyst

Tom Hassenboehler is a partner with the Coefficient Group. He recently served as the Chief Counsel for Energy and Environment at the U.S. House Committee on Energy and Commerce under Chairman Greg Walden (R-Oregon). During his time in the House, he led and managed the issues and staff under the jurisdiction of the Subcommittees on Energy and Environment. He successfully oversaw bipartisan Committee passage of reauthorizations of several energy and environmental laws, and the launching of the Powering America hearing series, a comprehensive review of emerging issues affecting the nation's electricity markets. He previously served as Chief Counsel for Energy under Chairman Fred Upton (R-Michigan), worked in the private sector as the Vice President of Policy Development and Legislative Affairs for America's Natural Gas Alliance, and was in the Senate as Counsel for the Committee on Environment and Public Works under Ranking Member Jim Inhofe (R-Oklahoma). He focused on Clean Air Act, climate and fuels-related issues while conducting bipartisan oversight. Tom is the founder and Executive Director of the Energy Consumer-Market Alignment Project (EC-MAP).

OTHER TEAM MEMBERS

- **Jeanette Pablo | EJM Associates | Legislative and Legal Analysis**
- **Joseph Rivers | Rivers Consulting | Environmental Analysis**
- **Steven Croley | Policy and Legal Analysis**
- **Sam Savitz | EJM Associates | Analyst**
- **Timothy Runyon | Transportation Regulatory and Facility Siting Specialist**

APPENDIX B

STAKEHOLDERS INTERVIEWED AS PART OF STRATEGIC PLAN DEVELOPMENT PROCESS

The following individuals were interviewed in 2019 and early 2020 as part of North Wind's stakeholder engagement to help inform the development of the Strategic Plan (see discussion in Chapter 4 of the Plan). North Wind thanks these individuals for their input. Their inclusion on this list does not indicate support for the Strategic Plan or concurrence with any statements made in the Plan.*

Michael Aguirre	Aguirre & Severson
Donna Boston	Office of Emergency Management, Orange County
Glenn Brummage	San Onofre Surfing and Cultural Heritage
Justin Cochran	California Energy Commission
Katie Day	Surfrider Foundation
Mark Delin	Assistant City Manager, City of Encinitas
Mark Denny	City Manager, City of Dana Point
Neil Driscoll	Scripps Institution of Oceanography Department
Dave Druker	Mayor, City of Del Mar
Geoff Fettus	Natural Resources Defense Council (Washington D.C.)
Regena Field	Interested citizen
Ryan Fitzpatrick	Third Way (Washington D.C.)
Kyle Krahel Froelander	Office of Congressman Levin, CA 49th District
Terry Gaasterland	Council Member, City of Del Mar
Jason Haber	Assistant to City Manager, City of Carlsbad
Matt Hall	Mayor, City of Carlsbad
Patricia Halloway	Capistrano Unified School District
Amy Hanacek	Capistrano Unified School District
Gary Headrick	San Clemente Green
Laurie Headrick	San Clemente Green
Bruce Higgins	Interested citizen
Elgie Holstein	Environmental Defense Fund (Washington D.C.)
Rob Howard	Utility Workers Union of America
Angela Howe	Surfrider Foundation
Molly Johnson	Mothers for Peace- San Luis Obispo
Roger Johnson	Interested citizen
Judith Jones	Alliance for Nuclear Responsibility
Jackie Kempfer	Third Way (Washington D.C.)
Jerry Kern	City Council Member, City of Oceanside
Pete Lawrence	Chief, Division of Administration, City of Oceanside
Jim Leach	South Orange County Economic Coalition

Mike Levin	U.S. Representative for the 49th District of California
Steve Long	San Onofre Parks Foundation
Ray Lutz	Citizen's Oversight
Valentine Macedo	Laborers International Union of North America- Local 89
Marni Magna	Sierra Club, Angeles Chapter
Lynn Mata	Emergency Services Manager, City of San Juan Capistrano
Martha McNicholas	Capistrano Unified School District
Bob Mignona	San Onofre Parks Foundation
Joe Muller	Mayor Pro Tem, City of Dana Point
Glenn Pascall	Sierra Club (Angeles Chapter)
Scott Peters	U.S. Representative for the 52nd District of California
John Pietig	City Manager, City of Laguna Beach
Mary Ann Pintar	Office of Congressman Peters, CA 52nd District
Rich Powell	Clear Path (Washington D.C.)
Caroline Reiser	Natural Resources Defense Council (Washington D.C.)
Mandy Sackett	Surfrider Foundation
Robert Sedita	Director of General Services, City of Dana Point
Linda Seely	Mothers for Peace- San Luis Obispo
Maria Severson	Aguirre & Severson
Dan Stetson	Nicholas Endowment
Lindsey Stigall	Senior Management Analyst, City of San Juan Capistrano
Gene Stone	Residents Organized for a Safe Environment
Jane Swanson	Mothers for Peace – San Luis Obispo
John Taylor	City Council Member, City of San Juan Capistrano
Jeff Toney	San Diego County Office of Emergency Services
Floyd Velasquez	Morongo Tribe of Mission Indians
Mel Vernon	Captain, San Luis Rey Band of Mission Indians
David Victor	School of Global Policy and Strategy, University of California at San Diego
Charlie View	Assistant City Manager, City of San Juan Capistrano
David Weisman	Alliance for Nuclear Responsibility – San Luis Obispo
Peter Weiss	Mayor, City of Oceanside
Bob Whalen	Mayor, City of Laguna Beach
Ed Wimmer	Engineer, City of Encinitas

* A few individuals interviewed by North Wind did not wish to be identified and are not included in this list.

APPENDIX C

AVAILABILITY OF FINANCIAL PROTECTION AND INDEMNIFICATION

Availability of Financial Protection and Indemnification for the Transport of Spent Nuclear Fuel and Reactor-Related Greater-Than-Class C Waste from the San Onofre Nuclear Generating Station to Offsite Storage and/or Disposal

A Discussion of Financial Protection and Indemnification Available to Cover Liability Claims of Members of the Public for Personal Injury and Property Damage

I. Overview

Under authority provided in the Nuclear Waste Policy Act (NWPA),[1] the U.S. Department of Energy (DOE) has entered into contracts (Standard Contract[2]) to make available nuclear waste disposal services to "any person who generates or holds title to" spent nuclear fuel (SNF) and high-level radioactive waste (HLW).[3] The NWPA specifies that:

> "...following commencement of a repository, the Secretary shall take title to the high-level radioactive waste or spent nuclear fuel involved as expeditiously as practicable upon the request of the generator or owner of such waste or spent fuel..." [4]

A federal repository for such purposes has yet to be licensed and constructed. In the interim, both DOE and private industry have begun to explore the possibility of constructing and operating consolidated interim storage facilities (individually, CISF) for the storage of SNF and reactor-related, greater-than-Class C low-level radioactive waste (GTCC[5]) until such time that a repository becomes available for disposal of this material.

There are a multitude of options for developing a CISF and the associated transportation infrastructure for managing SNF and GTCC until such time that a geologic repository becomes available for permanent disposal. The options span the range from completely federal to completely private deployment, ownership of assets, and management of operations. As of this date, two private initiatives (individually, PI) have stepped forward and submitted license applications to the Nuclear Regulatory Commission (NRC) for approval to develop and operate a private CISF for commercial nuclear industry use.[6]

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1 Nuclear Waste Policy Act of 1982 (as amended through Public Law 102-486) (NWPA), Section 302.

2 NRC Regulations, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste, Title 10 C.F.R. §961.

3 The Standard Contract uses the term "Purchaser" when referring to those entities who generate or hold title to SNF and/or HLW. "Purchaser" is defined as any person, other than a Federal agency, who is licensed by the Nuclear Regulatory Commission to use a utilization or production facility under the authority of sections 103 or 104 of the Atomic Energy Act of 1954, 42 U.S.C. 2133, 2134, or who has title to spent nuclear fuel or high-level radioactive waste and who has executed a contract with DOE (see 10 CFR Part 961.3). Typically, these NRC licensees will not only be generators of SNF and/or HLW but will also hold title to such waste.

4 NWPA, Section 302(a)(5)(A).

5 As discussed in Section IV, the U.S. Court of Appeals for the Federal Circuit has ruled that the Standard Contract's definition of HLW includes reactor-origin GTCC. While this ruling may be challenged at some time in the future, this paper assumes the current definition as ruled by the Court of Appeals.

6 The license applicants for the two private initiatives are Holtec International in Lea County, New Mexico, and Interim Storage Partners, LLC in Andrews County, Texas.

DOE has created a strategy to pursue the development of interim storage for SNF and GTCC.[7] DOE has the authority under the NWPA to develop and operate a Monitored Retrievable Storage (MRS) facility[8] utilizing the Nuclear Waste Fund (NWF), when certain statutory conditions regarding the development of a federal geologic repository are met.

However, DOE previously concluded they do not have the authority under the NWPA to provide interim storage services under current law,[9] and DOE has recently questioned in a Report to Congress whether it has any non-NWPA authority (specifically, under the Atomic Energy Act of 195 4[0]) to accept SNF from decommissioned reactors for storage. DOE's conclusion in its Report to Congress is that it does not have the authority to do so.[11] Additionally, based upon language in the NWPA, it appears DOE does not have the authority to utilize the NWF established by the NWPA, to participate in the development and operation of a PI or government-owned, contractor-operated (GOCO) CISF.[12]

For these reasons, were DOE to participate in the development and operation of a PI or GOCO CISF, or contract with a PI for storage capability, it appears DOE would require the legislative authority and Congressional appropriations to do so.

II. Issue Description

Southern California Edison (SCE) is the majority owner and NRC Part 50 licensed operator at the San Onofre Nuclear Generating Station (SONGS).[13] The SONGS licensees collectively are title holders to SNF and GTCC at SONGS,[1 4] and SCE is the named "Purchaser" in the SONGS DOE Standard Contract. SCE has contracted with the North Wind Team (NWT) to develop a Strategic Plan (SP) that analyzes alternatives for moving the SONGS SNF and GTCC to an offsite location. The alternatives the NWT is to consider at the time of this writing include:

(1) Federal CISF

(2) Private CISF

(3) SCE Offsite Independent Spent Fuel Storage Installation (ISFSI)

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7 "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," U.S. Department of Energy, January 2013.

8 Under the NWPA, DOE has the authority to design, construct and operate an MRS upon meeting certain statutory conditions. These conditions are found in the NWPA, Section 1 8, which addresses construction authorization for such a facility. Most notably, DOE may not begin construction of an MRS until NRC has issued a license to construct a geologic repository (see NWPA Section 1 8(d)(1)) and the MRS would be limited to 10,000 metric tons SNF (see Section 1 8(d)(3)) before repository operations begin. An MRS can be described as technically similar to a CISF, with certain administrative controls.

9 60 FR 21793, Department of Energy, Office of Civilian Radioactive Waste Management, Nuclear Waste Acceptance Issues.

10 Atomic Energy Act of 195 4as amended through Public Law 11 492) (AEA).

11 "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites," DOE/RW-0596, U.S. Department of Energy, December 2008, pp. 6-7.

12 See NWPA, Section 302(d) for allowable uses of the Nuclear Waste Fund.

13 SCE along with San Diego Gas & Electric (SDG&E) are the NRC Part 50 licensees for SONGS Unit 1. SCE along with SDG&E and the City of Riverside are the NRC Part 50 licensees for SONGS Units 2 & 3.

1 4 The SONGS assets are held as undivided interests by the co-owners as joint tenants in common; ownership of SNF and GTCC follows suit.

(4) California-Only CISF

(5) Storage at a Nuclear Power Plant Outside California

(6) Alternative Concepts for Geologic Isolation

A program enabling transportation of SNF and GTCC from SONGS to a facility off site licensed for interim storage and/or disposal, requires the ability to respond to public liability claims for personal injury and property damage caused by the remote possibility of a nuclear waste activity incident. The responsible parties must have adequate financial protection and indemnification for such liability claims. Additionally, since there may be multiple parties involved in transporting and storing SNF and GTCC, the coverage should be "omnibus" (or "no-fault"); the same protection available for the named insured should extend to any other persons who may be legally liable. This financial protection and indemnification should be available regardless of their identity or relationship to the transportation or storage activity.

AHL Consulting has been asked to identify and document the current NRC regulatory and other requirements for providing:

(1) Financial protection and indemnification for the originating site (SONGS) and the various identified receiving sites and licensees.

(2) Financial protection and indemnification for transportation between the originating and receiving sites.

(3) An assessment of the impact of transferring title (or not) to SNF and GTCC – for private or DOE-contracted transportation and storage – on available financial protection and indemnification.

There are numerous hurdles and gates associated with financial protection and indemnification for transportation and storage activities envisioned by the SP. The issues that arise are specific to the approach for acquiring transportation and storage capabilities and services, and are legal, regulatory and policy in nature.

III. DOE Requirements and Representations Under the Standard Contract and as Viewed by the U.S. Court of Federal Claims

The Standard Contract requires that:

> "DOE shall accept title to all SNF and/or HLW, of domestic origin, generated by the civilian nuclear power reactor(s) specified in Appendix A, provide subsequent transportation for such material to the DOE Facility, and dispose of such material in accordance with the terms of this contract."[15]

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[15] Title 10 C.F.R. §961.11, Article (IV)(B)(1).

The Standard Contract's definition of HLW[16] does not explicitly define reactor-origin, GTCC low-level radioactive waste as HLW. However, as adjudicated in the U.S. Court of Federal Claims[17] and upheld in the U.S. Court of Appeals for the Federal Circuit, the definition of HLW is assumed here to include GTCC:

> "In addition, as the trial court [U.S. Court of Federal Claims] found, the record shows that the Government planned to (and would have) removed the GTCC with the SNF. Thus, the trial court correctly determined that the parties interpreted the contract to include GTCC within HLW and acted accordingly."[18]

The Standard Contract defines "DOE Facility" as:

> "...a facility operated by or on behalf of DOE for the purpose of disposing of spent nuclear fuel and/or high-level radioactive waste, or such other facility(ies) to which spent nuclear fuel and high-level radioactive waste may be shipped by DOE prior to its transportation to a disposal facility."[19]

The AEA defines "nuclear waste activities" as used in the PAA to include storage, [20] and the Standard Contract appears to allow DOE to accept SNF and GTCC, and transport it to a DOE CISF (or MRS, were such a "DOE Facility" to exist) for storage, before it may be disposed of at a geologic repository. However, as noted earlier, DOE has the authority under the NWPA to develop and operate an MRS when certain statutory conditions regarding the development of a federal geologic repository are met, but appears not to have the authority to participate in the development and operation of a PI or GOCO CISF without the legislative authority to do so.

A DOE representation in the Standard Contract to perform this nuclear waste activity, states that DOE will:

> "...include in its contract(s) for the operation of any DOE Facility an indemnity agreement based upon Section 170(d) of the Atomic Energy Act of 1954 as amended, a copy of which agreement shall be furnished to the Purchaser; that under said agreement, DOE shall have agreed to indemnify the contractor and other persons indemnified against claims for public liability (as defined in said Act) arising out of or in connection with contractual activities; that the indemnity shall apply to covered nuclear incidents which (1) take place at a contract location; or (2) arise out of or in the course of transportation of source, special nuclear or by-product material to or from a contract location. The obligation of DOE to indemnify shall be subject to the conditions stated in the indemnity agreement."[21]

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16 *Id.* Article (I)(12).

17 U.S. Court of Federal Claims, "Yankee Atomic Electric Company v. United States," No. 98-126C, Filed September 30, 2006, pg. 85.

18 U.S. Court of Appeals for the Federal Circuit, "Yankee Atomic Electric Company et. al. v. United States," 2007-5025, -5026, -5027, -5031, -5032, -5033, Decided August 7, 2008, pg. 17.

19 *Id.* Article (I)(10).

20 AEA, Section 11(ff).

21 Title 10 C.F.R. §961.11, Article XIII.

The Standard Contract also requires DOE to: (1) indemnify all parties which have contracted with DOE, and are involved with transportation, storage and disposal of SNF and GTCC, (2) take title to SNF and GTCC, and (3) transport the material to a DOE Facility (which presumably can be a DOE CISF or MRS). The Standard Contract is between the Purchaser and the federal government and is silent on any PI for storage and/or disposal.

IV. Existing Financial Protection and Indemnification Structure for Transportation and Storage of Spent Nuclear Fuel and Greater-Than-Class C Waste

A. Price-Anderson Act Financial Protection and Indemnification

The Price-Anderson Act (PAA) was enacted into law in 1957 as an amendment to the AEA.[22] The main purposes of the PAA are to:

(1) encourage development of the nuclear industry by providing private industry financial protection for the legal liability resulting from a nuclear incident; and

(2) to ensure the availability of a large pool of funds to provide prompt and orderly compensation of public liability claims arising from a nuclear or radiological incident no matter who may be liable.

The PAA specifies financial protection and indemnification requirements for NRC licensees and DOE contractors, requires omnibus coverage for licensed activities, and provides a ceiling on the amount of total financial liabilities for which NRC licensees and DOE contractors are responsible. The PAA directs NRC licensees and DOE contractors to enter into agreements of indemnification to cover personal injury and property damage to those harmed by a nuclear or radiological incident, including the costs of incident response or precautionary evacuation, and the costs of investigating and defending claims and settlings suits for such damages.[23] The scope of the PAA includes the use, transportation[24] and storage[25] of nuclear fuel at covered facilities. NRC Part 50 licensees are required to maintain PAA financial protection and indemnity coverage for their facilities.

The following table identifies the requirements for financial protection and the availability of indemnification for NRC Part 50 licensees and DOE contractors. The current financial protection and indemnification available to the SONGS licensees is also shown.

Financial protection typically refers to a pool of funds (e.g., insurance policies, deferred premium payments) which can be accessed in the event of a nuclear incident. Indemnification provides compensation in the amounts specified and protects the indemnified party against legal liabilities which may arise beyond the underlying financial protection limits required.

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[22] AEA, Section 170, also known as the Price-Anderson Act.

[23] AEA, Section 11(k) and Section 11(w).

[24] An "insured shipment" as typically defined in 10 CFR Part 140 includes the shipment of material from the insured facility to any other location, but only until the material is removed from a transporting conveyance for any purpose other than the continuation of its transportation.

[25] It should be noted that in this instance, "storage" refers to storage at the Part 50 NRC-licensed facility which includes its NRC Part 72 specific or general license facility. It does not include storage at an away-from-reactor, stand-alone NRC Part 72 facility, which is not included in the Part 50 NRC-licensed "covered facility."

Requirements for financial protection and the availability of indemnification for NRC Part 50 licensees and DOE contractors

Entity	Primary Tier Financial Protection	Secondary Tier Financial Protection	Indemnification
NRC Part 50 Operating Licensee (including SNF stored on-site at an ISFSI under an NRC Part 72 license)	$ 50 million Provided through private insurance.	$13.21 billion[1] Provided through deferred premium payments from all operating licensees.	If the secondary tier financial protection is depleted, Congress is committed to review the incident, and take any actions determined to be necessary for full and prompt compensation of all public liability claims.
NRC Part 50 Shutdown Plant Licensee Applicable to SONGS (including SNF stored on-site at an ISFSI under an NRC Part 72 license)	$100 million[2,3] Provided through private insurance.	No secondary tier required per PAA.	NRC indemnifies licensee for an additional $ 60 million, for a total financial protection of $560 million. Beyond this amount, Congress is committed to review the incident, and take any actions determined to be necessary for full and prompt compensation of all public liability claims.
DOE Contractor (General)	As may be determined by the Secretary of Energy.	Not applicable.	DOE indemnifies contractor up to $13.70 billion total. Beyond this amount, Congress is committed to review the incident, and take any actions determined to be necessary for full and prompt compensation of all public liability claims.
DOE Contractor (Performing Activities Funded by the NWF)	As may be determined by the Secretary of Energy.	Not applicable.	Public liability claims are paid from the Nuclear Waste Fund, in an amount not to exceed $12.58 billion. [4] Beyond this amount, Congress is committed to review the incident, and take any actions determined to be necessary for full and prompt compensation for all public liability claims.
NRC Part 72 Stand-Alone Independent Spent Fuel Storage Installation	As may be determined by the NRC and implemented through a site license condition.	Not applicable.	NRC regulations do not provide NRC indemnification for 10 CFR Part 72 stand-alone ISFSIs. Such facilities do not have PAA protection available to them.

Notes:

1. Ninety-six (96) operating reactors × $131.056 million per reactor deferred premium × 5% excess pro rata share of excess. See "NRC Backgrounder – Nuclear Insurance and Disaster Relief," NRC Office of Public Affairs, April 2019.
2. Amount typically established for retired commercial nuclear power plants. Currently requires regulatory exemption from NRC. See discussion of SONGS Financial Protection and Indemnity below.
3. As of September 2020, the SONGS co-owners have chosen to maintain $ 50 million of primary tier financial protection. As discussed below, the co-owners are authorized to lower that amount to $100 million.
4. Ninety-six (96) operating reactors * $131.056 million per reactor deferred premium (assumes NRC approves currently requested offsite insurance reductions).

B. SONGS Financial Protection and Indemnity

On September 16, 2015, SCE submitted a request for exemption from NRC regulations at 10 CFR Part 140.11(a)(4), to allow a reduction in the level of primary financial protection and withdrawal from participation in the secondary retrospective rating pool (the secondary tier financial protection) for deferred premium charges.[26] NRC Staff reviewed SCE's request and concluded the following:

> "In its September 16, 2015, exemption request, SCE discusses both design-basis and beyond design-basis events involving irradiated fuel stored in the SFPs. The staff independently evaluated the offsite consequences associated with various decommissioning activities, design basis accidents, and beyond design basis accidents at SONGS, in consideration of its permanently shut down and defueled status. The possible design-basis and beyond design basis accident scenarios at SONGS show that the radiological consequences of these accidents are greatly reduced at a permanently shut down and defueled reactor, in comparison to a fueled reactor. Further, the staff has used the offsite radiological release limits established by the U.S. Environmental Protection Agency (EPA) early-phase Protective Action Guidelines (PAGs) of one roentgen equivalent man (rem) at the exclusion area boundary in determining that any possible radiological releases would be minimal and would not require precautionary protective actions (e.g., sheltering in place or evacuation), which could result in offsite liability."[27]

NRC permitted SONGS to reduce the required level of primary financial protection from $450 million to $100 million, as well as to withdraw from participation in the secondary layer of financial protection. One aspect of this arrangement is that while NRC has allowed SONGS to reduce the amount of primary financial protection carried and to withdraw from the secondary financial protection pool, SONGS is eligible to receive NRC indemnification in excess of the $100 million provided by the primary financial protection. There does not appear to be any provisions in the PAA or NRC regulations which allow NRC to reduce its indemnification requirements ($460 million, in this case to reach a total $560 million) specified by the PAA, for NRC licensees which do not have at least $560 million financial protection available.

SCE's request for an exemption addressed a specific set of accident analyses which did not include offsite transportation to a CISF. However, as stated in NRC's issuance of the SONGS exemption:

> "The NRC staff has conducted an evaluation and concluded that, aside from the handling, storage, and *transportation* of spent fuel and radioactive materials for a permanently shut down and defueled reactor, no reasonably conceivable potential incident exists that could cause significant offsite damage."[28] [*Emphasis added.*]

This paper assumes NRC is prepared accept the SONGS licensees' primary level of $100 million financial protection and to provide the SONGS licensees indemnification up to an additional $460 million (total $560 million), for transportation of SNF and GTCC should the SONGS licensees desire to provide such coverage. Once the SNF and GTCC are offloaded at a receiving site, the SONGS licensees can no longer provide such coverage (as discussed in further detail below).

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[26] NRC Accession No. ML15260B188, Letter, Southern California Edison to U.S. Nuclear Regulatory Commission, "Request for Exemption from 10 CFR 140.11(a)(4) San Onofre Nuclear Generating Station Units 1, 2 and 3," September 16, 2015.

[27] Federal Register, Volume 83, Number 8, January 11, 2018 at Page 1385.

[28] *Id.*

C. *Transportation to a Private Initiative Centralized Independent Storage Facility or Geologic Repository*

Private initiatives conducting transportation activities wholly within the private sector, including transportation to a CISF or geologic repository, would have to acquire commercial financial protection. The availability of such instruments is currently unknown.

The SONGS licensees are assumed to be able to provide PAA coverage for transport away from the SONGS site to a PI CISF or geologic repository for SONGS-contracted transporters, if desired. However, as discussed further below, there may be several hurdles impeding the ability to do so.

Alternatively, the PI might consider having DOE assume responsibility for transportation activities from the SONGS site to the PI CISF or geologic repository. While such activities might be allowed by the AEA,[29] DOE would need to seek Congressional appropriations to do so, since such activities are not within the approved use of the NWF.[30] PAA financial protection and indemnity up to $13.7 billion would be available to the DOE contractor performing these activities.

1. Title and Possession Transferred to a Private Initiative Licensee Prior to Transportation

Title and possession to SNF and GTCC may be transferred to a PI licensee (for storage or disposal at a PI CISF or geologic repository) beyond the SONGS site boundary. Title and possession would transfer at the SONGS site boundary, and the SONGS licensees would no longer be the owners of the SNF and GTCC. The PI licensee performs transportation services and becomes the new party to the DOE Standard Contract. Under this scenario, there is no PAA financial protection and indemnification available to the PI for transportation away from the SONGS site, and the PI would be responsible for obtaining such financial protection satisfactory to NRC.

2. SONGS Licensees Retain Title and Contract for Private Initiative Transportation Services

SONGS licensees might retain title to SNF and GTCC as a condition of the PI facility license or might consider maintaining some financial protection and indemnification in accordance with the PAA and NRC regulations. This coverage would normally extend to transportation of SNF and GTCC off site, up to the point where the material is offloaded at its destination (a PI CISF or geologic repository). PAA coverage for SNF and GTCC transported to a PI CISF or geologic repository provided by the SONGS licensees will be limited to the NRC-approved $100 million primary financial protection plus additional $ 460 million NRC-provided indemnification (up to $560 million total coverage).

Although PAA coverage can be provided in this manner, the SONGS licensees and the NRC may be hesitant to do so for the following reasons.

(1) Under the terms of the Standard Contract, DOE is responsible for taking title to and possession of SNF and GTCC, which would protect the SONGS licensees (in excess of $12.6 billion) for any nuclear waste incidents beyond their site boundary, at no cost and no liability.

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[29] AEA, Section 11(ff).

[30] NWPA, Section 302(d).

(2) Since NRC is required by the PAA to provide indemnification up to $560 million, NRC would remain responsible for up to $ 460 million ($560 indemnification maximum less the NRC-approved $100 million primary tier insurance) in the event of a nuclear incident. DOE's assumption of title and possession would eliminate this liability.

(3) SONGS could seek NRC's permission to withdraw the 10 CFR Part 1 40.11 exemption request, provide premium payments for $ 450 million in commercial primary tier financial protection and rejoin the secondary tier retrospective ratings pool for deferred premiums. This would restore the secondary tier financial protection, in excess of $13 billion. It is unknown if NRC (and the insurance carriers) would grant such a request.

(4) There is no longer a large pool of industry assets to fund public liability claims (the secondary tier pool for operating plants) and Congress would be responsible in the event of a transportation incident that led to claims in excess of $560 million.

D. Storage at a Private Initiative Centralized Independent Storage Facility

PAA financial protection requirements and indemnification agreements are not available to PI NRC Part 72 CISF specific licensees for storage of SNF and GTCC. Per NRC regulation, these PAA coverages are only available to NRC licenses issued under 10 CFR Parts 40, 50, 52, 54 and 70.[31] Currently, there are no NRC regulations allowing a PI to license, construct and operate a geologic repository.[32]

Privately-owned and operated CISF licensees will have to procure private liability financial protection and potentially indemnify any contractors involved in the storage activities. The NRC Safety Evaluation Report for Private Fuel Storage (PFS) agrees that no specific financial protection and indemnity requirements exist for non-DOE CISF licensees, [33] and that it is the PI's option to offer the amount of financial protection they intend to procure (subject to approval by NRC):

> PFS has committed to pursue and to maintain financial protection in the maximum commercially available amount of $200 million. The NRC does not have specific insurance and indemnity requirements for Part 72 facilities. PFS's commitment to provide financial protection, in addition to the funding required by NRC regulations, is acceptable to the staff.

Another non-DOE CISF, the 10 CFR Part 72 GE-Hitachi Morris Operation, maintains $200 million in financial protection.[3 4]

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[31] NRC Regulations, Financial Protection Requirements and Indemnity Agreements, Title 10 C.F.R. §1 0.2(a).

[32] NRC Regulations, Disposal of High-Level Radioactive Wastes in a Geologic Repositories, Title 10 C.F.R §60.1 and NRC Regulations, Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada, Title 10 C.F.R §63.1 specify the DOE as the only entity which may license a geologic repository for the disposal of SNF and GTCC.

[33] NRC Accession No. ML003755697, "Safety Evaluation Report of the Site-Related Aspects of the Private Fuel Storage Facility Independent Spent Fuel Storage Installation," Chapter 17, "Financial Qualifications and Decommissioning Funding Assurance," pg. 17-7.

[3 4] NRC Accession No. ML0 3436003 ,4Letter from NRC to Portland General Electric, "Denial of Request for Further Exemption from the Financial Protection Requirements of 10 CFR 1 0.11(a)(4)and Related Amendment to Indemnity Agreement No. B-78 for the Trojan Nuclear Plant," December 2, 200 4

It should be noted that NRC also held that PFS incorporate the license condition that PFS "include provisions in its service agreements requiring customers to retain title to the spent fuel stored and allocating legal and financial liability among PFS and the customers."[35] With this license condition, for events during storage which may lead to claims beyond the $200 million financial protection offered by PFS, NRC required PFS' customers (in this instance, the Part 50 licensees) to retain title and through their service agreements, assume legal and financial responsibility.

The license applicants for the two private initiatives identified earlier – Holtec International in Lea County, New Mexico, and Interim Storage Partners, LLC – have also included license conditions requiring customers to retain title to spent fuel stored, and to allocate legal and financial liability among the licensee and their customers.[36, 37] NRC has both of these license applications under review.

E. Transportation to and Storage at a PI-Owned, DOE-Contracted Consolidated Independent Storage Facility or Geologic Repository

As noted in Section I, without the legislative authority and Congressional appropriations to do so, DOE might not be able to contract with a PI CISF for storage and/or disposal of commercial SNF and GTCC. Were the legislative authority and Congressional appropriates made available to do so, transportation and use of a PI CISF or geologic repository could be covered by DOE's PAA financial protection and indemnification. It is assumed that DOE would contract SNF and GTCC transportation in this scenario.

F. Transportation to and Storage at a DOE-Owned, Contractor-Operated Consolidated Independent Storage Facility or Geologic Repository

As noted in Section I, without the legislative authority and Congressional appropriations to do so, DOE cannot construct and operate a CISF using the NWF and may be limited to construction and operation of an MRS only under certain conditions. Were the legislative authority and Congressional appropriates made available to do so, transportation and use of a DOE GOCO CISF could be covered by DOE's PAA financial protection and indemnification. It is assumed that DOE would contract SNF and GTCC transportation in this scenario.

V. Discussion of the Alternatives

NWT has requested an evaluation of five (5) alternatives for moving SNF and GTCC away from SONGS. The following provides details addressing existing financial protection and indemnification applicable to each of these alternatives, as provided for by the NWPA, the AEA, and the DOE Standard Contract. The discussions which follow are framed by:

- The SONGS licensees currently hold title to and maintain possession of SNF and GTCC at the receiving facility site.

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35 *Id*. Pg. 17-9.

36 NRC Accession No. ML17301A223, see NRC Form 588, "License for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," Holtec International, Docket No. 72-1051, Page 2 of 3.

37 NRC Accession No. ML16133A100, see NRC Form 588, "License for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," Interim Storage Partners LLC (ISP), Docket No. 72-1050, Page 2 of 3.

- The DOE Standard Contract follows the Purchaser (SCE). Unlike the multiple SONGS licensees, only SCE is a party to the Standard Contract; the other SONGS licensees are not. In the event title is transferred to a PI by the SONGS licensees (including SCE), the DOE Standard Contract would follow.

- PAA financial protection and indemnification follows the NRC licensee or the DOE. SONGS licensees utilizing an authorized agent to transport SNF and GTCC off site are covered by the PAA. In this instance, the material is considered to remain under authority of the SONGS licensees until such time it is offloaded at a receiving site. DOE contractors can transport and store SNF and GTCC with the benefits of the PAA's financial protection and indemnity.

- There is no PI 10 CFR Part 72 CISF financial protection and indemnity available under the PAA.

A. Federal Consolidated Interim Storage Facility

If the DOE controls a CISF (or MRS) either as the licensee or as a GOCO, in accordance with the DOE Standard Contract, the DOE has the responsibility and authority to accept SNF and GTCC for disposal at the boundary of the SONGS site. Upon transfer of title and possession to DOE, the SONGS licensees are no longer legally responsible for the transportation and disposition of this material. DOE may transport SNF and GTCC directly to a geologic repository. Alternatively, assuming the legislative authority and Congressional appropriations to do so, DOE might construct and operate a CISF (or MRS) using the NWF or other funding sources, and transport SNF and GTCC to that facility. If the facility were controlled by any other entity, legislation would be required for DOE to utilize it.

If DOE's activities (transportation and storage) are funded by the NWF, the PAA recognizes this alternative as "nuclear waste activities" subject to an agreement of indemnification, which provides in excess of $12.6 billion (to be paid from the NWF) to cover public liability claims for personal injury and property damage caused by the remote possibility of a nuclear waste activity incident. If DOE's activities are funded from other sources, the PAA could offer financial protection and indemnification supplied by the DOE currently in excess of $13.7 billion.

If transportation to a DOE CISF or geologic repository is performed by a PI, the SONGS licensees may choose to engage the PI as their authorized agents, and thus provide the SONGS existing financial protection and indemnification available to the SONGS licensees. In the event of a transportation incident, primary tier insurance of the NRC-approved $100 million with NRC providing an addition $ 460 million indemnification (up to $560 million total), would be available to cover any public liability claims. If the SONGS licensees do not desire to do so, the PI would need to obtain financial protection and indemnification from another source, or contract with the DOE.

B. Private Initiative Consolidated Interim Storage Facility

As discussed above, PI CISFs cannot benefit from PAA coverage and would need to seek private insurance for transportation to and operations of such a facility, if all such activities were privately executed. As also noted earlier, the SONGS licensees might be able provide their NRC-approved $100 million primary tier insurance with NRC providing an addition $ 460 million indemnification (up to $560 million total), subject to the potential hurdles identified earlier, by contracting transportation to the PI.

C. Southern California Edison Independent Spent Fuel Storage Installation Off of the SONGS Site

SCE could design, license, and operate an offsite Independent Spent Fuel Storage Installation (ISFSI). For SCE transport of SNF and GTCC to their private ISFSI (acting similarly to a CISF), SCE could offer its PAA coverage of the NRC-approved $100 million primary tier insurance with NRC providing an addition $ 460 million indemnification (up to $560 million total), to cover any public liability claims, subject to the potential hurdles identified above.

Regardless of the location of such a facility, SCE would obtain a license for the facility under 10 CFR Part 72 specific license provisions. SCE would be acting no differently than any other PI CISF might operating the facility and would not have the benefit of PAA financial protection and indemnification. Similar to PFS and GE-Hitachi Morris, SCE would need to obtain independent financial protection subject to NRC approval, and might remain legally obligated for public claims in excess of the available financial protection.

D. California-Only Consolidated Interim Storage Facility

A CA-only CISF would be licensed as a 10 CFR Part 72 specific license facility and would not have PAA financial protection and indemnification available to it. The facility would need to procure financial protection (e.g., private insurance) to satisfy NRC. NRC might also require the CA-only CISF to include provisions in its service agreements requiring the customers to retain title allocating legal and financial liability among facility and the licensees making use of the facility (as was required for PFS, and has been applied for by Holtec and Interim Storage Partners). Each licensee transporting SNF and GTCC to the facility might need to provide their available PAA coverage to provide financial protection and indemnification.

E. Storage at Another Nuclear Plant Site Outside California

Transfer of title and possession of SONGS SNF and GTCC to another commercial nuclear power plant NRC licensee outside California is possible. The SONGS licensees might be able provide their NRC-approved $100 million primary tier insurance with NRC providing an addition $ 460 million indemnification (up to $560 million total) for transportation to the plant site, subject to the potential hurdles identified above.

Alternatively, the recipient site (if still operating) might be able to take title and possession of the SONGS SNF and GTCC at the SONGS site boundary, and accept responsibility for transport and subsequent storage under their NRC Part 50 operating license and their primary and secondary tier financial protection and indemnification (in excess of $13.21 billion). Whether transported by SONGS or the recipient site, once at the nuclear plant outside California, the financial protection and indemnification available to the recipient site would be relied upon.

If the Palo Verde Nuclear Station (PVNS) were to be the recipient site requiring an expansion of its existing ISFSI under PVNS' NRC Part 50 and NRC Part 72 general licenses, Arizona Public Service (APS) would take possession of the SNF and GTCC through an NRC Part 50 license amendment. In this instance, the SNF and GTCC would be stored at the PVNS ISFSI, and financial protection and indemnification for offsite nuclear liability coverage provided by the PAA for PVNS' NRC Part 50 license would be available. However, if the SONGS SNF and GTCC were to be stored at the PVNS site at an ISFSI licensed separately under an NRC Part 72 specific license, PAA coverage would not be available.

VI. Conclusions

This paper identifies the nuances surrounding financial protection and indemnification of the parties involved in moving SNF and GTCC from the SONGS site. The issues that arise are specific to the approach for acquiring storage and transportation capabilities and services.

Assuming DOE (and its agents) were authorized to perform all transportation, storage, and disposal activities under the NWPA using NWF funds, moving SNF and GTCC from the SONGS site to a DOE Facility would have the benefit of PAA financial protection and indemnification in excess of $12.6 billion. This PAA coverage would be omnibus, providing financial protection for public liability claims for personal injury and property damage caused by the remote possibility of a nuclear waste activity incident off site.

For private initiatives, the SONGS licensees may be able to provide financial protection up to the NRC-approved $100 million with NRC providing an addition $ 460 million indemnification (up to $560 million total) for an offsite transportation incident, subject to the potential hurdles identified above. All offsite private storage initiatives, including any licensed by SCE, or any other initiative including those currently pursuing licenses in Texas and New Mexico, would require the acquisition of private insurance. SNF and GTCC transferred for storage by another NRC Part 50 licensee would have the benefit of financial protection and indemnification available to that licensee, for transport to the PI CISF.

APPENDIX D
SHUTDOWN COMMERCIAL NUCLEAR SITES WITH SPENT FUEL THROUGH 2040

SHUTDOWN COMMERCIAL NUCLEAR SITES WITH SPENT FUEL THROUGH 2040[1]
(by year of last reactor on site shutting down, no second license renewal approved or planned)

Permanently Shutdown Plant Sites with SNF as of the end of 2020 (19 sites/22 Rx)

1. Big Rock Point (1 Rx)
2. Connecticut Yankee (1 Rx)
3. Crystal River (1 Rx)
4. Duane Arnold (1 Rx)
5. Fort Calhoun (1 Rx)
6. Fort St. Vrain (1 Rx)
7. Humboldt Bay (1 Rx)
8. Kewaunee (1 Rx)
9. LaCrosse (1 Rx)
10. Maine Yankee (1 Rx)
11. Oyster Creek (1 Rx)
12. Pilgrim (1 Rx)
13. Rancho Seco (1 Rx)
14. San Onofre (3 Rx)
15. Three Mile Island (1 Rx)*
16. Trojan (1 Rx)
17. Vermont Yankee (1 Rx)
18. Yankee Rowe (1 Rx)
19. Zion (2 Rx)

Permanently Shutdown Plant Sites with SNF as of 2030 (25 sites/31 Rx)

2021: Indian Point (3 Rx)
2022: Palisades (1 Rx)
2025: Diablo Canyon (2 Rx)
2029: R.E. Ginna (1 Rx)
2030: H.B Robinson (1 Rx) and Monticello (1 Rx)

Permanently Shutdown Plant Sites with SNF as of 2040 (37 sites/54 Rx)

2031: Dresden (3 Rx)
2032: Quad Cities (2 Rx)
2033: None
2034 Prairie Island (2 Rx), Cooper (1 Rx), and FitzPatrick (1 Rx)
2036: Calvert Cliffs (2 Rx), Brunswick (2 Rx), and Browns Ferry (3 Rx)
2037: Davis-Besse (1 Rx) and D.C. Cook (2 Rx)
2038: E.I. Hatch (2 Rx) and Arkansas Nuclear One (2 Rx)
2039-2040: None

* The Three Mile Island site hosted two reactors. Only SNF from Unit 1 is stored on site. The damaged SNF and fuel debris resulting from the accident at Unit 2 is stored at an ISFSI located at Idaho National Laboratory and managed by DOE.

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[1] Source: Gutherman Technical Services, LLC.

APPENDIX E

LEGISLATIVE INITIATIVES IN THE 116TH CONGRESS

Several bills were introduced in the 116th Congress to revise current nuclear waste management policies in an attempt to move forward with specific programs and actions.[1] Many of these bills include new authorities for a CISF. Several of the major bills retain a linkage between a CISF and the Yucca Mountain repository (e.g. requiring final action by the NRC on the Yucca Mountain license application prior to opening a CISF); several legislative proposals in the Senate authorize work on a CISF independent of Yucca Mountain licensing process. See Table 5.2 in the main text for a summary; a more detailed synopsis of each bill follows.

Senate Bills

Nuclear Waste Administration Act of 2019 (S. 1234)

Sponsor: Lisa Murkowski (R-AK); Co-Sponsors: Lamar Alexander (R-TN), Dianne Feinstein (D-CA)
Status as of October 2020: hearings held by Committee on Energy and Natural Resources

The purpose of this bill[2] is to create a new Nuclear Waste Administration (NWA) to assume the powers and duties of DOE regarding siting, licensing, construction, and operation of nuclear waste management facilities. The mission of the NWA would be to work with affected parties—including state, local, and tribal entities—to identify interim storage facilities. The deadlines would be set at 2025 for an interim storage facility, 2029 for a storage facility for nonpriority waste, and 2052 for a permanent repository.

STRANDED Act of 2019 (S. 1985)

Sponsor: Tammy Duckworth (D-IL); Co-Sponsors: Susan Collins (R-ME), Angus King (I-ME), Ed Markey (I-ME), Bernie Sanders (I- VT), Tammy Baldwin (D-WI)

Status as of October 2020: read twice and referred to Committee on Environment and Public Works
The Sensible, Timely Relief for America's Nuclear Districts' Economic Development (STRANDED) Act[3] would create multiple programs to provide relief to communities with "stranded" waste at the site of a shutdown plant. The bill also directs the Secretary of Energy to establish a Stranded Nuclear Waste Task Force to study resources and funding available to affected communities and economic adjustment plans for each affected community.

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[1] This discussion focuses on pending legislation that specifically addresses programs for a CISF or a permanent repository. It does not address a number of bills that authorize nuclear waste R&D programs as part of broader energy R&D programs. Examples of such bills include H.R. 4091 (ARPA-E Reauthorization Act), H.R. 3915 (ARPA-E Reauthorization and Reform Act), H.R. 3358 (Advanced Nuclear Energy Technologies Act), S. 2368 (Nuclear Energy Renewal Act), S. 903/H.R. 3306 (Nuclear Energy Leadership Act) H.R. 6097, the Nuclear Energy Research and Development Act, and H.R. 1760, the Advanced Nuclear Fuel Availability Act. Several of these bills were included in omnibus economic recovery and budget legislation passed by the 116th Congress at the end of 2020Senate passes its package of energy related bills included in S. 2657 this 116th legislative session.
[2] See: https://www.congress.gov/bill/116th-congress/senate-bill/1234.
[3] See: https://www.congress.gov/bill/116th-congress/senate-bill/1985.

Energy and Water Development and Related Agencies Appropriations Act, 2020 (S. 2470)

Sponsor: Lamar Alexander (R-TN)

Status as of October 2020: FY20 of government funds ends on Sept 30th. Congress is poised to appropriate new funds through a Continuing Resolution at FY20 levels. After the election, an omnibus or additional CR in the December lame duck session could be a vehicle for renewed attempts to include the below language from 2019.

The DOE section of this appropriations bill introduced a Pilot Program for the interim storage and eventual repository for SNF. The Pilot allows for the creation and operation of one or more federal consolidated interim storage facilities for SNF from "stranded" sites.

Jobs, Not Waste Act of 2019 (S. 721/H.R. 1619)

[Senate] Sponsor: Jacky Rosen (D-NV); Co-Sponsors: Catherine Cortez Masto (D-NV)
[House] Sponsor: Susie Lee (D-NV); Co-Sponsors: Mark Amodei (R-NV), Rob Bishop (R-UT)

Status as of October 2020: read twice and referred to the Senate Committee on Environment and Public Works and the Subcommittee on Environment and Climate Change

The Jobs, Not Waste Act[5] would prohibit the Department of Energy from licensing, planning, developing, or building a nuclear waste repository at Yucca Mountain until the Office of Management and Budget had studied the economic viability of other uses of the site and Congress had held a hearing on the findings. The bill builds on Nevadan congresspeople's longstanding position against the development of the Yucca Mountain facility.

House Bills

Nuclear Waste Informed Consent (H.R. 1544)

Sponsor: Dina Titus (D-NV); Co-Sponsors: Steven Horsford (D-NV), Susie Lee (D-NV)

Status as of October 2020: Referred to Energy and Commerce Subcommittee on Environment and Climate Change

This bill[6] states that the Secretary of Energy must obtain consent from local from affected governments before making an expenditure from the NWF. The Secretary would be restricted from making any expenditures from the NWF unless he identifies a location for the final repository, and gains approval from the state in which it is to be located, as well as any local or tribal governments affected by the repository or by transportation.

See: HYPERLINK "https://www.congress.gov/bill/116th-congress/senate-bill/2470"https://www.congress.gov/bill/116th-congress/senate-bill/2470.
[5] See: https://www.congress.gov/bill/116th-congress/senate-bill/721; https://www.congress.gov/bill/116th-congress/house-bill/1619.
[6] See: https://www.congress.gov/bill/116th-congress/house-bill/1544

Nuclear Waste Policy Amendments Act of 2019 (H.R. 2699) (S 2917)

[House] Sponsor: Jerry McNerny (D-CA); Co-Sponsors: 13 Republicans and 12 Democrats, including California Reps. Scott Peters (D) and Salud Carbajal (D).
[Senate] Sponsor: EPW Chairman John Barrasso (R-WY) introduced the companion measure.

Status as of October 2020: considered and marked up by Committee on Energy and Commerce and passed Committee by a voice vote. The bill is not expected to reach the House floor in the 116th Congress or get a hearing in the Senate.

This bill[7] makes several amendments to the NWPA. Several of these concern the creation of one or more MRS facilities. The bill requires DOE to complete a study on the need for and feasibility of MRS by June 1, 2021. It permits DOE to site, construct, and operate one or more MRS facilities *and* store DOE-owned civilian waste at an NRC-licensed non-federal MRS. DOE is only permitted to establish one MRS before NRC rules on a permanent repository, and any MRS requires consent from affected state, local, and tribal governments. The bill also establishes the budget for an MRS agreement for FY 2021 through FY 2026. The NWPA provisions requiring DOE to take title to SNF for disposal are also amended in a manner intended to encourage DOE to prioritize acceptance of SNF from decommissioned sites for an MRS. [8]

Other provisions of this bill include:

- Maintaining Yucca Mountain as the site for a permanent repository
- Altering the rules for benefit agreements with host states and communities
- Establishing new rules for assessment and collection of NWF fees, as well as uses of the NWF
- Reestablishing OCRWM
- Establishing a Stranded Nuclear Waste Task Force (see STRANDED Act above)
- Prohibiting ocean disposal of SNF and HLW

Spent Fuel Prioritization Act of 2019 (H.R. 2995)

Sponsor: Mike Levin (D-CA); 11 Democratic Co-Sponsors, including CA Reps. Scott Peters, Katie Porter, Harley Rouda, Jared Huffman, Salud Carbajal, Juan Vargas, Alan Lowenthal, Susan Davis, Gil Cisneros

Status as of October 2020: referred to Energy and Commerce Subcommittee on Environment and Climate Change

This bill[9] states that prioritization for transportation and disposal of SNF or HLW removal from civilian nuclear reactors shall be based upon three factors: whether the reactor has been deactivated and decommissioned, where the population is highest, and where there is the highest chance of seismic activity.

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[7] See: https://www.congress.gov/bill/116th-congress/house-bill/2699.
[8] House REPT. 115-355 Part 1. NUCLEAR WASTE POLICY AMENDMENTS ACT OF 2017. October 19, 2017. P. 30
[9] See: https://www.congress.gov/bill/116th-congress/house-bill/2995.

STORE Nuclear Fuel Act of 2019 (H.R. 3136)

Sponsor: Doris Matsui (D-CA); Co-Sponsors: Salud Carbajal (D-CA), Mike Levin (D-CA), Scott Peters (D-CA), Andy Kim (D-NJ), Jared Huffman (D-CA), Peter Welch (D- VT)

Status as of October 2020: referred to Energy and Commerce Subcommittee on Environment and Climate Change

The Storage and Transportation of Residual and Excess (STORE) Nuclear Fuel Act[10] would authorize DOE to develop nuclear waste storage facilities and enter into a contract to store waste at a nonfederal facility. The bill would require DOE to obtain state, local, and tribal consent for storage facilities and would authorize financial and technical assistance to states, local governments, and tribes. DOE would be required to give storage priority to waste from closed reactors and to waste shipments required to address emergencies.

Spent Nuclear Fuel Solutions Research and Development Act (H.R. 8258)

Sponsor: Mike Levin (D-CA)

Status as of October 2020: referred to the House Committee on Science, Space, and Technology

The Spent Nuclear Fuel Solutions Research and Development Act[11] would direct the Secretary of Energy to conduct an advanced fuel cycle research, development, demonstration, and commercial application program that improves fuel cycle performance and supports a variety of options for used nuclear fuel storage, use, and disposal, including advanced nuclear reactor concepts, while minimizing environmental and public health and safety impacts, including, among other considerations, (1) dry cask storage; (2) consolidated interim storage; (3) deep geological storage and disposal, including mined repository, and other technologies; (4) used nuclear fuel transportation; and (5) integrated waste management systems.

Nuclear Safety Protocols for Extended Canister Transfers (INSPECT) Act (H.B. 8673)

Sponsor: Mike Levin (D-CA); Co-sponsors: Katie Porter (D-CA) and Harley Rouda (D-CA)]

Status as of the end of the 116th Congress: referred to the House Energy and Commerce Committee

Nuclear Safety Protocols for Extended Canister Transfers (INSPECT) Act would require the US NRC to keep a resident inspector at decommissioning nuclear power plants to conduct inspections of decommissioning and spend nuclear fuel transfer activities until all the spent fuel is out of the pool and into dry storage

[10] See: https://www.congress.gov/bill/116th-congress/house-bill/3136.
[11] See: https://www.congress.gov/bill/116th-congress/house-bill/8258.

APPENDIX F

THE STANDARD CONTRACT "QUEUE"

As we noted in Section 5.2, a key parameter in current U.S. nuclear waste policy is the existence of a queue that would govern the order in which SNF would be accepted for shipment to a "DOE facility"—whether a federal repository for disposal or another facility (e.g., a consolidated interim storage facility) to which DOE may ship SNF prior to final disposal.[1]

The queue has its origins in Section 302 of the NWPA, which authorizes DOE to enter into contracts with "any person who generates or holds title to" SNF "for the acceptance of title, subsequent transportation, and disposal of such waste or spent fuel." The Act further stipulates that these contracts shall provide for DOE to take title to SNF "as expeditiously as practicable" "following commencement of operation of a repository." DOE is also instructed to "establish in writing criteria setting forth the terms and conditions under which such disposal services shall be made available."

To implement these requirements, DOE established a "Contract for Disposal of Spent Nuclear Fuel and/or High-level Radioactive Waste" in 10 CFR 961. This is referred to as the Standard Contract in 10 CFR 961. One of DOE's defined responsibilities under the Standard Contract is to issue "an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository." The Contract goes on to state that this priority ranking "shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such material from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance…." While this "oldest fuel first" (OFF) principle is used to allocate rights to available annual acceptance capacity among contract holders based on the age of the oldest SNF in still in their possession, contract holders are free to use their annual acceptance rights for any SNF in their possession, at any site, that meets other acceptance criteria specified in the contract.[2]

In 2004 DOE published its Acceptance Priority Ranking and Annual Capacity Report for the planned Yucca Mountain repository.[3] The report projected that the repository would open in 2010 and would be receiving SNF at a rate increasing gradually from 400 metric tons uranium (MTU) in the first year of operations to 3,000 MTU in the fifth year and beyond (see Table F-3 below).

SONGS has a favorable position in the queue in terms of initiating early shipments of SNF due to the early start of operation of SONGS Unit 1. The last published schedule for shipments to a repository, however, would result in only about one-third of SONGS SNF being shipped within the first decade of repository operations. DOE's 2004 Acceptance Priority Ranking and Annual Capacity Report anticipates the annual acceptance rate for SNF at Yucca Mountain increasing gradually from 400 metric tons uranium (MTU) in the first year of operations to 3,000 MTU in the fifth year and beyond (see Table F-3 below). Further, the report indicates that the space allocated to SONGS SNF over the first 10 years of repository operation would be as follows:

- Year 1: 35.6 MTU
- Year 2: 20.5 MTU
- Year 3: 38.6 MTU
- Year 4: 19.2 MTU
- Year 5: 19.3 MTU
- Year 6: 0 MTU
- Year 7: 73.9 MTU
- Year 8: 118.7 MTU
- Year 9: 112.7 MTU
- Year 10: 60.5 MTU

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[1] Standard Contract Article II (b) sections 1 and 10.

[2] The planning basis for operation of a Yucca Mountain repository assumed that utilities would prefer to use their acceptance rights to deliver the youngest (and hottest) SNF in their pools allowed by the contract – 5 years after discharge.

[3] See DOE/RW-0567, July 2004. With the federal repository program at a standstill, DOE has not published an update to this acceptance schedule since 2004.

This initial 10-year allocation totals 499 MTU. The quantity of SNF being stored at SONGS (from all three SONGS reactor units) totals approximately 1,600 MTU. Under the current ordering of the queue, completing the shipment of all SONGS SNF could take a total of two to three decades.

It has been suggested that positions in the Standard Contract OFF queue could be monetized—in other words, that SNF owners could pay other owners to change places for a more favorable position in the acceptance ranking. Under the Standard Contract, utilities have a contractual right to make such exchanges with other contract holders, subject to DOE's right, "in its sole discretion," to "approve or disapprove…any such exchanges." Thus, SCE could negotiate with other nuclear utilities to move SONGS's allocation forward in the queue, subject to DOE approval. In the 2008 DOE report discussed below, DOE stated that in order to avoid the equity issues that might result from using its authority to give priority to acceptance from shutdown sites, "the government has consistently advised the parties seeking such priority treatment to avail themselves of the exchange provisions of the Standard Contract." A legal analysis of the provisions of the Standard Contract performed for the Blue Ribbon Commission on America's Nuclear Future concluded that a market for such exchanges would likely develop.[4] However, in order to clear the SONGS site completely in the first 10 years after the federal government starts accepting SNF, the SONGS co-owners would have to acquire acceptance rights for an additional 1,100 MTU from other utilities having those rights in that period. Since no market for rights has yet developed, the costs of acquiring the needed rights are uncertain.

A fundamental inefficiency built into the OFF queue is that it could lead to a large number of sites each shipping a relatively small amount of SNF each year. For example, in year 10 of the 2004 Acceptance Priority Ranking report, 46 SNF owners have allocations that would allow shipping SNF from 63 different sites. One study estimated that with shipments coming from the sites having the annual allocation (i.e., the SNF owners do not use the rights to ship fuel from other reactors they own), an average of 58 sites would be shipping SNF in any given year during the period in which the total annual acceptance capacity was 3000 metric tons. While the number of shipping sites could be reduced to some extent if the eight SNF owners with more than one reactor site used their allocations to concentrate their deliveries on one site, the owners with only one reactor site would not have that option.

This potential fragmented allocation of acceptance rights among multiple sites based on an OFF-based queue increases costs to the government for the service due to system inefficiency and also substantially extends the time that it would take to remove the SNF from sites after the last reactor has shut down. Fixed costs to SNF owners for storage operations (primarily for security) do not decrease proportionally with SNF inventory reduction; rather, they cease completely only after all SNF is removed

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[4] Van Ness Feldman, PC, *Legal Background and Questions Concerning the Federal Government's Contractual Obligations Under the "Standard Contracts" with "Utilities,"* December 20, 2010, pp. 45. https://cybercemetery.unt.edu/archive/brc/20120620222929/http://brc.gov/sites/default/files/documents/20101220_standard_contract_memo_revised_final_2.pdf.
"In fact, it appears likely, assuming DOE at some point in the future begins performance under the Contract, that the utilities will thereafter begin to exercise their rights under the exchange provision and that an exchange market will develop. This prediction stems from both the treatment of the exchange provision in Standard Contract litigation and the fact that the exchange provision was incorporated into the Standard Contract at the utilities' behest. When calculating damages under the Standard Contract, the courts have consistently determined that utilities would have exercised their right of exchange had DOE not breached its duties under the Contract, particularly in instances where a utility would have had a strong financial incentive to procure such an exchange. DOE itself has stated its belief "that once the Federal waste management system is operational, the exchange provision will be exercised by the Purchasers as originally anticipated."

from the site. This issue has become a growing concern as the projected time for start of federal waste acceptance has slipped from 1998 in 1982 to 2010 in 2004 to an unknown date today, while the number sites with shutdown reactors is expected to grow rapidly starting in the next decade. As of the end of 2020, there are 19 shutdown nuclear plant sites in the United States with ISFSIs that are storing spent fuel from 22 reactors (see Appendix D for details). The owners of these plants will likely all have an interest in moving their SNF off site. These numbers are expected to increase to 25 shutdown nuclear plant sites with spent fuel from 31 reactors in 2025 and 38 sites/56 reactors in 2040.[5] Figure 7.1 in the main text shows the projected accumulation of SNF at shutdown plant sites over the next two decades, assuming no removal to a central storage facility or repository. [6] This situation was not contemplated when the Nuclear Waste Policy Act was enacted in 1982 and the Standard Contracts were developed and signed pursuant to the Act shortly thereafter.

This situation has prompted a number of studies focused on acceptance approaches other than the Standard Contract OFF queue that could facilitate more rapid and efficient clearance of SNF from the shutdown sites.[7] Overall costs to SNF owners (and associated federal government liabilities) for SNF storage would decrease quicker than the OFF queue model if sites were cleared and storage facility NRC licenses terminated shortly thereafter. As discussed further below, the Standard Contract specifically allows DOE to give priority to acceptance of SNF from sites at which there is no longer an operating nuclear reactor.

The studies clearly show that both the number of sites shipping in any year and the costs of continued storage at shutdown sites can be reduced substantially by a strategy of using the available annual acceptance capacity of the storage facility to clear a few shutdown sites at a time in full-scale campaigns that remove the SNF canisters at the maximum rate achievable at each site, instead of removing small amounts of fuel from every site that has an OFF allocation for that year. These studies show that although the *start* of removal of SNF from some sites would be delayed compared to the OFF queue, in most if not all cases the removal of the *last* SNF from each site would occur no later than with the OFF queue, and in in many cases would be accomplished *sooner*. This can be seen in the following hypothetical example of four shutdown sites shown in Figure F-1. With the OFF queue, each ships a small amount each year, and all four are emptied within a few years of each other. Since the cost of maintaining SNF on the reactor site is constant until the last SNF is removed, the total cost of storage at each site is proportional to the length of the horizontal bar representing the site (the "site-years", i.e. the number of years there is any SNF on the site). In the alternative strategy, the sites are cleared of SNF sequentially in focused campaigns as fast as possible for each site.

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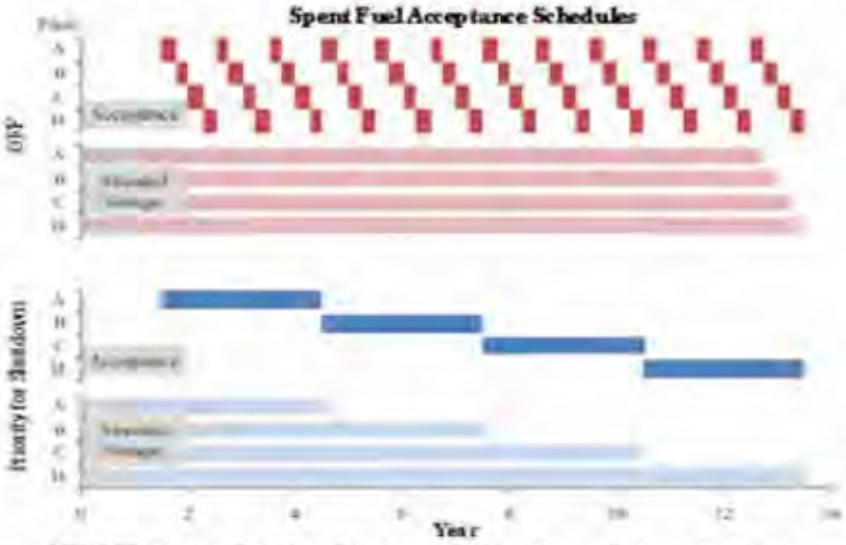
[5] Our estimate of plant shutdowns after 2025 is based on the last year of remaining plants' operating licenses from https://www.nrc.gov/reactors/operating/licensing/renewal/applications.html.

[6] Eileen M. Supko and Michael H. Schwartz. Overview of High-Level Nuclear Waste Materials Transportation: Processes, Regulations, Experience and Outlook in the U.S. Energy Resources International, Inc report ERI-2030-1101, prepared for the Blue Ribbon Commission on America's Nuclear Future, January 2011. https://cybercemetery.unt.edu/archive/brc/20120620222618/http://brc.gov/sites/default/files/documents/012511_final_report_transportation_of_nuclear_waste_material.pdf.

[7] For example, Spent Nuclear Fuel Management: How centralized interim storage can expand options and reduce costs, A study conducted for the Blue Ribbon Commission on America's Nuclear Future by Cliff W. Hamal Julie M. Carey Christopher L. Ring, May 16, 2011. https://cybercemetery.unt.edu/archive/brc/20120620222955/http://brc.gov/sites/default/files/documents/centralized_interim_storage_of_snf.pdf.

Figure F-1



SOURCE: Hamal et al. *Spent Nuclear Fuel Management: How centralized interim storage can expand options and reduce costs*, May 16, 2011. https://cybercemetery.unt.edu/archive/brc/20120620222955/http://brc.gov/sites/default/files/documents/centralized_interim_storage_of_snf.pdf.

In this latter approach, only one site is shipping at any one time; no site is emptied later than under the OFF rule while most are emptied sooner, and the aggregate number of site-years (and hence storage cost) is substantially reduced, as indicated by the smaller total of years in "stranded storage" shown in blue versus red.

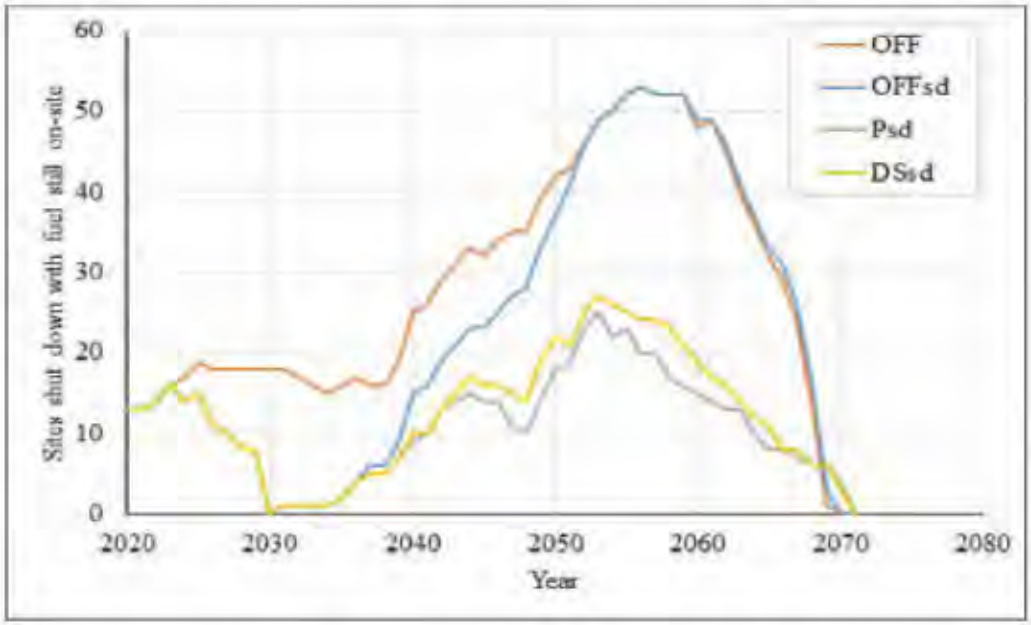
One study supported by DOE that analyzed alternative strategies for prioritizing waste acceptance projected the reduction in site-years for several alternative strategies compared to the OFF strategy:[8]

- **OFF**—the Standard Contract acceptance strategy.
- **OFFsd**—OFF with priority only for the sites shut down before 2020 ("legacy" shutdown sites).
- **Psd**— Acceptance of SNF only from reactor sites once all reactors on the site have been shut down and prioritization of clearing these sites in the order in which they were shut down.
- **DSsd**— Prioritization to eliminate additional dry storage first and then clear shutdown sites. Acceptance capacity is allocated first to removing SNF directly from spent fuel pools in order to avoid the need for new transfers of SNF to dry storage, with any remaining capacity allocated to clearing shutdown sites in the order in which they were shut down.

[8] This discussion is summarized from *The Next Generation System Analysis Model: Capabilities for Simulating a Waste Management System*.
R. Joseph1, B. Craig2, R. Cumberland1, C. Trail3, J. St. Aubin2, C. Olson2, L. Vander Wal2, et al. WM2019 Conference, March 3-7, 2019, Phoenix, Arizona, USA.

Figure F-2 shows the number of shutdown sites with SNF remaining on site for scenarios involving removal of 225 SNF transport packages (about 3,000 metric tons of SNF) from reactor sites annually. The alternative allocation strategies significantly reduce the number of sites with fuel remaining on site relative to using the OFF allocation strategy.

Figure F-2
Number of Sites Shutdown 5+ years with Fuel Still on Site (225 Packages-per-Year Scenarios)



The area under each curve represents the number of site-years (the number of years after a reactor shuts down that SNF remains on site) aggregated over all reactors, for each strategy. These quantities are shown in Table F-1.

TABLE F-1: Number of Site-Years with SNF on site and No Operating Reactors in Past Five Years and Decrease from OFF Scenarios for Alternative Allocation and Acceptance Scenarios

	OFF	OFFsd	Psd	DSsd
225 packages/year	1 459 (0%)	1198 (18%)	580 (60%)	652 (55%)

The reduction in the time that shutdown sites possess SNF in terms of site-years achieved by using the Psd or DSsd allocation strategy is dramatic. For an acceptance rate of 225 packages/year, these strategies provide a reduction of approximately 55% to 60% in the number of site-years SNF remains at sites that have been shut down for 5+ years (at which time all the SNF is assumed to have been placed into dry storage). Assuming an average annual cost of $10 million for maintaining a shutdown site with stored SNF, the simple shutdown site priority strategy (Psd) would reduce aggregate costs by almost $9 billion.

As can be seen in Table F-2, nearly 60% or more of the 75 reactor sites analyzed are cleared 10 years or more sooner than would be the case with the OFF strategy by using a strategy that prioritizes clearance of shutdown sites over the entire period of analysis (Psd or DSsd), with some of those sites being cleared more than 20 years sooner. The greatest differences between OFF and the alternative allocations occurs for sites that shutdown the earliest, with the differences decreasing for sites with later shutdown dates.

Table F-2:
Shutdown Site-Years (with SNF on Site) and Deviations from OFF for Alternative Allocation and Acceptance Scenarios

	225 packages/year			
	OFF	OFFsd	Psd	DSsd
Site-Years	1,459	1,198	580	652
Calendar Year of Last Pickup	2070	2070	2071	2071
Max Deviation from OFF (years)	–	22	23	23
Min Deviation from OFF (years)	–	-4	-2	-2
Average Deviation from OFF (years)	–	3.51	11.75	10.79
Count of sites cleared				
• 20 years or more before OFF	–	6	12	10
• 10 to 19 years before OFF	–	8	38	34
• 5 to 9 years before OFF	–	4	12	15
• 1 to 4 years before OFF	–	2	7	10
• In the same year as OFF	–	44	1	1
• After OFF	–	11	5	5

For the DSsd and Psd allocation strategy scenarios, 70 of the 75 sites analyzed were cleared of SNF in the same year or sooner than with the OFF allocation priority; only 5 sites are cleared later. Because the delays in the scenarios are small (no more than 4 years for any allocation strategy), and those sites are cleared very late in the system regardless of the allocation strategy, it is likely that some remediation process could be implemented to eliminate the delays, e.g. by increasing the acceptance capacity toward the end of the scenario to increase the allocation to such sites.

Another DOE-supported study[9] using the same systems analysis model[10] as the study discussed above compared the OFF queue to the OFFsd allocation queue which prioritizes the legacy shutdown sites and to a Shutdown Priority Ranking for Initiation of Transport (SPRINT) queuing strategy in which removal of SNF from shutdown sites would be prioritized over that at operating reactor sites and operating sites would be prioritized based on when they were scheduled to shut down (essentially identical to the Psd strategy in the study described above). (Unlike the previous study, in which the steady-state acceptance rate was limited to 225 packages/year, this study assumed that a repository begins operation in 2038 and reaches a 225 packages/year acceptance rate by 2042, for a total system acceptance rate of 450 packages/year thereafter.) This study clearly demonstrated that there are logistic and schedule advantages to the SPRINT approach over an OFF sequence. Figure F-3 shows the dramatic reduction in the number of sites shipping SNF in each year resulting from use of the SPRINT strategy compared to the OFF strategy or the OFFsd strategy that only prioritizes the sites expected to be shut down by 2020. Before the repository starts accepting SNF in 2038, the OFF strategy is shipping from about 63 sites, while the SPRINT strategy is shipping from only about 8 sites. The difference drops only slightly after the reactor has reached its full acceptance capacity in 2042.

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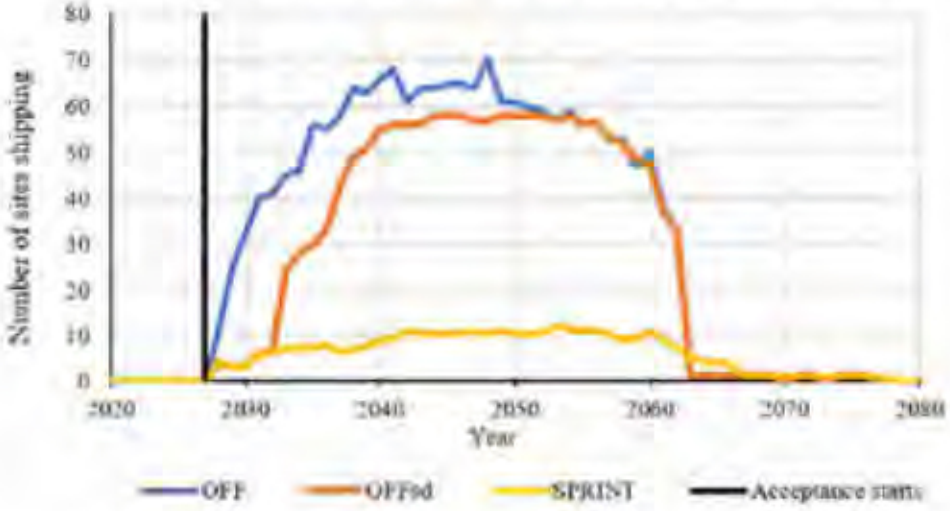
[9] This discussion is summarized from Joseph III, Robby, Cumberland, Riley M., Howard, Rob L., Jarrell, Joshua, and Kalinina, Elena. "Commercial SNF Pickup Queue Under the Standard Contact and Analysis of Hypothetical Alternate Acceptance Strategies." United States. https://www.ornl.gov/publication/commercial-snf-pickup-queue-under-standard-contact-and-analysis-hypothetical-alternate.

[10] The Next Generation System Analysis Model (NGSAM).

Figure F-3
Number of sites shipping SNF each year for various acceptance strategies



Not surprisingly, this sharp reduction in the number of shipping sites resulting from use of the SPRINT strategy also translates into a similar reduction in the number of states from which SNF shipments would originate during the decades of system operation compared to the OFF strategy, from approximately 25 to 30 to approximately 5 to 10.

The number of sites shipping SNF in any given year has significant implications for the nationwide impacts of operation of the waste management system. With the OFF strategy, many sites are shipping SNF simultaneously at a low rate for long periods of time, requiring each site to maintain resources such as infrastructure, licenses, permits, and certifications for personnel needed for the shipments over the entire period. However, with an efficient strategy such as SPRINT, fewer sites are shipping SNF at a faster rate each year, requiring maintenance of those resources for substantially shorter periods. In addition, the reduction in the number of sites shipping at any one time reduces the levels of transportation planning, training, readiness, coordination costs for emergency responders and local officials along routes, and overall operational complexity. Fewer states are required to manage the shipments passing through, with a reduction of the overall public impact each year.

Implications for California

Tables F-3 and F-4 show that the three California sites with stranded SNF would do particularly well with this approach, with Humboldt Bay and Rancho Seco cleared in the first year of acceptance by the federal government and SONGS cleared by the end of the fifth year, based on the projected acceptance rates in DOE's 2004 Acceptance Priority Ranking and Annual Capacity Report. In fact, all 16 sites with no operating reactor and all SNF in dry storage (a total inventory of 7,010 MTU) could be cleared by the end of the fifth year of acceptance. (Under the OFF queue, Humboldt Bay would be cleared in year 3 and Rancho Seco in year 8, while only about 1/3 of the SONGS SNF would be removed in the first 10 years.)

Table F-3
DOE Projected Waste Acceptance Rates

Year	SNF (MTU)	Cumulative
1	400	400
2	600	1,000
3	1,200	1,600
4	2,000	2,000
5	3,000	4,600
6	3,000	5,000
7	3,000	7,600
8	3,000	8,000
9	3,000	10,600
10	3,000	11,000

Table F-4: SNF at sites with no operating reactors and dry storage only in 2020

Permanently Shutdown Plant Sites	First reactor start	Last reactor shut down	MTU	MTU cum
Humboldt Bay (1 Rx)	4/18/1963	7/2/1976	29	29
LaCrosse (1 Rx)	4/26/1968	4/30/1987	38	67
Rancho Seco (1 Rx)	10/13/1974	6/7/1989	228	295
Yankee Rowe (1 Rx)	12/24/1963	10/1/1991	127	422
Trojan (1 Rx)	12/23/1975	11/9/1992	359	782
Connecticut Yankee (1 Rx)	1/1/1968	12/5/1996	414	1195
Maine Yankee (1 Rx)	11/8/1972	8/1/1997	542	1737
Big Rock Point (1 Rx)	12/8/1962	8/29/1997	58	1795
Zion (2 Rx)	4/28/1973	1/1/1998	1019	2815
Crystal River (1 Rx)	3/13/1977	2/20/2013	582	3397
Kewaunee (1 Rx)	12/1/1973	5/7/2013	519	3916
San Onofre (3 Rx)	7/16/1967	6/7/2013	1609	5525
Vermont Yankee (1 Rx)	11/30/1972	12/29/2014	702	6227
Fort Calhoun (1 Rx)	8/9/1973	10/24/2016	212	6439
Oyster Creek (1 Rx)	7/2/1991	9/17/2018	367	6806
Pilgrim (1 Rx)	12/1/1972	5/31/2019	204	7010

MTU data source: *Spent Nuclear Fuel and Reprocessing Waste Inventory*. Peters et al., SRNL, September 2020, FCRD-NFST-2013-000263, Rev. 7

In summary, multiple studies have shown that an efficient shutdown-site-focused acceptance strategy would have substantial system-wide benefits compared to the OFF strategy that could increase the incentive for policymakers to restart the federal waste management program:

- Reduction of the number of sites with stranded SNF by 16 or more within a decade.
- A sharp reduction of the number of sites shipping SNF each year (around 10 instead of around 50 during the period of peak shipments) that would similarly reduce the actual and perceived impacts of transportation by limiting the number of active transportation routes and affected states and the costs of training emergency responders each year.
- Dramatic reductions in the cost of unnecessary extended storage at shutdown sites – and hence reduced federal liabilities via Judgment Fund damage payments by taxpayers for activities that do nothing to advance final disposition of the SNF.

It should be noted that these studies have generally assumed that in the OFF queue case, the SNF is shipped from the site to which the annual allocation is assigned, without the SNF owner exercising the right to ship SNF from another reactor site or to exchange rights with a different SNF owner. While such exchanges would likely reduce the inefficiencies of the OFF allocation system, it is not likely that the full benefits of an alternative site-by-site clearance strategy could be achieved by multiple SNF owners independently exercising their rights.

Because the OFF framework is embodied in the Standard Contract, an effort to simply change it by legislation could trigger damage claims from affected contract holders.[11] Section B.1(b) of Article V of

[11] See Statement of Michael F. Hertz, Deputy Assistant Attorney General, Civil Division, Before the Blue Ribbon Commission on America's Nuclear Future, Presented on February 2, 2011. https://cybercemetery.unt.edu/archive/brc/20120621002717/http://brc.gov/sites/default/files/meetings/presentations/statement_of_michael_hertz.pdf.

the Standard Contract gives DOE the discretion to prioritize acceptance of SNF from shutdown plant sites, independent of the order that would be dictated by the OFF queue. DOE using this discretion, therefore, requires no change to the Standard Contract language. However, DOE has been reluctant to use that discretion in the past. In a 2008 report to Congress[12] pertaining to a program for storing SNF from decommissioned reactor sites, DOE noted that it has declined many requests to exercise its contractual discretion to prioritize acceptance of SNF from such sites on the grounds that this would delay timely removal of SNF from operating reactor sites. DOE's stated concern is that this could raise equity issues that could lead to further litigation from other contract holders. DOE concluded that legislation establishing a mandated storage program would need to "expressly direct the Department to exercise its discretionary authority under the Standard Contract to take SNF from the decommissioned reactors on a priority basis..."[13]

The key nuclear waste bills introduced in the 116th Congress that provide for development of consolidated interim storage facilities give priority to SNF from shutdown reactors, but do not explicitly direct DOE to use its authority under the Standard Contract.[1] The two Senate bills do not reference the Standard Contract, but *limit* these facilities to SNF from shutdown reactors, which might make that issue moot. The House bill (H.R. 2699), on the other hand, requires that the first "MRS agreement" storage facility should give priority to waste from any facility that "has ceased commercial operation," but only "to the extent allowable under...this Act[15] (including under the terms of the Standard Contract)," leaving it up to DOE to make the determination of allowability.

It is worth noting that in testimony in 2012 to the Senate Committee on Energy and Natural Resources on behalf of the Nuclear Energy Institute (NEI), Henry Barron (President and Chief Executive Officer of Constellation Energy Nuclear Group, LLC) stated that "the industry agrees that priority should be given to the shutdown commercial sites that no longer have an operating reactor."[16] When asked by Chairman Bingaman whether utilities would be "willing to renegotiate the fuel acceptance schedule to achieve that result," Mr. Barron noted that the Standard Contract already provides for the Secretary to give priority to fuel which is located at sites that do not have an operating reactor, and that "as utilities, as an industry, we have concurred that we would not argue with such a determination."[17]

"In developing its recommendations, the Commission must take into account the existing obligations of the Government. Because the NWPA required DOE to enter into contracts with the owners and generators of SNF, rather than merely create a statutory program, changes in the program, even if directed by a statutory change, can potentially cause further breaches of contract, which then can create additional monetary liability. ...The Commission should be mindful that any recommendations that alter the existing bargain between the parties could dramatically affect the monetary damages that the United States might have to pay the utilities and could even, depending on the changes made, lead to a total breach of the contract."

[12] Required by the House Appropriations Committee: https://www.congress.gov/congressional-report/110th-congress/house-report/185/1.

[13] U.S. Department of Energy, *Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites*, December 2008, DOE/RW-0596.

[1] H.R. 2699, S. 1234 and S. 2470 (appropriations for energy and water development and related agencies FY 2020, including a pilot interim storage program).

[15] The Nuclear Waste Policy Act as amended by the bill.

[16] The testimony was given in relation to S. 3469 (The Nuclear Waste Administration Act of 2012). This was the first version of current S. 1234 and was the first nuclear waste bill that gave priority to storing SNF from shutdown reactors. See: https://www.energy.senate.gov/public/index.cfm/hearings-and-business-meetings?Id=228FE2E8-8C9E-4440-B266-1D3885C3FA93&Statement_id=B2AC790B-66BB-478C-86E7-973EC86B229A, p. 32.

[17] Hearing record page 42.

DOE's stated reluctance to use the shutdown plant priority discretion without specific legislative direction is from 12 years ago, when the amount of SNF stored at shutdown plan sites was much less and the number of shutdown sites was 10 compared to nearly double that today. Such legislative direction may be more likely now, and might also be crafted to include guidance about how DOE should prioritize acceptance of SNF *among* the group of shutdown sites to ensure that an efficient system such as discussed above is adopted. As the expected time for the start of federal waste acceptance extends into the future, a growing number of plant sites are scheduled to be shut down permanently based on the expiration of their operating licenses in the next two decades. Others will surely be retired early due to financial challenges. This increased competition for a slot in the removal sequence could significantly limit any advantage to SONGS SNF on the basis of its stranded status in the absence of such a strategy. In the absence of clear direction, DOE would be free to choose to remove fuel from shutdown plant sites in any order it wishes. SONGS would, in theory, have to "compete" with all other shutdown plant sites in terms of priority for SNF removal.

While the current bills prioritize acceptance *from* shutdown reactors, none provide any guidance or direction about how DOE should prioritize acceptance *among* shutdown reactors. The House bill is much more restrictive than the Senate bills in defining the eligibility for priority acceptance, limiting priority acceptance not only to plant sites that have ceased commercial operation, but also more narrowly to only those sites that are located in "(I) an area that is of high seismicity" and "(II) close proximity to a major body of water." If adopted, these criteria would favor priority acceptance of the SNF at SONGS but would not clarify how acceptance would be prioritized among other sites that also meet this more restrictive qualification.

In any case, given DOE's past reluctance to take the initiative in exercising its discretion to give priority to shutdown sites, it would likely be advantageous to all owners of shutdown reactors if Congress directed DOE to accept SNF in a way that would maximize the speed with which individual sites could be emptied and minimize transportation impacts. This may be an opportunity for the industry to work together, perhaps via the Nuclear Energy Institute and/or the Decommissioning Plants Coalition, to create a consensus-driven prioritization scheme for the removal of SNF from shutdown sites and recommend adoption of that scheme.

APPENDIX G

CONSENT-BASED SITING

Introduction

The relative balance of state and federal interests and powers in siting nuclear waste facilities has been a major issue in national nuclear waste management policy development for over four decades. This issue paper addresses this debate over time, beginning with the Carter Administration's consideration of a state's authority relative to siting a nuclear waste repository to current day legislation under consideration in Congress. At the heart of the matter is whether or not the federal government can effectively site a repository in a state without its consent.

This paper is organized into eight sections that capture the nation's over 40-year debate about the roles and authorities of states (and less directly tribal and local governments) in the siting of a deep geologic repository for disposal of high-level nuclear waste. The paper begins by focusing on the 1970's efforts to site in New Mexico the Waste Isolation Pilot Plant (WIPP), a proposed repository for transuranic waste from national defense activities; transitions through discussions of the successful siting of WIPP and a negotiated agreement with the State of Idaho for continued storage of Department of Energy and Navy spent nuclear fuel; discusses the siting process mapped out in the Nuclear Waste Policy Act (NWPA) of 1982 and how it was derailed by the Nuclear Waste Policy Amendments Act of 1987; gives evidence to the original premise in the Carter Administration that successful siting will not occur without state consent and reintroduces concept of consent-based siting as promoted by both the Obama and Trump Administrations; describes legislative efforts to revitalize the nation's nuclear waste program; and closes with concluding observations.

Early Debate about Host State Authority: Consultation and/or Concurrence

When the U.S. Department of Energy (DOE) was seeking to evaluate sites in salt domes in Louisiana for suitability for a repository in the late 1970s, the Deputy Secretary of Energy John O'Leary signed an agreement with the Governor that no waste would be sent to a repository there without the state's consent.[1] At about the same time, Secretary of Energy James Schlesinger made a similar promise to New Mexico in the context of the DOE's efforts to develop a repository for transuranic waste from national defense activities (the Waste Isolation Pilot Plant or "WIPP"). Deputy Secretary O'Leary later explained that making such concessions to states was simply a recognition that in view of the range of regulatory powers of a state (e.g., over land use, highways, employment codes and so on), a repository could not be built over determined opposition from the host state – "When you think of all the things a determined state can do, it's no contest." He added that while the government would prevail in federal courts over state actions to block a repository, the process would take years and in a practical sense DOE would lose.[2]

In 1979, the Interagency Review Group (IRG), established in 1977 by President Carter to develop a long-term nuclear waste management policy, issued a series of recommendations including the concept of "consultation and concurrence" to formalize the relationship between DOE and the states in waste facility siting. Under this concept, the Government would consult with the State at each step in developing a repository, and the State would need to be in agreement (concur) with the step before the

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[1] "Principles of Understanding," signed on February 27, 1978, by Governor Edwards and Deputy Secretary John O'Leary of DOE. Cited in Luther J. Carter, *Nuclear Imperatives and Public Trust: Dealing with Radioactive Waste*. Washington, D.C.: Resources for the Future, 1987, p. 164

[2] Carter, *op. cit.*, p. 185

next activity began.[3] This was consistent with a 1978 resolution of the National Governors Association stating that DOE had to "obtain state concurrence prior to final site determination." [4] While this was intended as a compromise between the extremes of a federal preemption and a State veto, it was vague in its definition of concurrence and particularly in the distinction between nonconcurrence – the effective ability of the State to stop federal siting activities – and a veto.[5]

The IRG sought to clarify the distinction in its final report by noting that consultation and concurrence involved a continuing dialog between the States and the federal government, while a veto implied an action at one discrete point in time. This formulation made explicit the informal policy that DOE had been pursuing, as described above, and offered states more power than that to which they were legally entitled. But it did not clarify the distinction between nonconcurrence and a State veto, or what steps Federal Government could take if it disagreed with a State's nonconcurrence – a question that became central to the debates leading to enactment of the Nuclear Waste Policy Act.[6]

These offers of effective vetoes met resistance in Washington. The agreement with Louisiana was reviewed by the Comptroller General of the U.S. at the request of Congress and determined to have no legal standing.[7] The idea of state concurrence over development of a defense facility was rejected by the House Armed Services Committee, which had jurisdiction over the WIPP project,[8] and the 1979 act including the authorization for the WIPP project prohibited DOE from granting New Mexico a veto over construction of the facility.[9] As a compromise with the Senate in conference, the House agreed to a provision calling for "consultation and cooperation" between DOE and New Mexico, leaving it up to the two parties to work out the details, with no specific legislative remedy to resolve a situation in which there is no agreement. The conferees explained that they expected that an agreement could be successfully negotiated, "in view of the long history of cooperation by the state with the federal government in atomic energy matters, and in view of the national significance of the WIPP project..."[10]

Also, of note, DOE funded the New Mexico Environmental Evaluation Group (EEG) to conduct independent evaluation of a wide variety of WIPP technical issues -- before and after the plant opened in 1999 -- to provide assurance that New Mexico's public health and safety and the environment was protected. The EEG was established in 1978 and received federal support until the group was defunded and disbanded in 2004.[11,12]

A consultation and cooperation agreement was finally negotiated between DOE and New Mexico in 1981 as part of settlement of a lawsuit filed by New Mexico Attorney General Jeff Bingaman over DOE

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[3] U.S. Congress Office of Technology Assessment, *Managing the Nation's Commercial High-Level Radioactive Waste*, OTA-O-171, March, 1985, p. 224 https://cybercemetery.unt.edu/archive/brc/20120620233605/http://brc.gov/sites/default/files/documents/ota1985.pdf.

[4] OTA 1985 224

[5] OTA 1985 181-182.

[6] OTA 1985. Appendix A-1 - *Radioactive Waste Management Policymaking*, prepared for OTA by Daniel Metlay of the University of Indiana.

[7] Carter, *op. cit.*, p. 164

[8] McCutcheon, Chuck. *Nuclear Reactions: The Politics of Opening a Radioactive Waste Disposal Site*. Albuquerque, N.M.: University of New Mexico Press, 2002. p. 71. Discussion of WIPP condensed from pp 71-81.

[9] OTA 1985. P. 224

[10] McCutcheon, *op. cit.* p. 74

[11] See: http://www.sric.org/nuclear/eeg.php.

[12] See: https://www.osti.gov/biblio/6511269-new-mexico-environmental-evaluation-group-experiences-evaluating-wipp.

actions to move the project ahead without an opportunity for state involvement. In two key concessions, DOE agreed to consider and address the state's concerns before deciding to proceed with construction or bringing waste, and formally acknowledged New Mexico's right to seek judicial review of DOE actions regarding the project." Reflecting on the agreement years later, then-Senator Bingaman expressed satisfaction that the state finally had been given "a binding and enforceable legal mechanism" for asserting its rights that would allow the state to be confident its concerns were being addressed at each step."

A Legislative Model for Federal Negotiated Siting Agreement with a State

After years of negotiations, Congress succeeded in passing the Waste Isolation Pilot Plant Land Withdrawal Act in 1992.[13] This law could be viewed as a possible model for what a negotiated siting agreement approved by Congress might have looked like, since it incorporated a number of key measures to meet state concerns and give the state a significant degree of direct control over the development of the facility. It set statutory constraints on how WIPP could be used, limiting the amount of waste that could be disposed of in WIPP and prohibiting disposal of high-level waste, even for experimental purposes; provided additional funding for highways and emergency preparedness; and directed DOE to prepare plans for retrievability and eventual decommissioning. Of particular importance, the legislation required EPA (not DOE) to certify that WIPP met applicable waste disposal standards and gave the state authority to regulate mixed hazardous and radioactive waste at WIPP under the Resource Conservation and Recovery Act (RCRA), including issuing a hazardous waste permit for the facility that must be renewed every 10 years and that allows the state to limit the volumes of waste disposed of by limiting the size of underground waste panels. The Blue Ribbon Commission on America's Nuclear Future (BRC) concluded "...this development was very important in terms of giving state officials and residents beyond the local community confidence that the facility was safe."[1] [4]

A Non-legislative Model for Federal Siting Agreement with a State

A potential model for a non-legislative approach to an enforceable consent agreement is the Idaho Settlement Agreement[15] (also known as the Batt Agreement) that DOE and the Navy entered into with the State of Idaho in 1995. Among numerous other provisions, the Batt Agreement covers the storage, treatment, and disposal of DOE and Navy SNF stored at INL. It sets strict limits on the amounts of DOE and naval SNF that can be shipped to INL in the future and requires that all HLW and SNF (except for a small in-process inventory of naval SNF) be removed from Idaho by January 1, 2035. If either party fails to meet this milestone, it will face a financial penalty of $60,000 for each day SNF or HLW remains in Idaho after that date.

As in most other agreements between DOE and States, this financial penalty is subject to congressional appropriation of the necessary funds, meaning that in practice the state may have no legal recourse if Congress does not do so. For example, in 2019 a federal judge dismissed South Carolina's suit against the federal government seeking $200 million in fines established in federal law for failure to remove plutonium stored at DOE's Savannah River Site. The judge ruled the courts were not the right place for the State to pursue the fines, noting that the law specified that they would only be paid if Congress set

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[13] Summarized from *Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy*, January 2012. https://energy.gov/ne/downloads/blue-ribbon-commission-americas-nuclear-future-report-secretary-energy, p. 57.

[1] *Ibid*.

[15] See: https://www.energy.gov/sites/prod/files/em/2001_Agreements/Colorado_vs_Batt_10-16-95.pdf.

aside money for that purpose, which Congress had not done.[16] The State appealed the decision to the Supreme Court, where it is now under consideration.[17]

However, the Agreement includes other enforcement mechanisms that are not dependent on whether Congress appropriates funds needed for DOE and the Navy to meet requirements. Specifically, the Agreement allows the State of Idaho to stop further shipments of DOE or Navy fuel to INL *at any time* if any key parts of the Agreement are not upheld by either of those parties.[18] If Idaho refused to accept SNF from the Navy, the Navy could be unable to complete refueling operations of the nuclear fleet, which would raise national security concerns, according to Navy officials.[19] Such court-enforceable settlements might offer a strong assurance to States that actions or inactions on the part of future congresses or administrations could not undermine commitments made by the federal government.

State Roles and Authorities in the Nuclear Waste Policy Act of 1982

Not surprisingly, much of the debate about the State role in radioactive waste management during the 96th and 97th Congresses leading to enactment of the Nuclear Waste Policy Act of 1982 (NWPA) focused on the precise specification of the balance between Federal and State authority in siting nuclear waste facilities.[20] A critical unresolved question was what steps the Federal Government could take if it disagreed with a State's nonconcurrence. When Congress addressed this issue during debates on comprehensive nuclear waste legislation in 1980, both Houses agreed on an override mechanism for commercial high-level waste disposal: the host State nonconcurrence would only be sustained if either the House or the Senate voted to support the State's position. Congress, however, failed to agree on the right of a State to object to a facility for disposal of defense high-level waste - a disagreement that was largely responsible for the failure to pass a high-level waste bill that year.[21]

In 1981, after consideration of nuclear waste legislation resumed in Congress, the State Planning Council (SPC) composed of Governors, legislators, and representatives of Indian tribes, established by President Carter to provide advice on issues such as this, recommended that a State's nonconcurrence be overridden by the Federal Government only through a Presidential determination backed by both Houses of Congress.[22] In 1982, the National Governors Association advocated this same position, as well

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[16] Colin Demarest. "Federal judge dismisses SC suit seeking $200 million in fines for nuclear material." The Post and Courier, August 20, 2019 https://www.postandcourier.com/news/federal-judge-dismisses-sc-suit-seeking-200-million-in-fines-for-nuclear-material/article_e760 4fc-c363-11e9-8bbb-3ff301bfe756.html.

[17] Colin Demarest. "Federal appeals court to hear arguments in Savannah River Site plutonium fines case." The Post and Courier. March 2 4 2020. https://www.aikenstandard.com/news/federal-appeals-court-to-hear-arguments-in-savannah-river-site-plutonium-fines-case/article_de2c3386-6df5-11ea-82a9-7ba58a7f065b.html.

[18] *Section K. Enforcement Suspension of Shipments*. (a) **DOE**. If DOE fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of DOE spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied. (b) **Navy**. If the navy or the Naval Nuclear Propulsion Program fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of Navy spent fuel to INEL shall to suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.

[19] U.S. Department of Energy, *Report on Separate Disposal of Defense High-Level Radioactive Waste*. March 2015.http://www.energy.gov/sites/prod/files/2015/03/f20/Defense%20Repository%20Report.pdf.

[20] See full discussion of this debate in Ch. 8, OTA 1985, pp. 177-18 4

[21] OTA 1985 Appendi xA-1 - *Radioactive Waste Management Policymaking*, prepared for OTA by Daniel Metlay of the University of Indiana. p. 22 4

[22] OTA 1985 p. 87.

as requirements for an option for a state to conclude signed, binding agreements with the Department of Energy covering the rights and responsibilities of each party.[23]

The NWPA approved at the end of that year included both the right of a state to veto DOE's recommendation of a repository or storage site, subject only to an override approved by both houses and signed by the President, and a requirement for DOE to offer to enter into "consultation and cooperation" (C&C) agreements (modeled on the 1981 WIPP agreement) with states or tribes that hosted candidate facility sites.[2] While no final C&C agreements were negotiated between DOE and any of the states or tribes hosting sites that were under consideration, the NWPA directed the Secretary to make grants to a repository host state or Indian Tribe, enabling it to (i) review activities with respect to the repository site to determine potential economic, social, public health and safety, and environmental impacts; (ii) develop a request for impact assistance; (iii) engage in monitoring, testing, or evaluation of characterization of the site; and (iv) provide information to state residents.

Finally, the Act directed DOE to dispose of defense waste in a repository developed under the Act unless DOE determined that a separate repository exclusively for defense high-level waste was needed, but applied the same veto and consultation and cooperation provisions to such a repository.

The Impact of the Nuclear Waste Policy Amendments Act of 1987 on Repository Siting

DOE's efforts to negotiate consultation and cooperation agreements with states and tribes affected by sites under consideration for the first of the two repositories required by the NWPA were derailed by the 1987 Nuclear Waste Policy Amendments Act, which terminated all work on repository sites other than Yucca Mountain in Nevada. The Amendments Act did, however, extend the authority of the Secretary to also provide grants to affected units of local government for the same purposes as for those provided to the state.[25]

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[23] Statement of Governor Robert List of Nevada on behalf of the National Governors Association. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce of the House of Representatives on H.R. 1993, H.R. 2881, H.R. 3809, and H.R. 5016, bills to provide for development of facilities for storage, disposal, and reprocessing of radioactive waste and spent fuel, and for other purposes, June 8 and 10, 1982.

[2] NWPA, *Section 116, Participation of States*; and *Section 117, Consultation with States and Affected Indian Tribes.*

[25] NWPA, *Section 2, Definitions*, defines "affected unit of local government" as "...the unit of local government with jurisdiction over the site of a repository or a monitored retrievable storage facility. Such term may, at the discretion of the Secretary, include units of local government that are contiguous with such unit." In the context of Yucca Mountain, Nye County, NV was considered the "situs" affected unit of local government and was given the same authorization as the State to designate a representative to conduct on-site oversight activities. The Secretary did designate all counties contiguous to Nye as "affected."

In the context of Yucca Mountain, Nye County, as the "situs" local government, sought to fully leverage the authorities provided to it by the Amendments Act by pursuing and negotiating a set of agreements with DOE under an umbrella *Framework for Formal Interactions.*[26,27]

The Amendments Act also nullified DOE's recommendation of a site in Tennessee for a Monitored Retrievable Storage (MRS) facility and set up a voluntary process to find a site for an MRS facility or repository, with an independent Nuclear Waste Negotiator who would seek to develop an agreement between a State or Indian tribe and the federal Government that would be submitted to Congress for approval. Commenting in 1993 on the experience with that effort to date [28], the first Nuclear Waste Negotiator concluded that "The principal barrier to successful siting is the widespread distrust of the federal government held by the American public."

To address concerns that the government could not be trusted to run a temporary storage facility safely or assure that it would not become a *de facto* permanent site if a repository does not open, he stressed that "Every effort is made by the Negotiator's Office to urge prospective hosts to consider negotiating agreements which enhance the role of the host on operations, control and safety issues, create provisions which are enforceable in the federal courts, and establish significant penalties for federal non-compliance. Private, state or tribal ownership and operations of the facility is also negotiable." The Office of the Negotiator was allowed to expire in 1995, after Congress terminated the funding of exploratory grants to interested local governments and tribes in Fiscal Year 1994 and the second Negotiator decided to phase out the program. Both the first and Second Negotiators concluded that the process might have been able to succeed if it had been allowed to continue.[29]

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[26] *Framework for Formal Interactions Between Nye County, Nevada, and the U.S. Department of Energy/Office of Civilian Radioactive Waste Management*, signed by John W. Bartlett, Director, Office of Civilian Radioactive Waste Management and Barbara J. Raper, Chair, Nye County Board of County Commissioners, April 2, 1991. Three protocols were negotiated between Nye and DOE within this Framework addressing: (a) *Principles and Procedures for Interaction,* August 29, 1991; (b) *Socioeconomic Monitoring and Assessment,* August 29, 1991; and (c) *Procedures for Nye County On-Site Representation During Yucca Mountain Project Site Characterization Activities,* October 19, 1992.

[27] *Access and Procedures for On-Site Independent Verification and Testing: An Appendix to the On-Site Representation Protocol*, Daniel Dreyfus, OCRWM Director. and Cameron McRae, Chair, Nye County Commission, July 1, 1994

[28] David H. Leroy, Office of the Nuclear Waste Negotiator. "The Negotiator: A Novel Approach for Gaining Public Acceptance." Paper Submitted for Presentation to 4th International Conference on Nuclear Waste Management, 5-11/09/1993, Prague, Czech Republic.

[29] David Leroy, quoted in A.C. Kadak and K. Yost, *Key Issues Associated with Interim Storage of Used Nuclear Fuel*, MIT, 2010, pp. 27-28; and Richard H. Stallings letter report to Congress, February 8, 1995. Printed in *Congressional Record: Extensions of Remarks*, p. E798, April 6, 1995.

A report on issues of trust and confidence in radioactive waste management prepared for the Secretary of Energy in 1993[30] supported the first Nuclear Waste Negotiator's conclusion that the principal barrier to waste facility siting is distrust of the federal government:

> "Despite some progress over the last four years, there is widespread lack of trust in DOE'S radioactive waste management activities. That distrust is not irrational, nor can it be discounted merely as a manifestation of the "not-in-my-back-yard" syndrome."
>
> "For officials of the state of Nevada, DOE'S untrustworthiness is a *prima facie* reason for ceasing work immediately on characterizing the Yucca Mountain site. But they are not alone... As he vetoed further exploration of whether a monitored retrievable storage facility for commercial radioactive waste should be located in his state, the Governor of Wyoming observed, 'Let us not deceive ourselves - we are being invited through continuing study to dance with a 900-pound gorilla ... I am absolutely unpersuaded that Wyoming can rely on the assurances we receive from the federal government.' "
>
> Among a large number of recommendations in the report were several specifically directed to the DOE's Office of Civilian Radioactive Waste Management that involved the kind of sharing of decision-making power with affected state, local, and tribal authorities that might be expected in a consent-based siting agreement:
>
> - Give the Safety Review Board [composed of DOE managers and representatives of stakeholders, that can temporarily suspend operations at a facility for a pre-established set of reasons[31]] the power to decide when a repository should be sealed and when retrievability of the waste is no longer essential; and
> - Permit state, local, and tribal authorities to have a voice in determining the pace at which waste will be shipped to a repository for disposal.

In making these recommendations, the task force recognized that it is likely that legislation would be needed to enable DOE to implement them. Note that the option of giving affected political jurisdictions any rights of approval to siting and construction of a facility in the first place was not included among the recommendations.

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[30] *Earning Public Trust and Confidence: Requisites for Managing Radioactive Wastes*. Final Report of the Secretary of Energy Advisory Board Task Force on Radioactive Waste Management. U.S. Department of Energy, Washington, DC 20585, November 1993. (http://www.osti.gov/scitech/servlets/purl/10184 72 4.

"The Task Force on Radioactive Waste Management was created in April 1991 by former Secretary James D. Watkins, who asked the group to analyze the critical institutional question of how the Department of Energy (DOE) might strengthen public trust and confidence in the civilian radioactive waste management program. The panel met eight times over a period of 27 months and heard formal presentations from nearly 100 representatives of state and local governments, non-governmental organizations, and senior DOE Headquarters and Field Office managers. The group also commissioned a variety of studies from independent experts, contracted with the National Academy of Sciences and the National Academy of Public Administration to hold workshops on designing and leading trust-evoking organizations, and carried out one survey of parties affected by the Department's radioactive waste management activities and a second one of DOE employees and contractors."

[31] This idea had been recommended for inclusion in legislation authorizing an MRS facility at a DOE-proposed site in Tennessee by a joint task force formed by the City of Oak Ridge and Roane County Clinch River MRS Task Force, "Position on the Proposed Monitored Retrievable Storage Facility," October 10, 1985.

Returning Full Circle to the '70s

As is noted earlier with regard to the 1970s debate about a state's authority in siting a nuclear waste repository, DOE Deputy Secretary O'Leary presciently forecast that a repository could not be built over determined opposition from the host state.

Following the designation of Yucca Mountain as the sole site under consideration for disposal of nuclear waste, the state of Nevada mounted a determined campaign of resistance to the project, contributing to delays in evaluation of the site.[32] In 2002, the Secretary of Energy finally determined that the site was suitable for a repository and recommended it to the President, who in turn recommended it to Congress. Following the procedures laid out in the NWPA, Nevada filed a notice of disapproval, which was overridden by a joint "resolution of siting approval" adopted by both houses of Congress and signed by the president.[33] Nevada's opposition continued, and the license application was not filed until 2008. In the 2008 presidential election, candidate Obama stated his opposition to Yucca Mountain, and in 2010, DOE submitted a motion to the NRC to withdraw the Yucca Mountain license application on the grounds that "the Secretary of Energy has decided that a geologic repository at Yucca Mountain is not a workable option" for long-term nuclear waste disposal. This was based not on technical grounds but rather "the perceived difficulty in overcoming continued opposition from the State of Nevada and a desire to find a waste solution with greater public acceptance."[34]

Efforts to Revitalize the Nation's Nuclear Waste Program

In 2010, at the request of the President, Secretary of Energy Steven Chu formed the Blue Ribbon Commission on America's Nuclear Future (BRC) to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle and recommend a new strategy.[35] The challenge of finding sites for nuclear waste facilities was a central concern of the BRC, several of whose members had been in Congress at the time of the key legislative actions affecting the civilian waste program and WIPP.[36] After reviewing experiences in the U.S. and other countries, the BRC concluded "that any attempt to force a top down, federally mandated solution over the objections of a state or community—far from being more efficient—will take longer, cost more, and have lower odds of ultimate success,"

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[32] See Stewart, R. and J. Stewart. 2011. *Fuel Cycle to Nowhere: U.S. Law and Policy on Nuclear Waste*. Vanderbilt University Press: Nashville, Tennessee. Pp. 222-230.

[33] The text of the resolution, as specified in the NWPA, states "That there is hereby approved the site at [location of site] for *a* repository..." This language, adopted in 1982 in the context of a multiple-repository siting program, does not imply that the site being approved is intended to be the *only* repository.

[34] Congressional Research Service. Civilian Nuclear Waste Disposal. Updated September 6, 2018. RL33461 https://crsreports.congress.gov: "[The] Obama Administration's policy change was prompted by the perceived difficulty in overcoming continued opposition from the State of Nevada and a desire to find a waste solution with greater public acceptance, according to DOE."
See also U.S. Department of Energy, *Report on Separate Disposal of Defense High-Level Radioactive Waste*. March 2015.http://www.energy.gov/sites/prod/files/2015/03/f20/Defense%20Repository%20Report.pdf
"The path to a first and second repository as envisioned under the NWPA has been significantly more controversial, costly, and delayed than was anticipated in 1985. When the Act was amended in 1987 to focus on a single repository site at Yucca Mountain, it reflected a growing frustration in Congress over the increasing cost and delay. There was a strong belief at the time that focusing on a single site would alleviate these issues. That did not prove to be the case—cost escalation and delays continued, while state opposition and legal challenges mounted. In 2009, with the timeline for opening a repository pushed back by two decades, and no end to opposition in sight, the Department determined the site to be unworkable."

[35] This discussion is excerpted from the final report of the BRC, *op. cit.*

[36] Rep. Lee H. Hamilton (BRC Co-chair), Sen. Pete Domenici, and Rep. Phil Sharp.

and that "siting processes for all such future facilities are most likely to succeed if they are consent-based—in the sense that affected communities have an opportunity to decide whether to accept facility siting decisions and retain significant local control."

The BRC noted that the question of how to define "consent" had been raised by many stakeholders. "Some stakeholders, for example, have suggested that consent within a state could be measured by a state-wide referendum or ballot question. On the other hand, the WIPP facility was sited, opened, and has been operated without the state's elected leaders employing such consent-measuring mechanisms." The BRC declined to give a precise answer to this question, observing that "any process that is prescribed in detail up front is unlikely to work." Instead, the BRC took the view that "this question ultimately has to be answered by a potential host jurisdiction, using whatever means and timing it sees fit. We believe a good gauge of consent would be the willingness of affected units of government – the host states, tribes, and local communities – to enter into legally binding agreements with the facility operator, where these agreements enable to have confidence that they can protect the interests of their citizens." Note that while this suggests that a legally binding agreement with a prospective host would be *sufficient* evidence of consent, it does not imply that one is *necessary*.[37]

In response to the recommendations of the BRC, in 2013 the DOE issued the Administration's *Strategy for the Management and Disposal of Used Nuclear Fuel and High- Level Radioactive Waste,*[38] (Strategy), calling for a consent-based approach to siting and implementing a comprehensive management and disposal system that would include a pilot interim storage facility initially focused on serving shut-down reactor sites, a larger interim storage facility to provide added flexibility to the system, and a permanent geologic repository. The report "concurs with the conclusion of the BRC that a fundamental flaw of the 1987 amendments to the NWPA was the imposition of a site for characterization, rather than directing a siting process that is, as the BRC recommends, "explicitly adaptive, staged, and consent-based…" In practical terms, this means encouraging communities to volunteer to be considered to host a nuclear waste management facility while also allowing for the waste management organization to approach communities that it believes can meet the siting requirements." Like the BRC, the Strategy declined to define consent and how it would be implemented, leaving that for future consultations between the Administration and Congress.

In late 2015 the DOE began an initiative to develop a process for siting disposal or storage facilities for SNF and HLW in collaboration with the public, communities, stakeholders, and governments at the tribal, state, and local levels. The initiative involved an Invitation for Public Comment[39] and a series of public meetings

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[37] This discussion of consent is focused on the *product* of negotiations. The matter of the *content* of a potential "consent-based agreement" requires consideration of an array of topics that, while being unique to each state, tribe, and community, will likely be organized into a key set of common topics, such as health and safety protections, impact monitoring and mitigation, compensation, and incentives and benefits. One of the earliest, and perhaps seminal, discussions of the utility of incentives in nuclear waste repository siting came out of the Oak Ridge National Laboratory (ORNL) in the early 1980s. [See, for example, *Incentives and the Siting of Radioactive Waste Facilities*, ORNL, August 1982].

[38] See: https://www.energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf.

[39] U.S. Department of Energy, *Invitation for Public Comment to Inform the Design of a Consent-Based Siting Process for Nuclear Waste Storage and Disposal Facilities*, 80 FR 79872, December 23, 2015. https://www.federalregister.gov/documents/2015/12/23/2015-323 6/invitationfor-public-comment-to-inform-the-design-of-a-consent-based-siting-process-for-nuclear.

with stakeholders and communities around the country. DOE issued a summary of public inputs received during the process in December 2016, [30] and a draft consent-based siting process in January 2017. [31]

The latter document outlined DOE's thinking regarding specific steps and broader design principles for implementing a consent-based siting process and presented preliminary views on siting considerations for federal SNF and HLW storage and disposal facilities.

The proposed process detailed sequence of steps involving the potential host community and the implementing organization, with finalization of a consent agreement after evaluation of the suitability of the site for the facility, but before licensing is initiated. At that point, "The community determines the method to be used to ratify the agreement that the community considers suitable. The implementing organization and community accept terms of the agreement, and all required parties sign. Agreement is approved by necessary parties and finalized." Note that there is considerable ambiguity what parties would be involved in approving and signing the consent agreement, as evident in this introduction to the detailed description of the proposed process:

> "It should also be recognized that the while the local community is generally the most affected by any siting process, local and state government, Congressional delegations, as well as any affected Tribal governing body, will play important roles in the siting process. Therefore, the use of the term "community" in the following draft consent-based siting process should be interpreted as the broad and inclusive participation from all of these groups and not limited to the local community." [32]

The proposed process also would allow great flexibility with respect to the scope and nature of a possible consent agreement, which could include the types and amounts of SNF and/or HLW the community would consent to accepting at the proposed facility, and even the type of facility (storage, disposal, or both). [33]The initiative was not continued by the Trump Administration, which focused on restarting the Yucca Mountain licensing process.

In the summer of 2012, the Senate Committee on Energy and Natural Resources began consideration of legislation to implement key recommendations of the BRC, including new consent-based siting processes for interim storage facilities and repositories to be carried out by a new Nuclear Waste Administration. [44]The current version of that bill, S. 123 4 establishes different consent-based approaches for the two kinds of facilities.

After selecting a site for evaluation for a storage facility, the Administrator of the newly-established Nuclear Waste Administration is authorized, but not required, to enter into a cooperative agreement with the State, affected units of general local government, and affected Indian Tribes, as applicable. The agreement can include (a) terms of financial and technical assistance to enable each applicable unit

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[30]U.S. Department of Energy, *Designing a Consent-Based Siting Process: Summary of Public Input Final Report*, December 29, 2016. https://www.energy.gov/ne/downloads/designing-consent-based-siting-process-summary-public-input-report.

[31]U.S. Department of Energy. *Draft Consent Based Siting Process for Consolidated Storage and Disposal Facilities for Spent Nuclear Fuel and High-level Radioactive Waste*. January 12, 2017 https://www.energy.gov/sites/prod/files/2017/01/f3 4/Draft%20Consent-Based%20Siting%20Process%20and%20Siting%20Considerations.pdf.

[32]*Ibid*., p. 8.

[33]*Ibid*., p. 11.

[44]S. 3 69.

of government to monitor, review, evaluate, comment on, obtain information on, make recommendations on, and mitigate any pacts from, site characterization activities; and (b) any other term that the Administrator determines to be appropriate. Prior to final selection of a site for an interim storage facility, the Administrator is *required* to enter into a consent-based agreement with the Governor, each affected unit of local government, and tribe. The agreement must be binding, but no Congressional approval is required.

Requirements for state, local, and tribal participation in repository siting differ somewhat from those for a storage facility. Potential sites to be evaluated for a repository are to be identified voluntarily by being recommended by (a) the Governor or duly authorized official of the State in which the site is located; (b) the governing body of the affected unit of general local government; (c) the governing body of an Indian Tribe within the reservation boundaries of which the site is located; or (d) the Administrator, after consultation with, and *with the consent of*, the applicable unit(s) of government. Before selecting a site for detailed evaluation (characterization), the Administrator is *required* to enter into a consultation and cooperation agreement with the Governor of the State in which the site is located; the governing body of the affected unit of general local government; and the governing body of any affected Indian Tribe. The requirements for such an agreement generally reflect the consultation and cooperation provisions in the NWPA.

After making a final determination of site suitability based on site characterization, but before submitting a license application to the Nuclear Regulatory Commission, the Administrator is *required* to enter into a mutually-binding consent agreement with the Governor or other authorized official of the state in which the site is located, the governing body of the affected unit of general local government; and if the site is located on a reservation, the governing body of the affected Indian Tribe. The consent agreement is to contain the terms and conditions on which each State, local government, and Indian Tribe, as applicable, consents to host the repository and express the consent of each to do so.

Congressional approval is not required for any of these agreements. All are subject to the caveat that any provisions that authorize an expenditure or obligation exceeding an amount available in the Working Capital Fund (established to receive and accumulate fee payments going forward and to be available to the Administrator without appropriation) are subject to appropriation, limiting the scope of commitments that can be made to host jurisdictions that do not depend on future actions by Congress.

The draft Senate appropriations bill for energy and water development and related agencies for fiscal year 2021 authorizes a much simpler consent-based program for storage facilities for SNF from sites without an operating nuclear reactor. [5]Before siting such a facility, the Secretary of DOE must enter into an agreement to host the facility with (a) the Governor of the State; (b) each unit of local government within the jurisdiction of which the facility is proposed to be located; and (c) each affected Indian tribe.

In the House, H.R. 2699 [6]would create a new consent-based approach for siting a Monitored Retrievable Storage (MRS) facility through "MRS agreements" with non-federal parties that hold a license to such a facility. While there is no requirement for a formal consent agreement with host jurisdictions, DOE may not enter into an MRS agreement until "…the non-Federal entity that is a party to the MRS agreement has approval to store Department-owned civilian waste at such facility from each of— (A) the Governor of the State in which the facility is located; (B) any unit of general local government with jurisdiction over the area in which the facility is located; and (C) any affected Indian tribe." The bill also authorizes DOE to find a site for a federal MRS facility using the process established

[5]See: https://www.appropriations.senate.gov/imo/media/doc/EWFY2021.pdf.
[6]Passed by the House in almost the same form as H.R. 3053 in the 115th Congress.

by the 1987 amendments to the NWPA, but adds a requirement that the Secretary is required to "consider the extent to which siting a monitored retrievable storage facility at each site surveyed would ...be acceptable to State authorities, affected units of local government, and affected Indian tribes."

The State of Nevada favors a bill [78] that would give Nevada the same rights to a consent agreement for a repository that would be afforded to potential hosts of new repository sites under proposals for consent-based siting. Unlike S. 1234, which requires consent agreements with host jurisdictions before submission of a license application to the NRC, Nevada's approach defers that requirement until after licensing is completed but before construction and operation of the repository. Furthermore, it extends the right to consent agreements to certain jurisdictions that are affected by transportation of SNF or HW to the repository.

Concluding Observations

There are many questions to be resolved in operationalizing the concept of "consent" in a siting process. Who must consent? When? How? Is a written agreement required or is an indication of acceptance (or non-opposition) sufficient? Is Congressional approval of a written agreement needed? How can federal commitments be enforced? Which of these questions need to be answered in siting legislation, and which can be left to be negotiated with potential host jurisdictions?

Organizations representing the nation's governors, state legislatures, counties, and tribal governments have not adopted positions on these issues in general or on the consent provisions in pending bills in particular. On a regional level, the Western Governors' Association, expressing concern that western states may be disproportionately impacted by radioactive waste transportation and disposal activities given existing and proposed sites for disposal of radioactive waste in the United States, resolved that "In the event that centralized interim storage, either private or federal, is deemed necessary, no such facility, whether publicly or privately owned, shall be located within the geographic boundaries of a western state or U.S. territory without the written consent of the Governor in whose state or territory the facility is to be located." [88]

The Trump Administration also has not taken a position on these issues or legislative initiatives. As noted above, it dropped the consent-based siting initiative of the Obama Administration and consistently proposed funding to restart the Yucca Mountain licensing process. However, the budget proposal for DOE for Fiscal Year 2022 omitted such funding. In testimony on the proposal, Secretary of Energy Brouillette told Senator Cortez-Masto of Nevada "We have reached a point where the president has decided we will not pursue this over the objections of the people of Nevada' and said that he would work with her on alternatives that would require the consent of states when selecting locations to store nuclear waste. [89]

Timing of State Consent

A particularly important question in the context of the United States' federal system is at what point in the siting process explicit approval is required from elected leaders at the state level. Support for a nuclear facility at the local level but opposition in the surrounding parts of the state (the so-called

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[78] S. 649 (the Nuclear Waste Informed Consent Act).

[88] Western Governors' Association Policy Resolution 2018-10 Transportation, Storage and Disposal Radioactive Waste, Radioactive Materials and Spent Nuclear Fuel. https://westgov.org/images/files/WGA_PR_2018-06_Transportation_Infrastructure.pdf.

[89] Gary Martin. "Energy secretary: No money for Yucca Mountain in Budget." *Las Vegas Review-Journal*. March 3, 2020 . https://www.reviewjournal.com/news/politics-and-government/energy-secretary-no-money-for-yucca-mountain-in-budget-1971232/.

"donut effect") is not uncommon. In the case of WIPP, the initiative to explore the site for use as a radioactive waste repository came from the local level. New Mexico Governor Bruce King gave tacit approval of early studies of the suitability of the site. As a colleague observed, "His attitude was, go take a look. Bruce was too smart to get caught in an outright commitment early on. He'd say, 'Some of my friends support it, and some oppose it, and I'm for my friends.'"[50] While the project was purely military in nature (before DOE's short-lived proposal to dispose of a limited amount of commercial SNF there), New Mexico politicians followed Governor King's policy of tacit acceptance of studies and the state did not seek an active role in decision making. His successor, Jerry Apodaca, declined a request to exert veto power over the project, maintaining that "the proper position for me to take is one of concerned neutrality, awaiting the evidence before taking a firm position."[51] As described above, New Mexico ultimately was able to reach an acceptable working relationship with DOE with respect to WIPP.

In contrast, the experience of the Nuclear Waste Negotiator process suggests that there are risks to asking for a formal expression of state-level support too soon, before there has been extensive vetting of the idea of hosting a nuclear waste facility throughout the state. The Negotiator provisions of the NWPA as amended in 1987 require negotiations with a State or tribe to reach a formal agreement that must be approved by Congress. It also requires the Negotiator to consult with any other states, subdivisions of states, or tribes that might be affected by a proposed site and allows a negotiated agreement to include provisions related to the interests of those other parties.

The first Negotiator established a process providing exploratory grants to interested states, tribes, and local governments, but requiring explicit approval by the governor of a state at each stage of the process, although this was not required by the Negotiator provisions of the NWPA.[52] No state applied for exploratory grants, and none of the local governments that did were allowed by the host state to go beyond the first phase of study.[53, 5 4]

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[50] McCutcheon, *op. cit.*, p. 30.

[51] McCutcheon, *op. cit.*, p. 62.

[52] "Under the process as established by the Office of the Negotiator, the withdrawal of a governor's support terminates any possibility of further study or continuing dialogue with private parties or the representatives of political subdivisions of that state." Leroy, *op. cit.*

[53] *FINAL BUSINESS PLAN REPORT, REVISION 3 - INTEGRATED USED FUEL MANAGEMENT: A Strategy for the Disposition of the Nation's Used Commercial Nuclear Fuel*. Prepared for DOE GNEP Deployment Studies by ENERGYSOLUTIONS, Shaw, and Booz Allen Hamilton. September 30, 2009. P. 3-8. https://cybercemetery.unt.edu/archive/brc/20120620224136/http://brc.gov/sites/default/files/meetings/attachments/business_plan_base_report_final_.pdf.

[5] In disapproving a second exploratory grant to Fremont County, the Governor of Wyoming expressed a dim view of the requirement that he make that decision: "I arrive at this decision, *which the federal government in its infinite wisdom placed in the lap of the Governor* [emphasis added], because I believe it to be in the best long tern interests of Wyoming, its citizens and future generations."
Letter from Governor Mike Sullivan, State of Wyoming, to the Fremont County Commissioners, August 21, 1992. In Appendix G, Secretary of Energy Advisory Board report: *Earning Public Trust and Confidence: Requisites for Managing Radioactive Wastes*. It is interesting to note that in 1995 the State of Wyoming adopted a high-level radioactive waste storage act that lays out in detail the process and requirement for siting such a facility (private or federal) in Wyoming. It does not require the governor's explicit approval at any stage of the process; it does require final approval by the legislature, but that can become effective without the governor's signature. See: https://codes.findlaw.com/wy/title-35-public-health-and-safety/wy-st-sect-35-11-1501.html.

ATTACHMENT B:

SCE Action Plan

March 15, 2021

Southern California Edison Company
San Onofre Nuclear Generating Station

VOLUME I

ACTION PLAN FOR THE RELOCATION OF SONGS SPENT NUCLEAR FUEL TO AN OFFSITE STORAGE FACILITY OR A REPOSITORY

March 15, 2021

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

To our SONGS neighbors and community,

Southern California Edison Company (SCE) is pleased to share the Action, Strategic and Conceptual Transportation Plans for the off-site relocation of spent nuclear fuel from the San Onofre Nuclear Generating Station (SONGS). These plans reflect years of work and critical support from a team of nationally recognized leaders in nuclear waste policy, spent nuclear fuel transportation and nuclear engineering and science, as well as SONGS co-owners – San Diego Gas & Electric Company and the cities of Anaheim and Riverside.

The distribution of the plans is a significant milestone in a process that began following the 2017 settlement regarding the coastal development permit issued for SONGS' expanded spent fuel storage system. The Department of Energy was to begin transporting spent fuel from nuclear sites across the country to a repository in 1998. There are 123 canisters of spent nuclear fuel at SONGS and no available federal repository to which they can be relocated at this time.

These plans offer an analysis of the costs, opportunities and challenges of relocating spent nuclear fuel from a commercial utility and its customers. The evaluation found it unlikely that the SONGS co-owners and their customers would find a commercially reasonable path to move the spent nuclear fuel without federal government involvement. This is consistent with SCE's strong belief that its customers should not be exposed to additional costs or risks when it is the federal government's legal and contractual obligation to provide a solution.

The successful resolution of this challenge cannot come through the efforts of the SONGS co-owners alone. SCE and the counties of Orange and San Diego announced the formation of a stakeholder coalition, *Action for Spent Fuel Solutions Now*, to build momentum toward commercially reasonable off-site storage or disposal solutions and to urge the federal government to meet its legal obligations. While the coalition continues to grow, we are pleased that SONGS co-owners San Diego Gas & Electric and the City of Riverside are founding members.

While SCE recognizes that policy changes take time, as a steward for the environment and the communities it serves, SCE is pressing for federal action now.

Through these plans, SCE continues its pursuit of safe and commercially reasonable avenues for the off-site storage and/or disposal of the SONGS spent nuclear fuel. SCE respectfully looks forward to your support as it seeks to advance solutions to the spent fuel challenges facing the SONGS community and our nation.

Pedro Pizarro
President & CEO
Edison International

Kevin Payne
President & CEO
Southern California Edison Co.

Doug Bauder
Vice President,
Decommissioning and Chief Nuclear Officer, SONGS
Southern California Edison Co.

Statement of the Experts Team
on the
Plan for the Relocation of SONGS Spent Nuclear Fuel
to an Offsite Storage Location
March 15, 2021

We, the independent Experts Team, have provided advice and reviewed work products on spent fuel management at the San Onofre Nuclear Generating Station (SONGS) on behalf of Southern California Edison (SCE) for the last three years. We support the final products on spent fuel management of both the North Wind team and SCE. The studies provide a solid framework for the SONGS co-owners to move forward with the management and future removal of spent nuclear fuel (SNF) from the SONGS site. SCE has broken new ground for the U.S. nuclear industry by being one of the first sites to conduct such a detailed analysis of options for moving spent fuel off site. We applaud them for this effort.

Role of the Experts Team and Review Process

The Experts Team was formed in early 2018, consistent with provisions of the Settlement Agreement reached between SCE and Citizens' Oversight. The Experts Team included expertise in the areas of nuclear engineering, spent fuel siting and licensing, spent fuel transportation, and radiation detection and monitoring, among others. We assisted SCE in the creation of a Request for Information (RFI) to select a qualified and experienced company for the development of the Strategic Plan. When responses to the RFI were received, we provided independent input into the evaluation and ranking of the qualifications of the companies that responded to the RFI, leading to the selection of North Wind.

After North Wind had been selected, the Experts Team reviewed and provided comment on their proposed outline for the Strategic Plan and the alternatives to be assessed in the Strategic Plan. Assumptions and raw data inputs to the planning process were thoroughly vetted. We reviewed several drafts of the Strategic Plan as it was being developed and provided feedback to North Wind and SCE. The diverse and experienced backgrounds of the Experts Team members and North Wind assured wide ranging discussions of the issues affecting options for relocating the SONGS SNF offsite.

A similar process was conducted for the development of the Conceptual Transportation Plan. For this work product, key members of the Experts Team participated in weekly meetings, in conjunction with North Wind and SCE, to incorporate the Experts Team guidance early in the process for the development of the Conceptual Transportation Plan. As with the Strategic Plan, the full Experts Team reviewed and provided comments on several drafts of the Conceptual Transportation Plan.

SCE staff relied upon the "Key Findings" from the Strategic Plan and the Conceptual Transportation Plan to develop the Action Plan. The Experts Team provided review and comment as well.

The input provided by the Expert Team members on each of the three plans was fully considered and incorporated as appropriate.

Conclusion

The Experts Team has had a significant role in the development of the Action Plan, the Strategic Plan, and the Conceptual Transportation Plan. We concur that the alternatives evaluated in the Strategic Plan are those that make the most sense to evaluate in the current situation.

The Experts Team supports the "Key Findings" in both the Strategic Plan and the Conceptual Transportation Plan. The Action Plan prepared by the SCE staff appropriately incorporates these key findings. Finally, the recommendation in these documents to closely follow developments in offsite storage technology, legislative developments and changing business models for consolidated storage facilities is important as nuclear waste management options continue to evolve.

The result of this effort is that SCE will be well positioned to take advantage of any commercially reasonable opportunity to relocate spent fuel to an offsite storage facility. In addition, SCE will be in a better position to prepare spent fuel to be shipped off site. We have appreciated the opportunity to participate in this initiative.

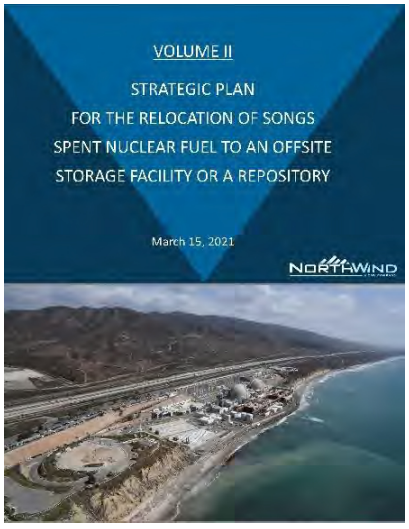
Tom Isaacs – Siting and Licensing, Chair
Dr. Allison Macfarlane – Siting and Licensing
Dr. Josephine Piccone – Radiation Detection & Monitoring
Richard C. Moore – Spent Fuel Transportation
J. Gary Lanthrum – Spent Fuel Transportation
Kristopher W. Cummings, M.S. – Nuclear Engineering

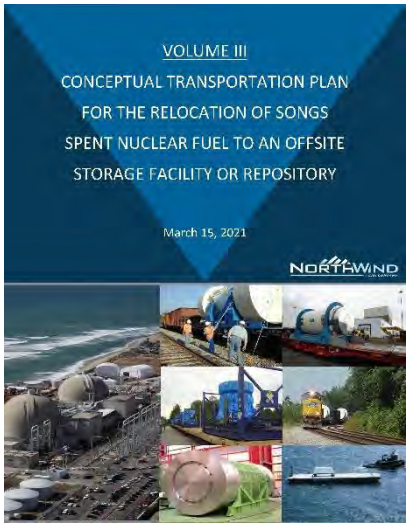
Table of Contents

1. Introduction

Through this Action Plan, the San Onofre Nuclear Generating Station (SONGS) co-owners[1] describe how they will act upon the insights, findings, recommendations and conclusions detailed in the *Strategic Plan for the Relocation of Spent Nuclear Fuel to an Offsite Storage Facility* ("Strategic Plan") and the *Conceptual Transportation Plan for the Relocation of Spent Nuclear Fuel to an Offsite Storage Facility* ("Conceptual Transportation Plan"), Volumes II and III of this compendium, respectively.[2] For convenience, this Action Plan provides cross references indicating where additional information and/or supporting discussion can be found in the Strategic and Conceptual Transportation Plans.

The overarching objective…is to…achieve the safe and commercially reasonable removal of all spent nuclear fuel (SNF) and greater-than-Class C (GTCC) low-level radioactive waste from SONGS as soon as possible.





The overarching objective for all three plans is to help the SONGS co-owners achieve the safe and commercially reasonable removal of all spent nuclear fuel (SNF) and greater-than-Class-C (GTCC) low-level radioactive waste from SONGS as soon as possible.[3]

[1] SONGS is co-owned by Southern California Edison Co. (SCE), San Diego Gas & Electric (SDG&E), and the City of Riverside. The City of Anaheim, a former SONGS owner, remains a co-participant in the decommissioning process and shares the co-owners' interest in finding an offsite solution for SONGS SNF. Where applicable, "SCE" may be used to designate responsibility for actions to be undertaken by SCE as the decommissioning agent for SONGS on behalf of the SONGS co-owners.

[2] SCE retained a consortium of consultants led by North Wind, Inc. (North Wind) to develop the Strategic and Conceptual Transportation Plans. North Wind developed these Plans with the guidance and oversight of SCE and an external Experts Team, which was comprised of six individuals with extensive, high-level experience in the field of nuclear waste management and regulation. Additional discussion regarding the role of the Experts Team is provided in Section 2.3 of the Strategic Plan (Vol. II) (*Approach to the Strategic Plan and the Role of the Experts Team*).

[3] In this Action Plan, as in the Strategic and Conceptual Transportation Plans, references to SONGS SNF should generally be understood to include SONGS GTCC waste unless otherwise specified.

Complete removal of these materials is necessary to enable the full decommissioning and restoration of the SONGS site so that the land can be returned to its owner, the U.S. Navy.[4]

Recognizing that no offsite facility currently exists that could accept the SONGS SNF and GTCC waste, the Strategic Plan explores a range of alternative pathways for pursuing this overarching objective. Several factors were considered, most critically the ability to provide an offsite solution that (1) meets rigorous regulatory requirements for safety and protection of public health and the environment and (2) can be implemented in a commercially reasonable manner.[5]

A federal solution, or at least one which encompasses a significant degree of federal support, offers the surest and most achievable path to relocating the SONGS SNF.

The results of the analysis, from both the Strategic and Conceptual Transportation Plans, point to a clear distinction between pathways that rely on the federal government's longstanding contractual and statutory obligation to take title to commercial SNF and remove it from plant sites, versus pathways that do not presume a central federal role. Put simply, a federal solution, or at least one that encompasses a significant degree of federal support, offers the surest and most achievable path to relocating the SONGS SNF. All other alternatives create uncertain but potentially large risks and costs and thus are far less likely to meet the test of commercial reasonableness, which encompasses critical considerations of cost, cost recovery, title and liability. The steps outlined in this Plan thus reflect an emphasis on federal action as the key to resolving the core SNF management challenges facing SONGS.

[4] Additional discussion of the SONGS co-owners' objectives with respect to the SONGS SNF and plant site may be found in the Strategic Plan (Vol. II), Section 2.2 (*Strategic Plan Objectives*) and in the Conceptual Transportation Plan (Vol. III), Section 8 (*Key Steps Toward Transportation Readiness*).

[5] The criterion of commercial reasonableness is articulated in detail in the August 2017 *Settlement Agreement Regarding Coastal Development Permit for Storage of San Onofre Spent Nuclear Fuel* that prompted the development of these Plans; it is also a standard that any utility, given its fiduciary responsibility to customers and shareholders, would apply in making decisions that have potentially significant cost and liability implications. Additional discussion regarding the standard of commercially reasonability is provided in Section 6.2 of the Strategic Plan (Vol. II) (*Cost Considerations and "Commercial Reasonableness"*).

2. A Framework for Action

In support of achieving the objectives for the SONGS site and implementing the Strategic and Conceptual Transportation Plans, the SONG co-owners will undertake near-term actions in four categories:

A. Pursuing relocation of SONGS spent nuclear fuel (SNF) to an offsite facility. Section 3 describes actions in support of alternatives that presume the federal government's assumption of responsibility for the SONGS SNF, including reestablishment of a federal program to dispose of SNF.

B. Catalyzing federal, state, and local support. Section 4 describes actions to encourage federal, state, and local support for the activities described in Section 3.

C. Preparing the SONGS site and SONGS SNF for offsite transportation. Section 5 describes actions at SONGS to ensure that the SNF is ready for offsite transport once a commercially reasonable offsite facility becomes available and to safely store the SNF on site in the meantime.

D. Corporate capacity building and governance. Section 6 describes corporate capacity building and governance measures in support of this Action Plan.

These actions reflect the fact, previously noted in the Introduction, that there is currently no licensed and operating facility prepared to accept SONGS SNF. Further, they reflect a recognition that the time required to develop any such offsite alternative remains uncertain.[6] The efforts described in this initial iteration of the Action Plan are in general support of the Phase I activities described in the Conceptual Transportation Plan, prior to the identification of an offsite facility.[7]

The efforts described in this initial iteration of the Action Plan are assumed to occur in general support of the Phase I activities described in the Conceptual Transportation Plan, prior to the identification of an offsite facility.

Given the recognized uncertainties surrounding when an offsite storage or disposal facility might become available, the approach of the SONGS co-owners must remain flexible and provide optionality. This Action Plan will be revisited periodically to consider the efficacy of the SONGS co-owners' actions, and to adjust future efforts in response to the changing technological and socio-political developments that will shape our national nuclear waste management landscape.

All actions will be assessed and undertaken with a focus on the health and safety of the public, SONGS workers, and the protection of the environment, as well as the prudent and commercially reasonable stewardship of customer funds.

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[6] Additional discussion regarding the likely timeframes associated developing different options for the offsite relocation of SONGS SNF is provided in the Strategic Plan, Vol. II, Section 6.7 (*Timeframe to Achieve Objective*).

[7] Additional discussion regarding near-term preparations necessary for the offsite transportation of SONGS SNF is provided in the Conceptual Transportation Plan, Vol. III, Chapter 5 (*Phase I: Near-term Actions To Prepare for Transporting SONGS SNF*).

3. Pursuing Relocation of SONGS SNF to an Offsite Facility

This section describes actions the SONGS co-owners will take to support the establishment of offsite disposal or storage facilities—*i.e.*, a permanent federal repository and/or one or more interim storage facilities—that would allow for the safe and commercially reasonable relocation of the SONGS SNF.[8] The specific actions described in this section will be taken in concert with the advocacy efforts described in Section 4.

The SONGS co-owners consider the development of a permanent federal disposal repository and revitalization of the national nuclear waste management program to be critically important, not only to implement the ultimate solution for the SONGS SNF, but also as a requisite complement to any interim storage alternative. Otherwise, the lack of an effective federal program to implement permanent disposal may call into question the interim nature of any alternative storage solution for SONGS SNF. Accordingly, the SONGS co-owners support efforts to reset the national nuclear waste management program in parallel with efforts to advance certain interim offsite storage alternatives, as considered in the Strategic Plan.

…it is the federal government's obligation to provide for the offsite disposition of SONGS SNF, including taking title to and assuming liability for the SONGS SNF…[C]ustomers should not be exposed to additional costs or risks associated with the federal government's failure to deliver a timely disposal solution."

Fundamental to this support, however, is the presumption that it is the federal government's obligation to provide for the offsite disposition of SONGS SNF, including taking title to and assuming liability for the SONGS SNF. The customers of the SONGS co-owners should not be exposed to additional costs or risks associated with the federal government's failure to deliver a timely disposal solution for SONGS SNF.[9] This is a foundational tenet of the commitments the SONGS co-owners make through this Action Plan.

3.1 Resetting the federal nuclear waste management program and support for a permanent federal disposal repository [10]

The structural reforms needed to effectively reset the federal nuclear waste management program are substantial, dependent on factors beyond the direct control or influence of the SONGS co-owners, and

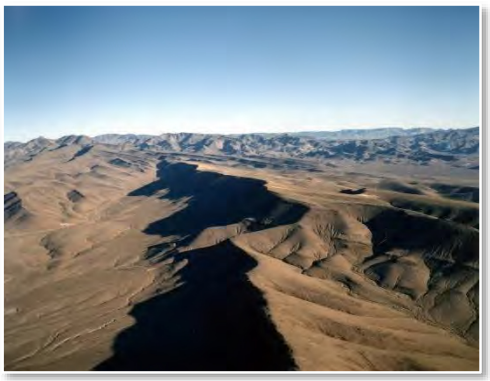
[8] In addition to the specific actions described here, the SONGS co-owners will continue monitoring developments relevant to the range of alternatives studied in the Strategic Plan, as well as emerging technologies, alternatives, and approaches to SNF management deserving of increased attention in the future. The SONGS co-owners will engage and/or support such concepts as appropriate.

[9] Additional discussion regarding the federal government's obligation to provide for the offsite disposition of SONGS SNF is provided in the Summary of the Strategic Plan, Vol. II, at p. iv ("Since the passage of the Nuclear Waste Policy Act of 1982 (NWPA), responsibility for implementing a disposal solution for SNF has rested with the federal government"), p. 28 ("The federal government has a responsibility to take title to commercial SNF and devise a solution for SNF disposal"), and in Sections 6.2 (*Cost Considerations and "Commercial Reasonableness*), 6.3 (*Legal and Regulatory Requirements and Challenges*), and 6.4 (*Title and Possession (including related issues of risk, liability, and indemnification)*).

[10] Additional discussion regarding restarting the national nuclear waste management program is provided in the Strategic Plan, Vol. II, Section 8.5 (*Restarting the National Nuclear Waste Management Program*).

likely to require significant efforts over an extended period. The SONGS co-owners can support these reforms, but their successful implementation will ultimately require a broad base of technical and focused socio-political support beyond the capabilities of the SONGS co-owners alone. Recognizing this, the SONGS co-owners will:

A1. Actively encourage several key structural reforms in support of successfully resetting the federal nuclear waste management program. Any reset of the federal nuclear waste management program should include:


Yucca Mountain, Nevada

- Establishing a path to one or more permanent geologic disposal repositories.[11]
- Authorizing federal interim storage (discussed further in Section 3.2.1 below) by developing a federal consolidated interim storage facility (CISF) and/or by allowing the U.S. Department of Energy (DOE) to contract for private storage services.
- Establishing a new single-purpose organization, ideally as an independent entity outside DOE, with mission responsibility for the safe management and final disposition of SNF in the United States. To preserve the personnel and capabilities needed to successfully address the nation's long-term (multi-decade) SNF management challenges, such an organization should be stable, properly staffed, securely funded, and insulated from short-term political changes.
- Establishing a new mechanism for consultation/collaboration between the national nuclear waste management program and state, local, and tribal authorities. Non-federal entities that have an interest, either in the location of SNF storage and disposal facilities and/or in the transportation of SNF from current reactor sites to storage or disposal facilities, are important partners in advancing the national program.
- Improving access to the approximately $41 billion[12] currently in the Nuclear Waste Fund to finance needed investments. Specific priorities include:
  - A new or modified mechanism to assure permanent and stable access to already collected ratepayer funds is needed to execute a large, multi-year capital investment program for an integrated national nuclear waste management system.

[11] The SONGS co-owners support prompt efforts by the federal government to initiate a deliberate and considered process for identifying and constructing a geologic repository for permanent SNF disposal. The SONGS co-owners take no position with respect to the suitability of the Yucca Mountain site or with respect to any decision that might be taken regarding whether to continue the licensing process for Yucca Mountain and/or pursue another repository site.

[12] *See* Strategic Plan, at p. 34 (noting the Nuclear Waste Fund had accrued approximately $42.1 billion (including interest) by the end of 2020).

- Resumption of funding for a permanent geologic repository program and in support of an immediate decision (with any required changes to the Nuclear Waste Policy Act (NWPA)) on whether to restart the licensing process for Yucca Mountain and/or begin work to identify and develop one or more alternative repository sites for the final disposal of all commercial SNF.[13]

- Clarifying criteria for the reimbursement of costs from the Nuclear Waste Fund and/or Judgment Fund in order to encourage consolidated spent fuel storage. Such clarification should include allowing reimbursement for all aspects of transportation (including indemnification as would be provided were DOE to contract for SNF shipments) and storage costs at alternate site(s), as well as addressing issues regarding SNF title transfer from the current owners to other parties, including the federal government, new public-private partnership(s), and/or wholly private entities.

- Providing federal support for preparedness capabilities among state, tribal and local entities in connection with private SNF shipments, including support for safety and emergency response training.

A2. Seek support for a new framework to prioritize federal acceptance of spent fuel from shutdown sites. The SONGS co-owners support a more efficient removal sequence for federal acceptance of SNF that better reflects the benefits and costs of clearing SNF from shutdown reactor sites. Relevant considerations should go beyond the current "oldest fuel first" approach to include a range of site-specific and systemic factors, such as status as an operating or shutdown reactor site, compatibility with decommissioning activities, risk reduction for SNF storage at reactor sites, beneficial re-use of decommissioned sites, total system cost effectiveness, shortened schedules for complete site closure, and facilitation and ease of transportation requirements. An improved framework for allocating SNF acceptance rights should provide incentives and enabling mechanisms for interested parties to negotiate amongst themselves for a more rational and efficient order of SNF removal (*e.g.*, an SNF priority list marketplace or trading platform).

3.2 Consolidated interim storage opportunities and potential federal support of same

In parallel with support for a reset of the federal nuclear waste management program, the SONGS co-owners will support the establishment of one or more CISFs that would allow for the safe and commercially reasonable relocation of the SONGS SNF. CISF opportunities are relatively mature (at least in comparison to other potential alternatives) and there has already been considerable work by the federal government and the private sector to plan for and develop consolidated storage concepts. Various federal legislative proposals have already been

The SONGS co-owners will support the establishment of one or more CISFs that would allow for the safe and commercially reasonable relocation of the SONGS SNF.

[13] *See* fn. 11, *supra.*

advanced that would support CISF opportunities, including by clarifying and expanding existing NWPA authority.[14]

Again, the federal government's assumption of responsibility for the SONGS SNF, which would avoid any additional financial burden to customers of the SONGS co-owners, is critical to satisfying the criterion of commercial reasonableness for any path forward.

3.2.1 Federal CISF

A federal CISF, or a federal contract for the use of a private CISF, would generally be consistent with historic national policy and the NWPA in terms of placing ultimate responsibility for SNF management and final disposition on the federal government. In support of federal CISF opportunities, the SONGS co-owners will:

A3. Advocate for modifications to the NWPA that would enable development of a federal CISF option that could accommodate all SONGS SNF. While the NWPA (as amended) contains two sets of provisions authorizing federal support for a CISF, neither set of provisions is workable in its current form to deliver an offsite storage alternative for SONGS SNF.[15] The federal program should have greater flexibility and broad authority to pursue multiple business models for SNF storage, including federal contracting for private storage, implementation of a federal CISF, and the formation of public-private partnerships. The SONGS co-owners support the modification of one or both of the NWPA's existing interim storage provisions to accommodate the SONGS SNF and/or changes to provide entirely new authority under a different framework.[16]

3.2.2 Private CISF

Currently, two private CISF initiatives - one in Texas and one in New Mexico – appear to be on a trajectory to receive licenses from the Nuclear Regulatory Commission (NRC) in 2021.[17] The Strategic Plan suggests SONGS SNF could be completely removed within a timeframe of approximately two

[14] Additional discussion regarding recent legislative proposals may be found in the Strategic Plan, Vol. II, Section 5.6 (*Recent Legislative Proposals*).

[15] Additional discussion regarding provisions for interim storage of SNF in the NWPA may be found in the Strategic Plan, Vol. II, at p. 29 ("The development of federal consolidated interim storage capability is constrained by current law").

[16] Additional discussion regarding a potential federal CISF alternative, may be found in see the Strategic Plan, Vol. II, Sections 7.4 (*Interim Storage in a Federal Consolidated Interim Storage Facility (CISF)*) and 7.5 (*Federal Use of a Non-Federal CISF*).

[17] Interim Storage Partners (ISP), a joint venture between Orano USA and Waste Control Specialists, is pursuing licensing of a CISF in Andrews County Texas. Holtec International (Holtec) and the Eddy-Lea Energy Alliance are pursuing the licensing of a CISF in southeastern New Mexico. Additional discussion regarding the private CISFs may be found in the Strategic Plan, Vol. II, Summary at p. xiv (referencing license approvals sought in 2021), and Sections 7.5 (*Federal Use of a Non-Federal CISF*) and 7.6 (*Non-Federal Consolidated Interim Storage Facility*).

decades once private facilities that can accept all the SNF are fully licensed and operational.[18] This timeframe is roughly compatible with the current SONGS plan for decommissioning. Other private proposals or modifications to existing proposals may be forthcoming.

Depiction of private CISF.
Source: Interim Storage Partners

Notably however, even after an NRC license is secured, significant challenges may remain and frustrate efforts to move forward with the implementation and eventual operation of these private facilities. Further, the commercial reasonableness of contracting for private storage of the SONGS SNF is unknown at this time and neither the Texas nor the New Mexico facility by itself, as currently proposed to be licensed, could accept *all* the SONGS SNF.[19]

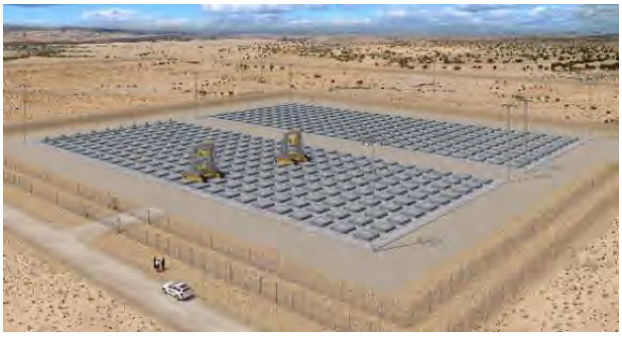
Actions of the SONGS co-owners with respect to private CISF opportunities will be probing and tentative, including:

A4. Engage in discussions with private CISF developers (*e.g.*, Holtec International and Interim Storage Partners) concerning potential terms for use of their storage services. The SONGS co-owners will monitor progress on these facilities and engage with private CISF vendors commensurate with the status of their respective projects. This could include seeking clarification on key issues including title and possession of the SONGS SNF, performance guarantees, liability, indemnification, technical matters, cost issues, and safety considerations, in addition to financial parameters. Discussions should also include whether the CISFs will be licensed to receive the proprietary canisters of other vendors and/or whether storage vendors would support license amendments to allow use of their canister systems by competitors.

[18] *See* Strategic Plan, Vol. II, at pp. 98 (noting two decades for SONGS SNF removal once private CISF is constructed) and 106 (*id*.).

[19] SONGS has two independent spent fuel storage installations (ISFSIs): the first, permitted in 2001, uses horizontal TN Americas LLC (TN) canisters (TN is a subsidiary of Orano USA, one of the partners in ISP); the second ISFSI, permitted in 2015, uses the Holtec vertical canister system. North Wind, in its analysis of the private CISFs alternative, concluded that the ISP and Holtec facilities that are currently moving through the licensing process must either be licensed to accept their competitor's canisters, or both these private facilities would have to operational to accept all the SNF from the SONGS site. *See* Strategic Plan, Vol. II, Summary at p. xv (noting neither facility alone could accept all SONGS SNF), at p. 98 (noting an estimated two-decade timeframe to clear all SONGS SNF once the private facilities are available), at p. 93 (noting remaining questions regarding either proposed facility's ability to accept all the SONGS SNF), and at p. 106 (*id*.).

A5. Engage in discussions with the federal government regarding the role of private CISF vendors in SNF management. These discussions would proceed in parallel with any discussions with the private vendors and would include issues such as liability protection under the Price Anderson Act, federal support for SNF transportation by private entities, and continued reimbursements from the Judgment Fund.



Depiction of private CISF.
Source: Holtec

4. Catalyzing Federal, State, and Local Support for a Federal Permanent Disposal Program and Solutions to Move SNF Off Site in the Interim

The successful offsite relocation and permanent disposal of the SONGS SNF described in Section 3 will not come through the efforts of the SONGS co-owners alone. Given the combination of factors that has led to the current national-level impasse regarding SNF management and given the barriers that stand in the way of even interim relocation alternatives, success requires aligning a broad coalition of interests, including but not limited to the nuclear industry, the scientific and environmental communities, as well as local elected officials, community and tribal leaders, and state and federal legislators.

Where possible, the SONGS co-owners will build momentum; strengthen relationships with local communities, public officials, and stakeholders; and seek collaboration with state and national allies to promote the re-establishment of an effective federal nuclear waste management program and the offsite relocation of the SONGS SNF as described in Section 3:[20]

Success requires aligning a broad coalition of interests, including but not limited to the nuclear industry, the scientific and environmental communities, as well as local representatives, community and tribal leaders, and state and federal legislators.

B1. Help form a local coalition to advocate for the offsite relocation of SONGS SNF. A locally based coalition of stakeholders is needed to champion issues related to the relocation of the SONGS SNF and sustain fact-based political pressure on Congress to act.[21]

- Members of this coalition may include local governments, current and former elected officials, businesses, business organizations, chambers of commerce, community and civic organizations, law enforcement, emergency management professionals, environmental organizations, education/science organizations, organized labor, local citizens, and/or local tribal officials.

- The SONGS co-owners will play a shared leadership role and contribute resources to help form and maintain this coalition, which will work with local partners to advocate for the provisions and reforms that are needed, in legislation and through changes in agency policy, to advance the offsite relocation of SONGS SNF.

- The SONGS co-owners will foster collaboration between the local coalition and regional and national stakeholder(s), professional associations, and other stakeholder groups that support

[20] Additional discussion regarding stakeholder engagement in support of the offsite relocation of the SONGS SNF may be found in the Strategic Plan, Vol. II, Chapter 4 (*SONGS Stakeholder Relationships and Perspectives*) and Section 8.4 (*Stakeholder Trust and Engagement*).

[21] Notably, such a coalition could draw support from the work of the SONGS Community Engagement Panel (CEP) which already serves to foster communication, public involvement and education on SONGS decommissioning activities, but focuses on matters of interest to area communities rather than on changes in national or state policies. Additional information regarding the CEP may be found at SCE's SONGS Community webpage, located at https://www.songscommunity.com/community-engagement/.

the offsite relocation of SONGS SNF and efforts to revitalize the national nuclear waste management program.

B2. Develop and implement a plan for stakeholder engagement and action. This plan will describe actions to improve upon and maintain a strong relationship of trust and transparency with stakeholders. This plan will also inform how the SONGS co-owners may engage stakeholders and local communities, as well as actions such stakeholders may undertake in support of the shared goal of relocating the SONGS SNF off site. Such actions may be further informed by the work of the coalition referenced in Action B1.

B3. Designate a lead SCE point of contact for information regarding efforts and progress made to relocate the SONGS SNF off site. The SONGS co-owners will identify a single point of contact at SCE who will be responsible for transparent, consistent and timely communication in support of community collaboration and stakeholder engagement.

B4. Continue stakeholder engagement efforts to promote transparency and to solicit support to relocate the SONGS SNF off site, including:

- Exploring options to improve the efficacy of the Community Engagement Panel (CEP) where possible, including by building its capacity for sharing information, providing updates, and soliciting community input.

- Continue coordinating with Marine Corps Base Camp Pendleton, Navy and Department of Defense officials regarding SONGS decommissioning activities and activities identified in the Strategic, Conceptual Transportation, and Action Plans. This includes exploring specific opportunities to leverage the Navy's experience in nuclear matters and unique relationship to SONGS (as the owner of the underlying property) in support of the shared goal of relocating SONGS SNF offsite.

- Maintaining lines of communication regarding the Strategic, Conceptual Transportation, and Action Plans, as well as other nuclear industry trends and developments, with the California congressional delegation, state regulatory stakeholders and agencies, local governments and tribal officials, other utility owners of SNF, and public interest groups.

5. Preparing SONGS and SONGS SNF for Transportation Off Site

The SONGS co-owners will take several near-term, on-site actions to prepare for the eventual offsite transport of the SONGS SNF.

5.1 Continue to safely and securely store SONGS SNF as long as it remains on site

The SONGS co-owners will continue to maintain a safety-conscious work environment that prioritizes sound nuclear management practices, security, and environmental protection, in balance with the efficient decommissioning of the SONGS site. The SONGS co-owners will also continue to prioritize a strong safety culture, foster a self-critical SONGS organization that strives for continuous improvement, and maintain a robust corrective action program. The SONGS co-owners will implement programs for the safe storage and monitoring of the SONGS SNF[22] until an offsite facility is available:

The SONGS co-owners will implement programs for the safe storage and monitoring of the SONGS SNF until an offsite facility is available.

SONGS site with the Holtec ISFSI in the foreground.
Source: Southern California Edison Co.
(https://www.songscommunity.com/)

[22] Additional discussion regarding the safe storage and monitoring of SNF at SONGS may be found in the Strategic Plan, Vol. II, Chapter 3 (*Spent Nuclear Fuel Management at SONGS*).

C1. Continue to implement robust, on-site programs for the safe storage and monitoring of SONGS SNF. Such measures include: real-time radiation monitoring of the Holtec and TN independent spent fuel storage installations (ISFSIs) at SONGS and data sharing with surrounding communities per the requirements of the SONGS lease with the California State Lands Commission (CSLC); compliance with the NRC's aging management protocols; and implementation of the Inspection and Maintenance Program (IMP) for the Holtec ISFSI. IMP implementation includes the deployment and routine inspection of a test canister (which does not contain spent fuel) as a leading indicator of potential stress corrosion, as well as continued support for the *in-situ* metallic overlay process and/or other emergent technologies that could be applied in the unlikely event any canisters need repair.

C2. Continue support for the further development of best management practices and technological advances in spent fuel storage and management. Appropriate planning to manage canister aging and to analyze and prepare for the potential need for canister repairs will be important if progress toward an offsite solution continues to be slow. As appropriate, such activities may include:

- Monitoring domestic and international developments in nuclear waste management, assessing their potential relevance for SONGS SNF, and identifying opportunities for SONGS engagement.

- Sharing available and appropriate data regarding the management of SONGS SNF with government, industry groups, national laboratories, and vendors to contribute to the discussion of aging management issues.

- Participating in relevant demonstration projects related to long-term canister integrity and *in situ* inspection and repair techniques. These activities may broaden support for and expand the adoption of the metallic overlay canister repair technique designated for use at SONGS, while also increasing the knowledge base in support of that technique.

C3. Continue monitoring and evaluating the effects of climate change and sea-level rise at the SONGS site. The SONGS co-owners will continue to monitor and evaluate the impacts of coastal erosion and sea-level rise in accordance with the requirements of the California Coastal Commission's (CCC's) 2019 Coastal Development Permit for the decommissioning of the SONGS site (CDP) and the SONGS lease with the CSLC.[23]

[23] Special Condition 3 of the 2019 CCC CDP requires, in relevant part, that SCE submit an application to amend its CDP at or near the completion of decommissioning activities describing, among other things, coastal erosion, sea-level rise, and the remaining onshore structures at SONGS that may be exposed due to coastal processes or that would otherwise have coastal impacts if they were to remain. Further, the 2019 CSLC Lease No. PRC 6795.1 for the SONGS site also requires, in relevant part, regular reporting on sea-level rise and shoreline changes, as well as an annual summary of information related to the site's vulnerability to sea-level rise.

5.2 Prepare for future SNF shipments

The SONGS co-owners will plan for future SNF shipments consistent with the goal of expeditiously relocating SNF off site as soon as a receiving facility becomes available on commercially reasonable terms.

The SONGS co-owners will plan for future SNF shipments consistent with the goal of expeditiously relocating SNF off site as soon as a receiving facility becomes available on commercially reasonable terms.[24]

C4. Prepare and maintain the documentation required to ship SONGS SNF. Such efforts include:

- Collecting and maintaining all supporting information required to demonstrate compliance with the certificates of compliance (CoCs) for SONGS spent fuel storage canisters. CoCs specify technical requirements and operating conditions that rely on detailed descriptions of the type(s) of wastes the canisters store.

- Reviewing and documenting the compliance status of each SNF and GTCC waste canister and its contents against the current revision of the applicable transportation CoC. This includes identifying issues that potentially require amendments to transportation licenses and specific revisions to package drawings.

- Developing canister documentation packages based on applicable regulations and the assumed maximum expectations of any interim receiving facility, as well as any permanent repository.

C5. Seek appropriate and timely opportunities to validate and improve site readiness to support an SNF transportation campaign. For example, under appropriate circumstances, demonstrating the capability to successfully move SNF or GTCC canisters to an offsite facility through dry runs and/or tabletop exercises can serve to identify operational improvements and train on-site personnel before a transportation campaign takes place. Such exercises can also provide valuable insights and bolster confidence that barriers to removing all the SNF and GTCC at the site have been, or can be, safely overcome. An effort of this type could potentially be undertaken on a pilot or demonstration basis, in partnership with a private entity, other utilities, and/or the federal government.

C6. Determine on-site infrastructure and space needs for loading SONGS SNF in preparation for transport. This determination will be made sufficiently early to make needed changes in "as-left" conditions at the site after current decommissioning activities are complete (in or around 2028). For both the Holtec and TN ISFSIs, this determination will specifically encompass:

- Transferring the SNF canisters from the ISFSIs into transportation packages.

- Loading SNF transportation packages onto rail cars for offsite transport.

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[24] Additional discussion regarding preparations for the safe, offsite transport of the SONGS SNF may be found in the Conceptual Transportation Plan, Vol. III, Chapters 4 (*Site Considerations and Readiness to Ship*), 5 (*Phase I: Near-Term Actions To Prepare For Transporting SONGS SNF*), 6 (*Phase II: Actions After a Destination Is Known*), and 7 (*Phase III: Actions Within a Five-Year Timeframe For Transporting SONGS SNF*).

- Additional permitting and/or license amendments that may be required.

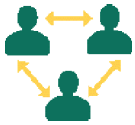
- Determining whether all or part of the rail sidings and spurs that will be constructed for the decommissioning of SONGS Units 2 and 3 should be left in place to be utilized for future SNF transportation.

An MP197 Package and Locomotive
Source: Orano USA website (https://www.orano.group/usa/en/our-portfolio-expertise/used-fuel-management/nuclear-transport-and-logistics)

- Evaluating tradeoffs between (1) extending the existing, abandoned on-site rail spur to allow for SNF rail cars to be placed adjacent to the ISFSIs for direct loading versus (2) extending the reinforced roadway from the ISFSI area to the planned decommissioning sidings and spurs instead. This evaluation will account for the need for a self-propelled modular transporter, if a roadway extension is used; for the number of cranes and fixtures required to rotate, load and move transportation packages from the ISFSI area to rail cars; and for the ability of loaded groupings of railcars (or "consists") to negotiate the uphill grade away from the ISFSI area in the space available.

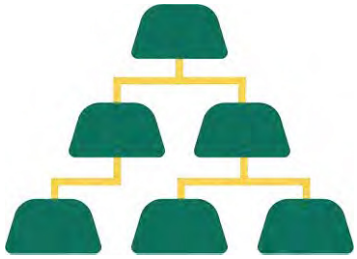
- How options for loading rail cars and assembling consists will affect the required security for these activities.

6. Corporate Capacity Building and Governance Actions



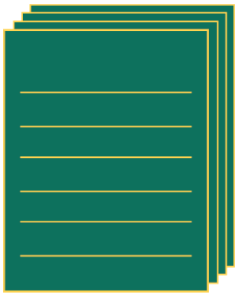
As needed and at its discretion, SCE – the decommissioning agent for SONGS - will enhance its capacity to support the offsite relocation of the SONGS SNF by taking the following steps:

D1. Aggregate select subject matter experts into an SNF relocation planning and management group (RPMG) to support the offsite relocation of the SONGS SNF. The RPMG will have the capabilities needed to carry out site readiness activities, manage efforts to relocate the SONGS SNF offsite, and coordinate ongoing stakeholder engagement activities in support of efforts to restart the national nuclear waste management program, as collectively described herein.



D2. Retain the independent strategic advisor for spent fuel management. The SONGS co-owners will continue to retain the position of Independent Strategic Advisor for Spent Fuel Management,[25] or similarly qualified individual, to advise the SONGS co-owners regarding the implementation of this Action Plan. The independent advisor will provide guidance regarding various issues, including but not limited to, readiness for offsite SNF transportation, external stakeholder engagement, legislative initiatives, issues related to title and liability for the SNF, and efforts to encourage the development of commercially reasonable options for offsite SNF storage or disposal. The independent advisor will provide recommendations and guidance to the RPMG and serve as a resource to the SONGS co-owners.

D3. Implement a "knowledge management" program to bolster the institutional memory of the RPMG and support any eventual transfer of knowledge needed to facilitate the offsite relocation of the SONGS SNF. This program will leverage existing knowledge management practices and collect relevant "primer" documents, which are expected to include, but not be limited to: an "as-left" site plan; site schematics and engineering drawings showing rail siding locations and the weight rating of surfaces; the Strategic, Conceptual Transportation, and Action Plans (with any modifications that might be added from time to time); copies of detailed SNF records and operational history; complete copies of all applicable American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) standards; NRC-issued nuclear regulations (NUREGS) pertaining to SNF transportation; and other regulatory guidance documents relating to both SONGS ISFSIs. Given the potential for decades-long delays in the offsite relocation of the SONGS SNF and attendant losses of in-house knowledge and capacity, such documents would support any future engagement of a competent contractor to address the loading and offsite relocation of the SONGS SNF.



[25] The current Independent Strategic Advisor for Spent Fuel Management is Tom Isaacs, who also serves as Chair of the Experts Team. Details regarding the role of the Experts Team are provided in the Strategic Plan, Vol. II, Section 2.3 (*Approach to the Strategic Plan and the Role of the Experts Team*).

7. Conclusion

Success in relocating the SONGS SNF off site is most likely to be achieved by pursuing a multifaceted strategy that includes:

- Focusing near-term efforts to support options under which the federal government fulfills its legal and contractual obligations to take responsibility for SONGS SNF, including assuming title and liability, and covering the costs of transportation and offsite storage;

- Increasing awareness of the importance and challenges of nuclear waste management issues at the national level and supporting a broad-based coalition of stakeholders and legislative leaders in their efforts to overhaul and restart the national nuclear waste management program, including advancing a permanent disposal solution for all SNF; and

- Making reasonable preparations to assure that SONGS SNF can be moved to an offsite facility as expeditiously as possible when one becomes available on commercially reasonable terms.

By the actions described in this Action Plan, the SONGS co-owners will continue to pursue safe and commercially reasonable avenues for the offsite storage and/or disposal of SONGS SNF, while also setting an example that other nuclear utilities may support and follow.

SONGS site viewed from the North
Source: Southern California Edison Co. (https://www.songscommunity.com/about-decommissioning/decommissioning-san-onofre-nuclear-generating-station/decommissioning-overview)

Action Table

No.	Action
3.	**Pursuing Relocation of SONGS SNF to an Offsite Facility**
3.1	*Resetting the federal nuclear waste management program and support for a permanent federal disposal repository*
A1.	Actively encourage several key structural reforms in support of successfully resetting the federal nuclear waste management program.
A2.	Seek support for a new framework to prioritize federal acceptance of spent fuel from shutdown sites.
3.2	*CISF opportunities and potential federal support of same*
A3.	Advocate for modifications to the NWPA that would enable development of a federal CISF option that could accommodate all SONGS SNF.
A4.	Engage in discussions with private CISF developers (e.g., Holtec International and Interim Storage Partners) concerning potential terms for use of their storage services.
A5.	Engage in discussions with the federal government regarding the role of private CISF vendors in SNF management.
4.	**Catalyzing Federal, State, and Local Support for a Federal Permanent Disposal Program and Solutions to Move SNF Off Site in the Interim**
B1.	Help form a local coalition to advocate for the offsite relocation of SONGS SNF.
B2.	Develop and implement a plan for stakeholder engagement and action.
B3.	Designate a lead SCE point of contact for information regarding efforts and progress made to relocate the SONGS SNF off site.
B4.	Continue stakeholder engagement efforts to promote transparency and to solicit support to relocate the SONGS SNF off site.
5.	**Preparing SONGS and SONGS SNF for Transportation Off Site**
5.1	*Continue to safely and securely store SONGS SNF as long as it remains on site*
C1.	Continue to implement robust, on-site programs for the safe storage and monitoring of SONGS SNF.
C2.	Continue support for the further development of best management practices and technological advances in spent fuel storage and management.
C3.	Continue monitoring and evaluating the effects of climate change and sea-level rise at the SONGS site.
5.2	*Preparations for future SNF shipments*
C4.	Prepare and maintain the documentation required to ship SONGS SNF.
C5.	Seek appropriate and timely opportunities to validate and improve site readiness to support an SNF transportation campaign.
C6.	Determine on-site infrastructure and space needs for loading SONGS SNF in preparation for transport.
6.	**Corporate Capacity Building and Governance Actions**
D1.	Aggregate select subject matter experts into an SNF relocation planning and management group (RPMG) to support the offsite relocation of the SONGS SNF.
D2.	Retain the independent strategic advisor for spent fuel management.
D3.	Implement a “knowledge management” program to bolster the institutional memory of the RPMG and support any eventual transfer of knowledge needed to facilitate the offsite relocation of the SONGS SNF.

ATTACHMENT C:

A4NR-SCE-004 Q.05 Answer

Southern California Edison
A.24-12-003 – SCE & SDGE 2024 NDCTP

DATA REQUEST SET A 4 N R - S C E - 0 0 4

To: A4NR
Prepared by: Jessica Rankin
Job Title: Senior Attorney
Received Date: 2/19/2025

Response Date: 3/5/2025

Question 05:
Please provide copies of any writen communications received by SCE from the Navy in which "the Navy, the landowner of the SONGS site and lessor, indicated it will not identify the end state criteria un?l the fuel is removed from the site," as stated in SCE-04, p. 28, lines 21 – 22.

Response to Question 05:
As stated in SCE-04, lines 18-22, SCE learned after the 2017 DCE was developed that the Navy will not confirm the SONGS end state criteria until the spent fuel is removed from the site. As described in more detail in SCE-04, p. 36, line 23 to p. 37, line 16, the Navy must conduct an environmental review pursuant to the National Environmental Policy Act (NEPA) as part of its decision-making process for any future end-state decisions. Because the California Coastal Commission has indicated that SCE must retain the ability to relocate the ISFSI on the SONGS site if necessary, SCE cannot return the site to the Navy until the relocation possibility has been dismissed and the fuel has been removed.

A July 17, 2019 letter from the Navy to SCE is attached. At page 3, the letter states:

> At this time, the DoN cannot provide definitive terms and conditions for removal of SONGS substructures, the seawall, or other features associated with the restoration of the SONGS facility to its final end state. Those decisions will be made consistent with the terms of the existing real estate instruments, after careful evaluation, when there is sufficient information to make such evaluation.

The letter then states that the Navy will continue to participate in SCE's overall progress with federal and state regulators for the investigation, cleanup and decommissioning to allow an efficient turnover of the SONGS site.

ATTACHMENT D:

A4NR-SCE-004 Q.11 Answer

Southern California Edison
A.24-12-003 – SCE & SDGE 2024 NDCTP

DATA REQUEST SET A 4 N R - S C E - 0 0 4

To: A4NR
Prepared by: Jessica Rankin
Job Title: Senior Attorney
Received Date: 2/19/2025

Response Date: 3/5/2025

Question 11:
Please provide a copy of the "recent coastal processes impact study" referred to in SCE-04, p. 36, line 16.

Response to Question 11:
SCE objects to this request on the grounds that it seeks the production of a draft document that is protected by the attorney-client privilege and/or the attorney work product doctrine.

Subject to and without waiving the foregoing objection, SCE responds as follows.

The quoted text refers to a coastal processes analysis that has not yet been finalized, which SCE commissioned for an upcoming requirement of the 2019 SONGS Onshore Decommissioning CDP, No. 9-19-0194, Special Condition 3. Special Condition 3 requires SCE to submit a CDP amendment application for the 2019 Onshore Decommissioning CDP within six months of completing SONGS onshore decommissioning, and no later than June 1, 2028. Among other things, this CDP amendment application must include an assessment of how coastal processes will affect the SONGS substructures, assuming no coastal armoring exists.

SCE engaged two contractors, Coastal Environments, Inc., and Radiation Safety and Control Services, Inc., to provide the coastal processes analysis required by Special Condition 3. The draft study was completed in early 2024 and indicated that some SONGS substructures could remain on site because they are not expected to become exposed due to weather and coastal erosion. SCE cannot provide the coastal processes analysis in response to this A4NR request because it is not yet finalized. SCE will finalize the coastal processes analysis before submitting the CDP amendment application to the Coastal Commission in or about 2028. A copy of the 2019 Onshore Decommissioning CDP is attached for reference.

ATTACHMENT E:

A4NR-SCE-004 Q.08 Answer

Southern California Edison
A.24-12-003 – SCE & SDGE 2024 NDCTP

DATA REQUEST SET A 4 N R - S C E - 0 0 4

To: A4NR
Prepared by: Stephanie Johns
Job Title: SONGS Consultant
Received Date: 2/19/2025

Response Date: 3/5/2025

Question 08:
Besides the $8.9 million (2014 dollars) variance identified in SCE-04, p. 29, line 17, please identify any other cost increases, including but not limited to security costs, likely to result from the inability to amend the 10 C.F.R. Part 50 licenses to reduce the site's footprint to ISFSI-only at the completion of D&D Phase II in 2028.

Response to Question 08:
In addition to the $8.9 million added for the License Termination project, the 2024 DCE includes $0.3 million within contracted services during D&D Phase II for a third-party review of the final status surveys and license termination plan prepared by the Decommissioning General Contractor (DGC). Since the license termination plan will not be submitted to and reviewed by the NRC at the end of D&D Phase II, a third-party review is required to confirm the DGC has met the requirements of the Decommissioning General Contractor Agreement.

The inability to reduce the site's footprint to ISFSI-only at the completion of D&D Phase II in 2028 is not expected to impact security costs because SCE is responsible for the whole site until it is returned to the Navy (regardless of whether the 10 C.F.R. Part 50 licenses can be amended). In addition, the majority of security costs at the site relate to protecting spent fuel in the ISFSI.

In addition to the cost increases, there were also cost decreases. As explained in SCE-04 p. 45 and p. 58, the NRC fees for both SONGS 2&3 and SONGS 1 decreased due to the change in license termination strategy.

ATTACHMENT F:

A4NR-SCE-004 Q.06 Answer

Southern California Edison
A.24-12-003 – SCE & SDGE 2024 NDCTP

DATA REQUEST SET A 4 N R - S C E - 0 0 4

To: A4NR
Prepared by: Jessica Rankin
Job Title: Senior Attorney
Received Date: 2/19/2025

Response Date: 3/5/2025

Question 06:
Please provide copies of any writen communications received by SCE from the NRC in which "the NRC informed SCE that it will not consider an 'intermediate state' LTP," as stated in SCE-04, p. 28, line 23 – p. 29, line 1.

Response to Question 06:
This was a spoken statement in a meeting with SONGS staff on or about July 18, 2023. At that meeting, NRC staff said the NRC would not accept an LTP developed for an "intermediate state," given that SCE will likely remove more SONGS substructures in the future.

The attached NRC summary of the meeting, which is also available at https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML23206A206, alludes to this discussion at page 2. The summary states, "NRC stated that the LTP license amendment application (LAR) addresses end state. Licensees should briefly discuss intermediate states in their LTPs, but detailed intermediate clean up criteria calculations should not be presented for approval."

ATTACHMENT G:

Amy M. Snyder, NRC Senior Project Manager, July 28, 2023, Summary of July 17-18, 2023, Routine Site Visit at SONGS Units 1, 2, and 3

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

LICENSEE: Southern California Edison

FACILITY: San Onofre Nuclear Generating Station, Units 1, 2, and 3

SUBJECT: SUMMARY OF JULY 17-18, 2023, ROUTINE SITE VISIT AT SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

On July 17, 2023, U.S. Nuclear Regulatory Commission (NRC) staff from Headquarters visited the San Onofre Nuclear Generating Station (SONGS), Units 1, 2, and 3. The purpose of the site visit was for the NRC License Termination Plan (LTP) technical team to:

1) tour the site to get a better understanding of the site layout and the relationships between facility structures, natural and engineered land features, and the ocean since their last visit in February 2022 (ML22062B645)

2) obtain an understanding of the licensee's Southern California Edison's (SCE's) status of its characterization progress and plans particular to Unit 1 and subsurface

3) inquire about the licensee's plans and potential complexities for LTP development

NRC LTP Team:

Amy Snyder, Senior Project Manager
Greg Chapman, Health Physicist, CHP
Randall Fedors, Senior Hydrogeologist
Cynthia Barr, Senior Performance Analyst (remote)

SCE and Contractors:

James Madigan, et al., SCE
Steven Mannon, et al., AECOM
Sarah Roberts, et al., *Energy*Solutions

Items Reviewed by NRC or discussed with SCE:

Before the site visit, the NRC Project Manager and the SCE Licensing Manager developed the agenda (see attachment 1). The agenda also includes the meeting participants. The

NRC & Korea Institute of Nuclear Safety (KINS) Bilateral meeting was conducted at SONGS from July 17-July 20, 2023. The KINS regulators participated as observers in this site visit on July 17 through midday on July 18, 2023.

Topics that were new from the last NRC LTP technical team site visit were:

- Location of the intake and discharge conduits/structures and any onshore structures and plans and timing of their removal
- The subsurface and Unit 1 areas planned for near-term radiological characterization survey and sampling and analysis strategy
- Intermediate stage before final license termination conceptual strategy
- Groundwater program and analyses status
- Discrete Radioactive Particle contamination control at reactor decommissioning sites
- Overall LTP license amendment request (LAR) development schedule for resource planning purposes

On the first day, the meeting began with a site safety briefing, and introductions were made. SCE and its contractor, SDS, and subcontractor, *Energy*Solutions, provided an overview of the decommissioning project, including Federal, State, and local interests in the project; and intermediate and end state preliminary concept for unrestricted release. SCE then gave various presentations, as noted on the agenda.

SCE noted that the conduits are not part of the Unit 2 and 3 license. The NRC stated that in such cases, if there is licensed material residual radioactivity offsite for a Part 50 license, then the licensee would be required to provide information to the NRC for evaluation that there is no health and safety issue.

Regarding characterization of subsurface and Unit 1 areas, SCE stated that its characterization is an iterative process, and more data would be collected as remaining substructures are remediated, and structures are removed later in the project.

NRC stated that the LTP license amendment application (LAR) addresses end state. Licensees should briefly discuss intermediate states in their LTPs, but detailed intermediate clean up criteria calculations should not be presented for approval.

SCE reviewed the status and plans for its groundwater input development to include sorption coefficient (Kd) measurements of a limited number of site media samples. The NRC staff noted that licensees that provide site-specific Kd values should include a range or average value for each appropriate solid media with uncertainty information.

SCE presented contamination control practices at the decommissioning project to include open air demolition plans, construction of negative pressure structures, and attention to identification and removal of any discrete radiological particles that might be generated due to prior or certain decommissioning-related activities such as reactor internal segmentation. For the latter, the NRC noted that an information notice is being developed for reactor sites addressing how licensees should document and incorporate technical survey data into their

decommissioning strategies to avoid potential delay in license termination. This information notice is expected to be published later this year.

SCE stated that the submittal of the SONGS LTP LAR is presently anticipated in the third quarter of calendar year 2024.

The second day in the morning, SCE provided a tour of SONGS, including visiting containment and a walkdown of various areas of the site to provide a better understanding of the end state concept for unrestricted release. The site walkdown included the forebay area, the power block area, upcoming work for the foundation of the turbine building, and the south yard facility.

The site visit resulted in no action items. Please direct any inquiries to me at (301) 415-6822 or amy.snyder@nrc.gov.

Sincerely,

Amy M. Snyder, Senior Project Manager
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket Nos.: 50-206, 50-361,
50-362, 72-041

Attachments: Agenda,
List of Participants

Agenda
and
List of Participants

July 17-18, 2023, Site Visit - San Onofre Nuclear Generating Station

Travel Day Sunday July 16					
Day 1: Monday July 17					
Time	**Activity/Topic**	**Presenters**	**Duration**	**Attendees**	**Location**
0730	Arrive on Site/Badging	N/A	30 min	NRC LTP Team and Korea Institute of Nuclear Safety (KINS)	L50
0800	Welcome and Introductions **Status of SONGS Decommissioning Project**	J. Madigan B. Sholler	30 min	NRC and KINS	Pier North Conference Room
0830	LTP Update End State Considerations and Partial Site Release Conceptual Plans	W. Barley	1 hour	NRC Staff KINS Observation	Pier North Conference Room
0930	Offshore Conduit Plans	E. Goldin	1 hour	NRC Staff KINS Observation	Pier North Conference Room
1030	Updated Hydrological Study (Site Conceptual Model)	D. Randall	1 hour	NRC: Amy Snyder and Randy Fedors (optional KINS Hydro-geologists)	Pier North Conference Room
1130	Lunch	N/A	1 hour		Pier North Conference Room
1300 – 1400	Contamination Control, Discrete Radioactive Particles	Greg Chapman Bob Corbett		NRC Staff KINS Observation	Pier North Conference Room
1400 - 1430	Break: Region IV Inspection Entrance Meeting	Stephanie Anderson, Sr. Inspector		Jane Marshall, Division Director, DUWP; Inspection Team NRC and KINS observers	Pier North Conference Room
1430 - 1530	Review of the Day Adjourn	NRC and KINS	1 hour		Pier North Conference Room

Attachment

Time	**Activity/Topic**	**Presenters**	**Duration**	**Participants**	**Location**
0730	SONGS Decommissioning Status/ issue dosimetry	SCE	0.5 hour	NRC and KINS	Dosimetry
0800	Site Tour and Q&A	B. Sholler/C. Ahola	3.5 hours	NRC and KINS	Various
1130	Lunch	N/A	1.0 hour	NRC and KINS	Pier North Conference Room
1230	End of Meeting Adjourn				

List of Participants:

U.S. Nuclear Regulatory Commission:
- Jane Marshall, Division Director, NMSS/DUWP (Mon & Tue)
- Bruce Watson, CHP, NMSS/DUWP (Sun – Fri)
- Amy Snyder, Senior Project Manager, DUWP/RDB (Sun-Tues)
- Greg Chapman, CHP, PE, Sr. Health Physicist, DUWP/RDB (Sun-Fri)
- Randall Fedors, Sr. Hydrogeologist, DUWP/RDB (Sun-Tues)
- Shaun Anderson, Chief, DUWP/RDB (Sun – Fri)
- Nathan Fuguet, New Staff/DUWP/RDB (Sun – Fri)
- Cynthia Barr, Sr. Risk Analyst, Risk and Technical Analysis Branch, NMSS/DUWP (Virtual Monday only)
- William (Chris) Allen, Project Manager, DUWP/RBD(Mon-Tues)

Korea Institute of Nuclear Safety:
- Haiyong Jung, Principal Researcher, Department of Radiation Protection & Radioactive Waste Safety
- Jeongken Lee, Principal Researcher, Department of Radiation Protection & Radioactive Waste Safety
- Yoonji Lee, Senior Researcher, Department of Radiation Protection & Radioactive Waste Safety
- Jonghyun Kim, Senior Researcher, Department of Radiation Protection & Radioactive Waste Safety
- Jiyoon Jung, Senior Researcher, PM, Decommissioning & Spent Fuel Regulation

Southern California Edison
- Ronald Pontes, General Manager, Environmental/Waste and Radiation Protection
- James Madigan, Manager, Regulatory Affairs, Nuclear Oversight & Safety Culture
- Mark Morgan, Regulatory Affairs
- Julie Holt (Site Coordinator), Public Outreach and VIP Tours
- Sandra Sewell, Manager, Radiation Protection and Waste Contract Management
- Bill Barley, Manager, Site Closure
- Eric Goldin, Project Manager, License Termination Plan
- Chris Ahola, Radiological Controls, Contract Management Specialist
- Emery Grohregin, Specialist, Final Status Survey\

AECOM:
- Steve Mannon, Decommissioning Director

SDS Participants:
- Bob Sholler, Project Manager, License Termination/Final Status Survey
- Dale Randall, Manager, License Termination/Final Status Survey
- Bob Corbett, Radiation Protection Manager

***Energy*Solutions:**
- Sarah Roberts, *Energy*Solutions, Radiation Protection Director

SUMMARY OF JULY 17-18, 2023, ROUTINE SITE VISIT AT SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 DATED JULY 28, 2023

DISTRIBUTION:
RidsACRS_MailCTRResource, ACRS
RidsOgcMailCenterResource, OGC
MFerdas, NMSS/DUWP
SAnderson, R-IV/DNMS/RIB
RidsRgn4MailCenterResource, RGN IV
NRC participants

Mark Morgan, SCE, mark.morgan@sce.com

ADAMS Accession No.: ML23206A206 via email

OFFICE	NMSS/DUWP/RDB	NMSS/DUWP/RDB	NMSS/DUWP/RDB
NAME	ASnyder	SAnderson	ASnyder
DATE	07/28/23	07/25/23*	07/28/23

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