September 27, 2021

Via Electronic Mail

Chairman Christopher T. Hanson
Commissioner Jeff Baran
Commissioner David A. Wright

Dear Chairman Hanson, Commissioner Baran, and Commissioner Wright:

As detailed in the attached study, the spent fuel in dry storage at the San Onofre Nuclear Generating Station may be vulnerable to overheating damage from a beyond-design-basis external event; namely a flood that compromises passive air cooling of the canisters.

Your agency required owners of operating nuclear power reactors to re-evaluate external hazards and take steps to mitigate beyond-design-basis events. The adverse consequences from beyond-design-bases events include extended loss of alternating current power, loss of ultimate heat sink, and challenges to multiple units at the site. Such consequences can also adversely affect the removal of decay heat emanating from spent fuel in over 100 dry storage canisters at San Onofre.

Evaluations of the two dry storage systems used at San Onofre indicate that fuel damage will not occur if passive air cooling is interrupted as long as the cooling is restored in time. A beyond-design-basis flood involving an extended loss of alternating current power could significantly complicate restoring passive air cooling in a timely manner.

The measures needed to successfully mitigate flooded dry storage systems at San Onofre are very likely comparable to those undertaken at operating nuclear plants (i.e., FLEX) to ensure adequate reactor core and spent fuel pool cooling in event of a beyond-design-basis flood. A comparable effort for the sry storage systems should achieve comparable protection of public health and safety.

I respectfully ask that you direct the NRC staff to require the owner of San Onofre to take the steps necessary to mitigate beyond-design-basis external events affecting the Independent Spent Fuel Storage Installation (ISFSI). My research focused solely on San Onofre and its dry storage systems. It seems very possible that other ISFSIs can also benefit from such measures. If so, their owners should also be required to take the precautionary steps to address the vulnerabilities.

Sincerely,

David Lochbaum
865 Traditions Drive
Chattanooga, TN 37415

Attachment:
San Onofre Nuclear Generating Station: Another Step Needed on Nuclear Safety Journey

SAN ONOFRE NUCLEAR GENERATING STATION
ANOTHER STEP NEEDED ON NUCLEAR SAFETY JOURNEY

DAVID LOCHBAUM
SEPTEMBER 2021

Nuclear Safety Journey

The licenses issued by the U.S. Nuclear Regulatory Commission (NRC) to authorize nuclear power reactor operation and the certificates of compliance issued by the NRC to permit storage of highly radioactive spent fuel in dry storage systems onsite impose regulatory requirements that, when met, manage the risks to public health and safety to an acceptable level.

The regulatory requirements are not carved in stone because nuclear safety is a journey:

> *Reasonable assurance of adequate protection of the public health and safety and assurance of the common defense and security are the fundamental NRC regulatory objectives. Compliance with NRC requirements plays a critical role in giving the NRC confidence that Licensees or CP* [construction permit] *holders are maintaining an adequate level of public health and safety and common defense and security. While compliance with NRC requirements presumptively assures adequate protection, new information may reveal that additional requirements are warranted. In such situations, the Commission may act in accordance with its statutory authority under Section 161 of the Atomic Energy Act of 1954, as amended, to require Licensees or CP holders to cake action in order to protect health and safety and common defense and security.* (NRC 2012c, attachment 1, pages 4-5)

The NRC recognizes the nuclear safety journey also applies to managing the risk from spent fuel in onsite dry storage systems:

> *A strong regulatory framework that involves regulatory oversight, continuous improvement based on research and operating experience, and licensee compliance with regulatory requirements is important to the continued safe storage of spent fuel until repository capacity is available. As part of its oversight, the NRC can issue orders and new or amended regulations to address emerging issues that could impact the safe storage of spent fuel, as well as issue generic communications such as generic letters and information notices.* (NRC 2014b, page 48)

The NRC uses various methods to revise existing and impose new regulatory requirements along the nuclear safety journey:

- 02/25/1981: The NRC issued Generic Letter 81-04 requiring owners to review their facilities for a station blackout (i.e., loss of connection to the offsite power grid concurrent with unavailability of the onsite backup emergency diesel generators) and take steps (e.g., modifications to the plant and/or upgrades to the training programs) to improve mitigation capability.[1] Southern California Edison (SCE) responded to the NRC on August 31, 1981, detailing steps it had taken to comply with the new requirements. (SCE 1981)

- 02/18/1983: The NRC issued Amendments 14 and 3 to the SONGS Unit 2 and 3 operating licenses increasing the minimum acceptable flow rate of the Control Room Emergency Air Cleanup System from 1,500 cubic feet per minute to 2,050 cubic feet per minute. (NRC 1983b)

- 04/27/1983: The NRC issued Amendments 18 and 6 to the SONGS Unit 2 and 3 operating licenses imposing a license condition requiring two emergency preparedness measures mandated by the Atomic Safety and Licensing Appeal Board (ALAB-717). (NRC 1983a)

[1] This NRC mandate pre-dated the March 1990 station blackout event at Vogtle (GA).

- 04/28/1989: The NRC issued Generic Letter 89-07 requiring owners to protect against radiological sabotage using a vehicle bombs.[2] SCE responded to the NRC on November 27, 1989, with its plans to upgrade its physical protection program to comply with the new requirements. (SCE 1989)

- 07/18/1989: The NRC issued Generic Letter 89-13 requiring owners to prevent cooling water system problems (e.g., silt buildup in heat exchangers and debris blocking tubes) from impairing safety equipment. SCE informed the NRC on April 24, 1992, that it had completed the steps needed to comply with the new requirements. (SCE 1992)

- 04/11/1996: The NRC issued Bulletin 96-02 requiring owners to control the movement of heavy loads over irradiated fuel in the reactor core and spent fuel pool. SCE provided the NRC on July 23, 1996, corrections to its original response describing actions to comply with the revised requirements. (SCE 1996)

- 12/06/1996: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses increasing the minimum acceptable boron concentration in the Safety Injection Tanks from 1,850 parts per million to 2,200 parts per million to support extending the length of the operating cycle from 18 months to 24 months. (NRC 1996)

- 08/03/2001: The NRC issued Bulletin 2001-01 requiring owners to inspect control rod drive mechanism (CRDM) nozzles for cracking indications. Workers at Oconee (SC) found cracks in CRDM nozzles in places not examined under the existing inspection regimes. SCE provided the NRC on August 31, 2001, with its initial plans for actions to comply with the new regulatory requirements. (SCE 2001)

- 02/25/2002: The NRC issued Order EA-02-026 after the 9/11 tragedy requiring owners to develop and maintain means for reactor core and spent fuel pool cooling in event an aircraft's impact damages large areas of the plant due to explosions and/or fires. The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses on July 29, 2007, approving the measures undertaken by SCE to comply with Section B.5.b of the Order. (NRC 2007a)

- 06/09/2003: The NRC issued Bulletin 2003-01 requiring owners to prevent accumulation of debris during a loss of coolant accident from clogging the strainers for the pumps that provide reactor core and containment cooling and impairing these vital safety functions. SCE provided the NRC on September 8, 2005, with an update on the progress of their actions to comply with this new regulatory requirement. (SCE 2005)

- 12/12/2007: The NRC issued Bulletin 2007-01 requiring owners to lessen the likelihood that the inattentive (i.e., sleeping) security officer problem discovered at the Peach Bottom nuclear plant (PA) would occur elsewhere. SCE responded to the NRC on February 11 2008, outlining the measures they had taken and planned. (SCE 2008)

- 10/16/2012: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses imposing restrictions on the movement of new fuel assemblies over irradiate fuel assemblies in the reactor core and spent fuel pool. (NRC 2012a)

[2] This NRC mandate pre-dated the February 1993 terrorist attack on the World Trade Center using a panel truck filled with explosives.

The NRC also has methods to relax or remove existing regulatory requirements along the nuclear safety journey.

- 09/24/1984: The NRC issued Amendments 24 and 13 to the SONGS Unit 2 and 3 operating licenses relaxing the testing interval for relays in the Engineered Safety Features Actuation System from 6 months to 18 months. (NRC 1984)

- 06/30/1989: The NRC issued Amendments 74 and 62 to the SONGS Unit 2 and 3 operating licenses to relax the testing interval for safety components from 18 months to once per refueling interval (typically 24 months). (NRC 1989b)

- 09/09/1998: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses that extended the length of time a reactor could continue operating with one inoperable emergency diesel generator. (NRC 1998)

- 09/12/2000: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses that extended the length of time a reactor could continue operating with one inoperable Containment Spray train to 7 days from 3 days. (NRC 2000)

- 07/06/2001: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses that increased the maximum reactor power levels to 3,438 megawatts thermal, increasing the electrical output of each units by about 16 megawatts electric. (NRC 2001)

- 09/08/2002: The NRC issued amendments to the SONGS Unit 2 and 3 operating licenses that relaxed the inspection frequency for the Reactor Coolant Pump flywheels from 3 years to 10 years. (NRC 2002)

History demonstrated that when NRC determined that existing regulatory requirements are, or may be, insufficient, it imposed additional requirements. History further demonstrated that when NRC concluded existing regulatory requirements are undue burdens on plant owners, it relaxed or removed them. It’s not so much a matter of give and take as it is doing what it takes to achieve and maintain the proper focus on nuclear safety.

The next section describes how the nuclear safety journey protects San Onofre from flooding hazards.

Flood Protection Safety Journey at SONGS

The NRC issued reactor operating licenses to SCE for SONGS Unit 1 on March 27, 1967,[3] for Unit 2 on February 16, 1982, and for Unit 3 on November 15, 1982. The licensing process culminating in these issuances included SCE submitting a Final Safety Analysis Report (FSAR) describing how the plant's design and operation complied with regulatory requirements. The NRC's review and acceptance of the FSAR was documented in its Safety Evaluation Report (SER).

The FSAR and SER each explicitly addressed the potential flooding hazard. The FSAR stated that "*As discussed in paragraphs 2.4.5.2, 2.4.5.3, and 2.4.6.1, the occurrence of storm surge, storm wave action, and tsunami will not cause flooding of the site*" (SCE 2007b, Section 2.4.2.2). The FSAR addressed the tsunami hazard:

> *The controlling tsunami occurring during simultaneous high tide and storm surge produces a maximum runup to elevation +15.6 feet mllw* [mean lower low water] *at the Unit 2 and 3 seawall. When storm waves are superimposed, the predicted maximum runup is to elevation +27 mllw.*

The SER contained NRC's determination regarding flooding hazards and associated protections:

> *The probable maximum flood (PMF) level is calculated to be at elevation +30.8 feet mean lower low water (MLLW). This flood level is based on the probable maximum precipitation in the San Onofre area. The applicants identified all the openings and penetrations in safety-related buildings that are below PMF level. All openings and penetrations below the PMF level are either sealed, protected by watertight doors or, hatches, protected by waterstops, or the applicants' analysis has shown the PMF does not impact safety-related equipment.* (NRC 1981, page 3-5)

That determination factored into NRC's conclusion as stated in the SER:

> *On the basis of our review as described above, we conclude that the design of the facility for flood protection meets the requirements of Criterion 2 of the General Design Criteria with regard to protection against the effects of natural phenomena, and the guidelines in Regulatory Guide 1.102 "Flood Protection for Nuclear Power Plants" with regard to provision of protection by incorporated barriers. On these bases, we conclude that the San Onofre 2 and 3 water level (flood) design is acceptable.* (NRC 1981, page 3-6)

As with other nuclear safety issues, adequate protection against flooding hazards at SONGS was not a "one and done" proposition but a journey. The NRC imposed additional regulatory requirements to ensure flooding hazards remained managed adequately:

- 10/19/1989: The NRC issued Generic Letter 89-22 informing owners that it was using updated probable maximum precipitation criteria published by the National Oceanic and Atmosphere Administration's National Weather Service in future licensing decisions. The updated information could increase the weight on building roofs from the higher rainfall amounts that could also cause higher site flooding depths. (NRC 1989a)

- 02/07/2007: The NRC issued Generic Letter 2007-01 requiring owners to monitor the condition of inaccessible or underground electrical cables to prevent their degradation from disabling safety functions. Water, from either rainfall or groundwater, in amounts below worst-case design basis

[3] The Atomic Energy Commission (AEC), NRC's predecessor, issued the Unit 1 reactor operating license.

levels submerged electrical cables in underground conduits at some nuclear plants accelerating the aging degradation of the insulation. SCE responded to the NRC on May 7, 2007, with their plans for satisfying the new regulatory requirements. (SCE 2007a)

- 05/11/2011: The NRC issued Bulletin 2011-01 requiring owners to ensure that the measures taken in response to the 9/11 tragedy (i.e., Section B.5.b of Order EA-02-026) would not be compromised by an extreme earthquake or flooding event. (SCE 2011)

- 03/12/2012: The NRC issued Order EA-12-049 requiring owners to take steps to reduce plant vulnerabilities from an extreme earthquake or flooding event:

> *This Order requires a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and spent fuel pool (SFP) cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.* (NRC 2012c, attachment 2)

- 03/12/2012: The NRC issued a request under 10 CFR 50.54(f) requiring owners to revisit flooding and earthquake hazards and associated protections for their plants:

> *… re-evaluate the seismic and flooding hazards at their sites using updated seismic and flooding hazard information and present-day regulatory guidance and methodologies and, if necessary, to request they perform a risk evaluation.* (NRC 2012e, pages 4-5

As discussed in the next section, the flood protection safety journey may leave spent fuel in dry storage vulnerable to beyond-design-basis external events.

Dry Storage Risk at SONGS

The NRC piloted a probabilistic risk assessment of a dry storage system at a U.S. nuclear power plant. The risk assessment considered hazards including tsunamis, earthquakes, shockwaves from pipeline explosions, impacts from vehicles, blocked air vents, flooding from heavy rainfall, and forest fires (NRC 2007b, Table 6).

The sole plant examined by the NRC in its risk assessment of dry storage did not bound the situation at San Onofre:

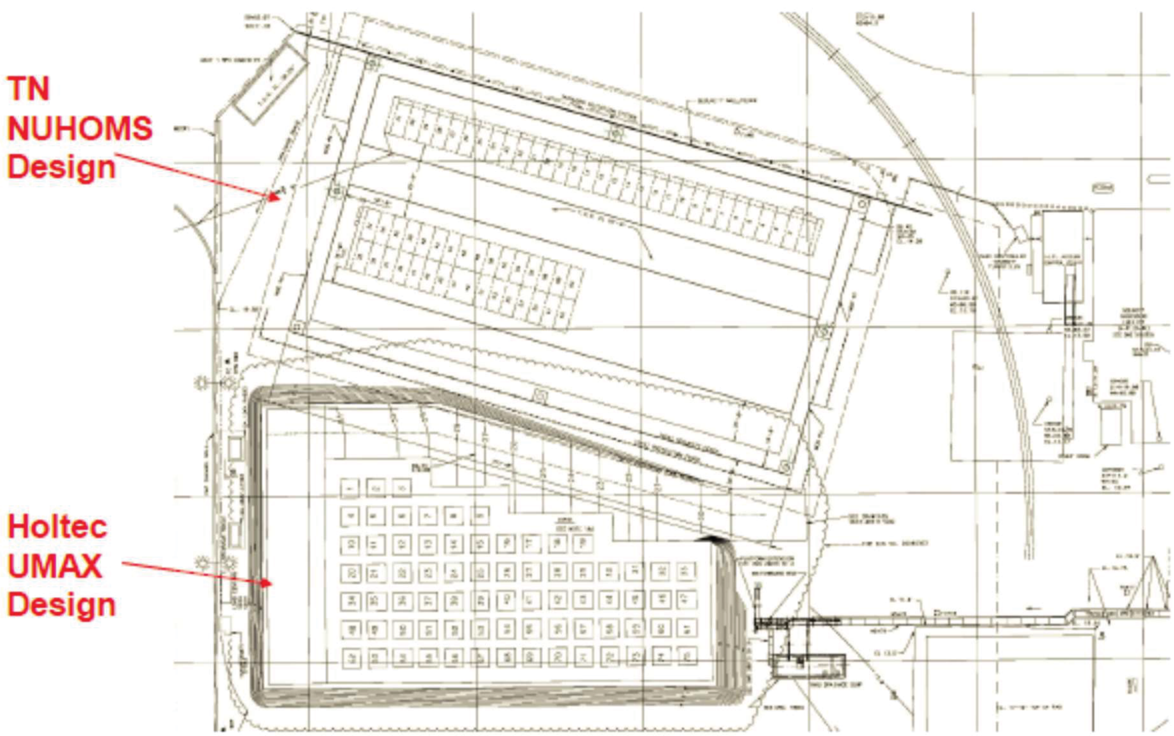
> *The ISFSI at the subject site is at an elevation of 38 meters (126 feet). Thus, the flood waters from a combined maximum storm, sustained winds, and dam failures would be insufficient to reach storage casks on the storage pad.* (NRC 2007b, Section 3.2.1)

According to the NRC, "*The SONGS ISFSI is located 19.75 feet above sea level.* ***The maximum flood condition of 29 feet was evaluated for the ISFSI which would potentially put the ISFSI pad under 9 feet under water****.*" [Boldfacing added for emphasis] (NRC 2013a, slide 44)

Thus, the NRC's risk assessment concluding that the spent fuel in dry storage at the one plant it examined was not vulnerable to flooding is not applicable to SONGS. By itself, this does not mean that spent fuel at SONGS is vulnerable to flooding; only that the NRC's pilot risk study did not show it to be flood-proof.

Two different methods of dry storage are utilized at SONGS, the Transnuclear NUHOMS design and the Holtec UMAX design:

Figure 1 – Dry Storage at the San Onofre Nuclear Generating Station



Source: NRC 2018a

Irradiated fuel assemblies were first transferred from spent fuel pools into dry storage at SONGS in September 2003 (NRC 2004b). The last irradiated fuel assemblies were transferred from spent fuel pools into dry storage at SONGS on August 7, 2020 (SCE 2020). All spent fuel is now in dry storage.

The NUHOMS design features sealed metal canisters containing spent fuel assemblies lying horizontally inside reinforced concrete storage modules that have bottom ports that allow air to enter and flow past the metal canisters to remove heat via the chimney effect:

Figure 2 – NUHOMS Dry Storage Design

Source: NRC 2013a, slide 42

The UMAX design features sealed metal canisters containing spent fuel assemblies standing vertically inside underground concrete storage vaults. Atop each vault is a square closure lid with two air inlet vents on each of its four sides and an outlet air vent rising from its center for the heat-removing chimney effect:

Figure 3 – UMAX Dry Storage Design

Source: NRC 2018a

The NRC reported that "*If the ISFSI* [at SONGS] *were to get temporarily flooded during a tsunami, no adverse thermal effects would occur*" (NRC 2013a, slide 44). The operative word in this statement is "temporarily." The cores of operating reactors suffer no adverse thermal effects if their cooling is "temporarily" lost. Irradiated fuel in spent fuel pools suffers no adverse thermal effects if their water cooling is "temporarily" lost. The duration of "temporarily" is defined as how long it takes for adverse thermal effects to occur in reactor cores, spent fuel pools, and dry storage systems.

The NUHOMS design has been analyzed for temperature increases caused by postulated events where passive air cooling is impaired. The analyses rely on two factors to prevent overheating damage: (1) detection of impaired cooling, and (2) restoration of unimpaired cooling.

The analyses assume that impaired air cooling will be detected by increases in the monitored temperature:

> *If the temperature of the AHSM/AHSM-HS at the monitored location rises by more than 80°F for the 24PT1-DSC, 30°F for the 24PT4-DSC, and 52°F for the 32PTH2 DSC, based on this surveillance, then it is possible that some type of an inlet and or outlet vent blockage has occurred. Visual inspection of the vents will be initiated and appropriate limits.*
>
> ***The 80°F/30°F values are obtained from a review of a transient thermal analysis of the AHSM with a 24 kW heat load to ensure that the rapid heatup is detected in time to initiate corrective action*** *prior to exceeding concrete or DSC basket material temperature limits for the respective AHSM DSC payloads.* [Boldfacing added for emphasis] (Orano 2021, pages 5-6 to 5-7)

The analyses assume that an impaired air cooling condition will not exist for longer than 25 hours:

> *The AHSM/AHSM-HS design and accident analyses demonstrate the ability of the ISFSI to function safely if obstructions in the air inlets or outlets impair airflow through the AHSM/AHSM-HS for extended periods. This specification ensures that blockage will not exist for periods longer than assumed in the analyses.*
>
> *Site personnel will conduct a daily visual inspection of the air vents to ensure that AHSM air vents are not blocked for more than 40 hours (with 24PT1-DSC). For the 24PT4-DSC credit will be taken for the temperature measurement taken in Section 5.2.5.b. Visual inspection of the AHSM air vents with the 24PT4-DSC will be performed only if the temperature monitoring system data is unavailable or* ***if the temperature limits specified in Section 5.2.5.b are exceeded to ensure that AHSM air vents are not blocked for more than 25 hours***. [Boldfacing added for emphasis] (Orano 2021, pages 5-7 to 5-8)

The Holtec UMAX design has also been analyzed for temperature increases caused by postulated events where passive air cooling is impaired:

> *A potentially severe flood event could happen during the storage period. In that event, the water could enter the inlet ducts and block portion or the entire cooling air flow passageway at the bottom of the cavity, which reduces the air flow ventilating through VVM* [Vertical Vault Module] *and causes an elevation of the fuel cladding temperature and system component temperatures.* (Holtec 2014, page 2-112)
>
> *The configuration of the HI-STORM UMAX VVMs makes them uniquely suited to withstand a flooding event. Indeed, introducing water in the CEC is an effective method to lower the MPC contents' temperature. However, accumulation of debris in the intake plenum or the storage cavities is undesirable as is the risk of corrosion from long-term exposure to floodwaters. Thus,*

> ***while the short-term effect of flood on the loaded HI-STORM UMAX VVM is essentially benign, corrective actions after such an event are necessary****. Visual examination using a boroscope or a camera or temperature monitoring of the exiting air to identify blockage of the cooling passages following flooding or other site specific natural events is necessary to ensure adequate cooling.* [Boldfacing added for emphasis] (Holtec 2014, pages 12-19 to 12-20)

> *A complete blockage of all VVM inlets cannot be realistically postulated to occur at most sites. However, a flood, blizzard snow accumulation, tornado debris, or volcanic activity, where applicable, can cause a significant blockage.* (Holtec 2014, page 12-28)

The Technical Specifications for the UMAX Certificate of Compliance define Operability of the air cooling system and how soon an inoperable system must be remedied:

> *The SFSC* [Spent Fuel Storage Cask] *Heat Removal System is a passive, air-cooled, convective heat transfer system that ensures heat from the MPC canister is transferred to the environs by the "chimney effect." Air is drawn into the inlet duct vents and travels down through the ducts to space between the Cavity Enclosure Container (CEC) and the Divider Shell, through the cutouts at the bottom of the Divider Shell, up the space between the Divider Shell and the MPC, and out through the outlet duct and vent*. (Holtec 2021, page 13-A-17)

> *The SFSC Heat Removal System must be verified to be operable to preserve the assumptions of the thermal analyses.* ***Operability is defined as either 50% or more of the inlet air ducts are unblocked and available for flow or when differential temperature requirements are met.*** *Operability of the heat removal system ensures that the decay heat generated by the stored fuel assemblies is transferred to the environs at a sufficient rate to maintain fuel cladding and other SFSC component temperatures within design limits.* [Boldfacing added for emphasis] (Holtec 2021, page 13-A-18)

> ***If the heat removal system has been determined to be inoperable, it must be restored to operable status within eight hours****. Eight hours is a reasonable period of time to take action to remove the obstructions in the air flow path*. [Boldfacing added for emphasis] (Holtec 2021, page 13-A-19)

Flooding of a dry storage system has been analyzed for both dry storage designs used at SONGS. The analyses show that overheating damage will not occur if impaired air cooling is detected and corrected within hours.

SCE reported that the "*duration of the design basis flood event for SONGS is defined as 6 hours*" (SCE 2012, enclosure 2, page 6), leaving 120 minutes to restore cooling to nearly six dozen UMAX storage vaults. If a beyond-design-basis flooding event had a longer duration, less time would be available.

What corrective actions much be completed in time?

> *If a state of vent blockage is discovered, then corrective actions to alleviate such condition will be required.* ***To restore the system to a normal configuration, all floodwater and any debris deposited by the receding water must be removed. The specific methods to be used shall be addressed in the site event response procedure*** *or equivalent.* [Boldfacing added for emphasis] (Holtec 2021, page 12-20)

Presuming flooding event response procedure(s) already exist for SONGS, 120 minutes seems precious little time to remove all the floodwater from dozens of UMAX vaults, particularly if an extended loss of alternating current power deprives workers of the normal vacuuming equipment.

An extended loss of alternating current power would also disable the temperature monitoring equipment routinely used to alert workers to cooling problems. Loss of this capability would deprive workers of useful insights on which UMAX vaults need fixing first (i.e., which canisters are heating up fastest).

The NRC inspected the SONGS ISFSI after the Fukushima accident. The NRC noted:

> *The ISFSI was located 19.75 feet above sea level. A flooding condition was assumed to reach elevation 29 feet, resulting in 9 feet of water on the pad. This was less than the 50 feet of water evaluated in Section 2.2.2 of the FSAR for the design basis flood. The maximum tsunami, which included the storm height of the waves, was 27 feet. As such, the ISFSI pad could be 7 feet underwater. The height of an AHSM was approximately 18 1/2 feet above the pad level (i.e., 38 feet above sea level). The outlet vents were on the top of the AHSM. The inlet vents were approximately 2 feet above the ISFSI pad.* (NRC 2011a, page 23)

The NRC only reported that the weight of the flood water and the force of the flowing flood water would not cause the ISFSI's structure to fail. While noting that the floodwater would submerge the air vents, the NRC did not report on the consequences of impeded air cooling of spent fuel canisters within the non-collapsed ISFSI.

As described in the next section, another step on the flood protection safety journey is needed to ensure that air cooling problems for the dry storage systems at SONGS in a beyond-design-basis external event will be detected and corrected in time to prevent overheating damage.

Additional Step Needed on SONGS Flood Protection Safety Journey

The NRC evaluated the one-two punch to Fukushima Dai-ichi from the March 2011 earthquake and the tsunami it spawned that resulted in the meltdown of three reactor cores. The NRC concluded:

> *Current regulatory requirements and existing plant capabilities allow the NRC to conclude that a sequence of events such as the Fukushima Dai-ichi accident is unlikely to occur in the U.S. Therefore, continued operation and continued licensing activities do not pose an imminent threat to public health and safety. (NRC 2012c, attachment 1, page 3)*

Despite having determined that such an event was unlikely to happen here, the NRC issued an Order on March 12, 2012, requiring owners of all operating nuclear reactors to take steps to better mitigate beyond-design-basis external events:

> *Guidance and strategies required by this Order would be available if the loss of power, motive force, and normal access to the ultimate heat sink to prevent fuel damage in the reactor and SFP* [spent fuel pool]*, affected all units at a site simultaneously.* (NRC 2012c, att. 1, pages 3-6)

A federal regulation, specifically 10 CFR 50.109, Backfitting, prevents the NRC from imposing new or stricter requirements on plant owners unless they are formally justified. The NRC's regulatory analysis supporting issuance of the mitigation Order concluded:

> *Order EA-12-049 imposed new requirements to implement mitigation strategies to provide additional capability to respond to beyond-design-basis external events (BDBEEs) that lead to an extended loss of ac power (ELAP) and loss of normal access to the ultimate heat sink (LUHS) (e.g., events arising from severe natural phenomena).* ***The Commission concluded that the new requirements were necessary to continue to have reasonable assurance of adequate protection of public health and safety****.* [Boldfacing added for emphasis] (NRC 2015a, page 5-6)

The Order required that owners address three consequences from beyond-design-basis external events:

1. Extended Loss of Alternating Current Power (ELAP)
2. Loss of Ultimate Heat Sink (LUHS)
3. Common cause affecting multiple reactors at a plant site

The NUHOMS and UMAX designs for dry storage of spent fuel at SONGS rely on temperature monitoring to detect when air cooling is impaired (or, conversely, to show when air cooling is NOT impacted.) Thus, an ELAP could compromise this safety function unless compensatory measures (e.g., battery or portable generators as backup power supplies) are available and deployed in time. In addition, an ELAP could leave normal mitigation equipment literally and figuratively powerless to correct any degraded condition(s).

The NUHOMS and UMAX designs feature passive air cooling to remove the decay heat being generated by the irradiated fuel assemblies within metal canisters. Air is the Ultimate Heat Sink for these designs. A flood can block the air flow through a dry storage system to cause LUHS and necessitate timely remedial actions to restore air cooling.

The NUHOMS and UMAX designs use 123 canisters to store spent fuel at SONGS. A beyond-design basis flood represents a common cause challenge to over 100 canisters; far more than the three reactors and three spent fuel pools formerly at SONGS. (SCE 2018, slide 2)

Neither the NRC nor plant owners applied the Fukushima Orders to onsite dry storage of spent fuel. For example:

- The evaluation of external events for SONGS does not mention “cask” or “ISFSI.” (SCE 1993)[4]
- The technical review of the external events evaluation for SONGS, which included walkdowns of flood protection devices at the plant, did not mention “cask” or “ISFSI.” (Energy Research 1998)[4]
- More than a year prior to Fukushima, the NRC was working on a Generic Issue (GI-204) to address the flooding hazard to dozens of U.S. nuclear power plants from the failure of upriver dams. ISFSI risk was excluded from the scope of this effort. [4]
- The spent fuel storage handbook developed by the Electric Power Research Institute (EPRI) for the industry’s use does not mention “tsunami” and only mentions “flood” in two non-substantive ways. (EPRI 2010) [4]
- The guidance document issued by the Nuclear Energy Institute (NEI) for risk assessments of external hazards does not mention “cask” or “ISFSI.” (NEI 2012a)
- The guidance document issued by NEI for developing coping strategies (FLEX) does not mention “cask” or “ISFSI. (NEI 2012b)
- The NRC decided not to evaluate the effect of external flooding on dry storage safety within its Generic Issues Program. (NRC 2012b)
- The NRC Ordered plant owners to provide reliable monitoring of the water level in the spent fuel pool after Fukushima “*demonstrated the confusion and misapplication of resources that can result from beyond-design-basis external events when adequate instrumentation is not available*” (NRC 2012d), but did not require reliable monitoring of ISFSI air temperatures to avoid similar confusion and misapplication of resources.
- SCE’s response to the NRC’s post-Fukushima request to walkdown SONGS for flooding vulnerabilities does not mention “cask” or “ISFSI.” (SCE 2012)
- The NRC’s guidance for assessing tsunami and surge hazards and associated protections does not mention “cask” or “ISFSI,” (NRC 2013b)
- SCE’s response to the NRC’s beyond-design-basis mitigation Order does not mention “cask” or “ISFSI.” (SCE 2013)
- The NRC’s procedure for inspecting measures undertaken by plant owners in response to the Fukushima Order does not mention “cask” or “ISFSI.” This inspection procedure did seek to confirm that procedures could successfully mitigate degraded reactor core and spent fuel pool cooling and that sufficient resources, including staffing, were available to mitigate all cores and pools in jeopardy, but not to confirm similar capability for ISFSIs. (NRC 2015b)

---

[4] This work pre-dated the Fukushima orders, but it is consistent with the theme that dry storage risks were excluded from plant risk studies and safety upgrades.

- The NRC's guidance for assessing flooding hazards for compliance with its Fukushima Order does not mention "cask" or "ISFSI," (NRC 2016)

- The guidance document issued by the NEI on external flooding assessments does not mention "cask" or "ISFSI." (NEI 2016)

The flooding hazard re-evaluations mandated by the NRC following Fukushima and two ensuing events revealed that the reactor cores and spent fuel pools at some facilities were not adequately protected from design basis flooding while others were not adequately protected from beyond-design-basis events:

- 01/09/2014: Approximately 50,000 gallons of rainwater flowed into the Unit 1 Reactor Auxiliary Building at Saint Lucie (FL) through penetrations in its wall for conduits containing electrical cables. Subsequent inspections identified six conduits lacking internal flood barriers that had been overlooked during the post-Fukushima flooding walkdowns. The NRC reported "*During a design basis external flood event water would have entered the Unit 1 RAB and potentially impact both trains of high head and low head ECCS* [Emergency Core Cooling System] *pumps*." (NRC 2018b, page 7)

- 08/09/2013: The NRC issued a White finding for inadequate flooding protection at Point Beach Units 1 and 2 (WI). The NRC reported:

  > *The site had a plan and procedure in place to install jersey barriers to protect the turbine building and pump house from external wave run-up and flooding. However, the licensee discovered that they did not have enough barriers to effectively cover the area that needed protection, the procedure did not consider the length of time that would be needed to place the barriers, and the licensee did not account for the gaps that would remain between and under the jersey barriers*. (NRC 2018b, page 8)

Figure 4 – Somewhat Ineffective Flood Barriers at Point Beach post-Fukushima

Source: NRC 2014a, slide 22

- 06/04/2013: The NRC issued a Yellow finding for inadequate flooding protection at Watts Bar Unit 1 (TN) involving non-conservative analysis of precipitation events and ineffective response measures. The NRC reported "*…equipment needed to carry out procedures was missing, mislabeled, or did not fit up properly because of piping interferences and the lack of suitable rigging locations. In addition, the time required to carry out the instructions was under-estimated*." (NRC 2018b, page 7)

- 03/31/2013: The drop of the main turbine stator during its removal and replacement ruptured fire headers that flooded the turbine and reactor buildings at Arkansas Nuclear One (ANO). Subsequent inspections identified over 130 degraded or missing flood protection features that had been overlooked during the post-Fukushima flooding walkdowns. The NRC reported:

> *The ANO Safety Analysis Reports state that a maximum probable flood would take at least two days to develop, and that the auxiliary building and emergency diesel generator fuel storage building can withstand flooding up to a level of 361' above mean sea level (MSL). Extent of condition reviews by the licensee following the stator drop event revealed that any flooding at or above site grade (354' MSL) would have resulted in a cliff-edge effect, inundating the auxiliary buildings and flooding the EDG fuel storage building at a rate beyond the capacity of the building sump pump.* ***Flooding would have rendered enough safety systems inoperable that core damage would have been unavoidable***. [Boldfacing added for emphasis] (NRC 2018b, page 6)

Flood barriers protecting reactor cores and spent fuel pools against design basis floods were routinely examined by plant workers and NRC inspectors before Fukushima. Flood barriers protecting reactor cores and spent fuel pools against both design basis and beyond-design-basis floods were examined by plant workers and NRC inspectors after Fukushima. It is not credible to suspect, yet alone believe, that unexamined flood protection features protecting ISFSIs from beyond-design-basis floods will be more reliable than periodically examined flood barriers sometimes shown to be deficient.

Unless the risk from irradiated fuel in dry storage is significantly lower than its risk in spent fuel pools, the steps ordered to better protect spent fuel pool cooling against an ELAP, LUHS, and common-cause challenges are equally justified to better protect dry storage air cooling against the same beyond-design-basis external events.

The NRC examined the dry storage risk at plants being decommissioned and determined that irradiated fuel poses no less hazard in dry storage than when in spent fuel pools. The Price-Anderson Act as Amended is a federal law providing liability protection against nuclear plant events causing harm offsite. Owners of an operating nuclear power reactor are required to obtain private liability insurance coverage for $375 million. Should a nuclear event cause more than $375 million[5] in damages, Price-Anderson calls for invoicing the owners of all other operating reactors up to a maximum amount. The depth of this secondary pool depends on the number of operating reactors, but provides nearly $10 billion of additional liability coverage. (NRC 2011b)

When a reactor ceases operating and all irradiated fuel has been permanently removed from the reactor vessel, the NRC has granted exemptions from the Price-Anderson requirements enabling owners to reduce their liability coverage to $100 million and to be excluded from the secondary pool. The owners of the Trojan (OR), Yankee Rowe (MA), Maine Yankee (ME), and Big Rock Point (MI) nuclear plants asked the NRC to approve further reductions in their liability coverage levels. All irradiated fuel at these

[5] The individual reactor liability coverage amount is periodically inflation-adjusted. This value may not match the current coverage level.

plants had been transferred from the reactor vessels and spent fuel pools into dry storage onsite. The owners asked the NRC to lower the liability coverage level to $25 million "*given the reduction in radiological risk associated with moving the spent fuel to dry cask storage*" (NRC 2004a, page 4).

The NRC considered the requests to reduce liability coverage levels for dry storage and identified both security and safety reasons for not doing so:

> *SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Fuel in Spent Fuel Pools," dated June 4, 2001, further addressed decommissioning reactor insurance levels but was withdrawn by the staff because treatment of spent fuel pool vulnerability to radiological sabotage had not been sufficiently considered. Because of the ongoing spent fuel pool risk studies, reassessment of vulnerability to radiological sabotage, and overall reconsideration of NRC safeguards policy as a result of the September 11, 2001 terrorist attacks, the staff is not yet prepared to recommend new generic requirements related to decommissioning reactor liability insurance coverage.* (NRC 2004a, page 4)
>
> *Another justification provided by the licensees for reducing primary insurance levels is that the risk from spent fuel stored in a dry cask ISFSI is significantly less than the risk from the same spent fuel stored in a spent fuel pool. Although the staff recognizes that the risks of dry storage and wet storage of spent fuel are different, **there is no indication that moving spent fuel from wet storage to dry storage would result in a significant reduction in the overall risk of radiological release**.* [Boldfacing added for emphasis] (NRC 2004a, page 6)

The NRC further determined that dropping the liability coverage for dry storage to $25 million:

> *… would also increase the potential for Federal Government liability claims for lesser damage because it would accelerate the stage at which the Government would have to pay. For example, if damages were $40 million and the facility only had private insurance coverage of $25 million, the Federal Government would be responsible for the remaining $15 million*. (NRC 2004a, page 5)

Because the NRC granted exemptions from Price-Anderson's secondary pool to owners of decommissioning reactors, the federal government becomes liable for damages greater than the primary pool limit. For the federal government to pay for damages above the primary pool limit, American citizens would have first paid a heavy price. After all, it is their harm for which someone becomes liable. Better management of the dry storage risk better protects Americans from harm and better protects the federal government, or private insurer, for having to pay for it – the ounce of prevention, pound of cure adage seldom being more suitably warranted.

The NRC staff also identified an optics reason for not approving reductions in liability coverage for dry storage:

> *… the staff believes that reducing the private insurance coverage requirements might inadvertently send a message to the public that dry cask storage of spent fuel in an ISFSI is significantly safer than storage of spent fuel in spent fuel pools.* (NRC 2004a, page 8)

Since ISFSIs are not significantly safer than spent fuel pools, the comparable hazard warrants comparable protection.

The U.S. Congress passed legislation signed into law by the President that included this requirement:

> *The Nuclear Regulatory Commission shall require reactor licensees to re-evaluate the seismic, tsunami, flooding, and other external hazards at their sites against applicable Commission requirements and guidance for such licenses as expeditiously as possible, and thereafter when appropriate, as determined by the Commission, and require each licensee to respond to the Commission that the design basis for each reactor meets the requirements of its license, current applicable Commission requirements and guidance for such license. Based upon the evaluations conducted pursuant to this section and other information it deems relevant, the Commission shall require licensees to update the design basis for each reactor, if necessary.* (Congress 2011)

This federal law required re-evaluation of external hazards at nuclear plant sites and neither explicitly nor implicitly excluded dry storage facilities from the effort.

The NRC should require SCE to take steps needed to protect spent fuel in dry storage at SONGS against beyond-design-basis external events. The NUHOMS and UMAX designs housing spent fuel at SONGS have been evaluated for flooding events. In each case, the evaluation concluded that irradiated fuel will not suffer overheating damage as long as the impaired air cooling is detected and corrected in a timely manner. A beyond-design-basis external event can result in an extended loss of alternating current power, a loss of the ultimate heat sink, and multiple storage units affected by the common cause hazard. If so, the ability to detect a loss of air cooling and capability to restore air cooling in a timely manner could be compromised.

No owner was unable to implement the measures mandated by the NRC to better protect their reactor(s) and spent fuel pool(s) from beyond-design-basis external events. Similarly, SCE should be equally capable of providing measures mandated by the NRC to better protect spent fuel in dry storage at SONGS from beyond-design-basis external events.

SONGS has experienced a SLAP (short loss of alternating current power) event that degraded its capacity to monitor plant conditions. On July 28, 2016, power was lost to the workstations and video equipment in the Central Alarm Station and Secondary Alarm Station. The power loss impaired the ability to detect unauthorized entries into Protected and/or Vital Areas and respond. Per procedure, compensatory measures were promptly taken until power was restored and security monitoring re-established (SCE 2016). This event showed that anticipating a problem and pre-planning its solution works.

With pre-planning and sufficient resources, SCE could successfully mitigate a beyond-design-basis external event that adversely affects the ISFSI. The NRC must ensure that either SCE already has such plans and resources or provides them.

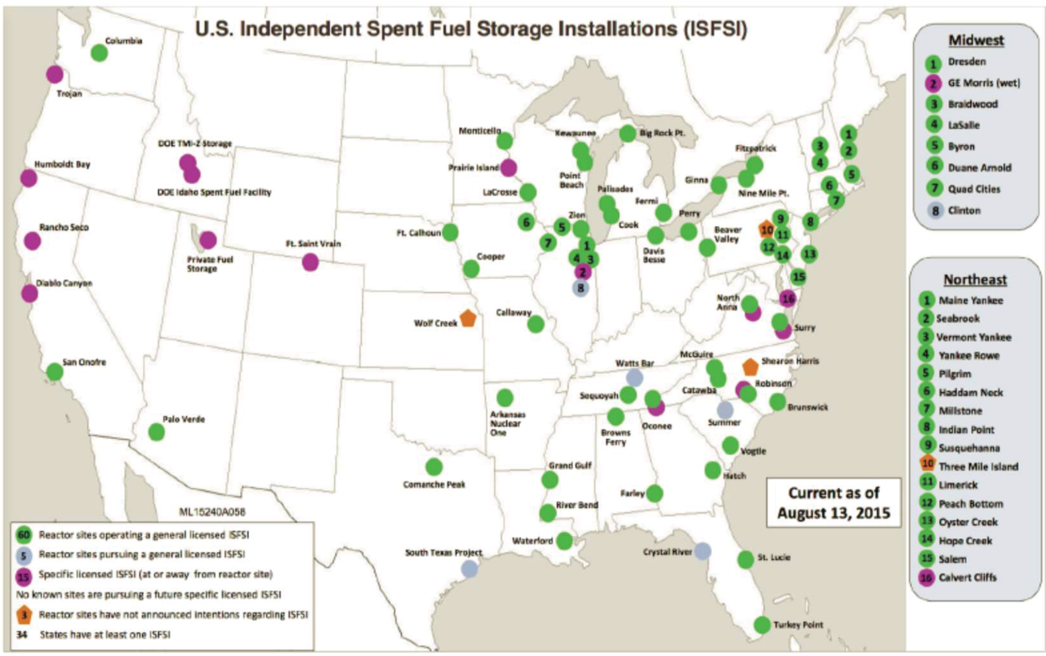
The first section of this study described several methods used by the NRC to impose regulatory requirements on plant owners along the nuclear safety journey: Orders, Generic Letters, Bulletins, Operating License Amendments. In addition, the NRC's 2.206 petition process enables any member of the public to petition the NRC to take enforcement action against a plant owner. The author has submitted numerous 2.206 petitions to the NRC.

This situation seems better addressed by an Order, Generic Letter, or other method than by a 2.206 petition. In the first place, the NRC has not yet required ISFSI owners to provide reasonable assurance of adequate protection of public health and safety from a beyond-design-basis external event. Thus, SCE is not violating any existing regulatory requirement. An enforcement action petition seems the wrong path to the right outcome.

Because the NRC stated that dry cask storage of spent fuel in an ISFSI is not significantly safer than storage of spent fuel in spent fuel pools, the requirements it imposed on plant owners to upgrade their capacity to mitigate beyond-design-basis external events affecting spent fuel pools seem equally necessary for ISFSIs. The methods used by the NRC then seem more appropriate now than a 2.206 petition.[6]

The Commission should direct the NRC staff to undertake the steps necessary to extend the measures against beyond-design-basis external events for reactors and spent fuel pools to ISFSIs – not only at SONGS but also at the many ISFSIs across the country.

Figure 5 – Independent Spent Fuel Storage Installations in the United States



Source: http://pbadupws.nrc.gov/docs/ML1524/ML15240A058.pdf

[6] While other methods appear more viable, the author will submit a 2.206 petition if told by the NRC that it would be the only way to resolve this vulnerability at SONGS.

Sources

Congress 2011 - U.S. Congress, “Public Law 112-74, Consolidated Appropriations Act, 2012,” December 23, 2011.

Energy Research 1998 - Energy Research, Inc., “Technical Evaluation Report on the Submittal-Only Review of the Individual Plant Examination of External Events at San Onofre Nuclear Generating Station, Units 2 and 3,” November 1998. (ML20212L354)

EPRI 2010 - Electric Power Research Institute, “Industry Spent Fuel Storage Handbook,” July 2010.

Holtec 2021 - Holtec International, HI-2115090 Rev. 7, “Final Safety Analysis Report on the HI-STORM UMAX Canister Storage System,” April 23, 2021. (ML21113A193)

Holtec 2014 - Holtec International, “Submittal of HI-STORM UMAX Canister Storage System Certificate of Compliance No. 1040 Final Safety Analysis Report,” July 11, 2014. (ML14202A030)

NEI 2016 - Nuclear Energy Institute, NEI-16-05, Rev. 0, “External Flooding Integrated Assessment Guidelines,” April 2016. (ML16105A327)

NEI 2012a - Nuclear Energy Institute, NEI 12-13, “External Hazards PRA Peer Review Process Guidelines,” August 2012. (ML12240A027)

NEI 2012b - Nuclear Energy Institute, NEI 12-06 Rev. 0, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” August 2012. (ML12236A116)

NRC 2018a - U.S. Nuclear Regulatory Commission, “San Onofre Special Inspection Webinar,” November 8, 2018. (ML18318A064)

NRC 2018b - U.S. Nuclear Regulatory Commission, “Operation Experience Smart Sample (opESS) 2007/02 Revision 3,” September 1, 2018. (ML18151A442)

NRC 2016 - U.S. Nuclear Regulatory Commission, JLD-ISG-2016-01, “Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flooding Hazard Reevaluation; Focused Evaluation and Integrated Assessment,” July 11, 2016. (ML16162A301)

NRC 2015a - U.S. Nuclear Regulatory Commission, “Regulatory Analysis – Proposed Rulemaking to Address Mitigation of Beyond-Design-Basis Events,” October 2015. (ML15266A133)

NRC 2015b - U.S. Nuclear Regulatory Commission, Temporary Instruction 2515/190 Revision 1, “Inspection of the Licensee’s Proposed Interim Actions as a Result of the Near-Term Task Force Recommendation 2.1 Flood Reevaluation,” September 4, 2015. (ML15176A790)

NRC 2014A – U.S. Nuclear Regulatory Commission, “Status of Lessons Learned from Fukushima Dai-Ichi,” July 31, 2014.

NRC 2014b - U.S. Nuclear Regulatory Commission, Final Rule, “Continued Storage of Spent Nuclear Fuel,” September 11, 2014. (ML14238A441)

NRC 2013a - U.S. Nuclear Regulatory Commission, “NRC Regulation of Spent Fuel at San Onofre,” September 29, 2013. (ML13268A003)

NRC 2013b - U.S. Nuclear Regulatory Commission, JLD-ISG-2012-06, Rev. 0, “Guidance for Performing a Tsunami, Surge, or Seiche Hazard Assessment Interim Staff Guidance,” January 4, 2013. (ML12314A412)

NRC 2012a - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendments: Request to Revise the Technical Specifications Applicable to Movement of Fuel Assemblies," October 16, 2012. (ML12215A399)

NRC 2012b - U.S. Nuclear Regulatory Commission, "Acceptance Review of Proposed Generic Issue (Pre-GI-0013) on the Effect of External Flooding on Independent Spent Fuel Storage Installations," September 6, 2012. (ML12240A096)

NRC 2012c - U.S. Nuclear Regulatory Commission, EA-12-049, "Issuance of Order to Modify Licenses With Regard to requirements for Mitigation Strategies For Beyond-Design-Basis External Events," March 12, 2012. (ML12054A735)

NRC 2012d - U.S. Nuclear Regulatory Commission, EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," March 12, 2012. (ML12054A679)

NRC 2012e - U.S. Nuclear Regulatory Commission, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident,' March 12, 2012. (ML12053A340)

NRC 2011a - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station – Independent Spent Fuel Storage Installation (ISFSI) Inspection Report 050-206/2011-011; 050-361/2011-011; 050-362/2011-011; 072-041/2011-001," May 20, 2011. (ML111430612)

NRC 2011b – U.S. Nuclear Regulatory Commission, "Frequently Asked Questions," March 29, 2011. (ML13308B572)

NRC 2010 – U.S. Nuclear Regulatory Commission, "Identification of a Generic External Flooding Issue Due to Potential Dam Failures," July 8, 2010. (ML13066A429)

NRC 2007a - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station, Units 2 and 3 – Conforming License Amendments to Incorporate the Mitigation Strategies Required by Section B.5.b of Commission Order EA-02-026," July 29, 2007. (ML072060010)

NRC 2007b - U.S. Nuclear Regulatory Commission, NUREG-1864, "A Pilot Probabilistic Risk Assessment Of a Dry Cask Storage System At a Nuclear Power Plant," March 2007. (ML071340012)

NRC 2004a - U.S. Nuclear Regulatory Commission, SECY-04-0176, "Exemption Requests to Reduce Liability Insurance Coverage for Decommissioning Reactors After Transfer of All Spent Fuel From a Spent Fuel Pool to Dry Cask Storage," September 29, 2004. (ML040850518)

NRC 2004b - U.S. Nuclear Regulatory Commission, "SONGS ISFSI Inspection 72-41/2003-01 (Inspector Notes)," January 6, 2004. (ML040070255)

NRC 2002 - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendments on Relaxing the Current 3-Year Inspection Frequency for Reactor Coolant Pump Flywheels to a 10-Year Interval," September 8, 2002. (ML003748732)

NRC 2001 - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendments Re: Increase in Reactor Power to 3438 MWt," July 6, 2001. (ML012180231)

NRC 2000 - U.S. Nuclear Regulatory Commission, "San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendments Related to Containment Spray System Allowed Outage Time from 72 Hours to 7 Days," September 12, 2000. (ML003750014)

NRC 1998 - U.S. Nuclear Regulatory Commission, "Issuance of Amendment for San Onofre Nuclear Generating Station, Unit No. 2 and Unit No. 3," September 9, 1998. (ML022000066)

NRC 1996 - U.S. Nuclear Regulatory Commission, "Issuance of Amendment for San Onofre Generating Station, Unit No. 2 and Unit No. 3," December 6, 1996. (ML022000194)

NRC 1989a - U.S. Nuclear Regulatory Commission, "Potential For Increased Roof Loads and Plant Area Flood Runoff Depth at Licensed Nuclear Power Plants Due to Recent Change in Probable Maximum Precipitation Criteria Developed by the National Weather Service (Generic Letter 89-22)," October 19, 1989. (ML031210438)

NRC 1989b - U.S. Nuclear Regulatory Commission, "Issuance of Amendment No. 74 to Facility Operating License No. NPF-10 and Amendment No. 62 to Facility Operating License No. NPF-15 – San Onofre Nuclear Generating Station, Units 2 and 3," June 30, 1989. (ML021980350)

NRC 1984 - U.S. Nuclear Regulatory Commission, "Issuance of Amendment No. 24 and 13 to Facility Operating Licenses NPF-10 and NPF-15, San Onofre Nuclear Generation Station, Units 2 and 3," September 24, 1984. (ML022280340)

NRC 1983a - U.S. Nuclear Regulatory Commission, "Issuance of Amendment No. 18 to Facility Operating License NPF-10 and Amendment No. 6 to Facility Operating License NPF-15 – San Onofre Nuclear Generating Station, Units 2 and 3," April 27, 1983. (ML022280112)

NRC 1983b - U.S. Nuclear Regulatory Commission, "Issuance of Amendment No. 14 to Facility Operating License NPF-10 and Amendment No. 3 to Facility Operating License NPF-15 – San Onofre Nuclear Generating Station, Units 2 and 3," February 18, 1983. (ML022280149)

NRC 1981 – U.S. Nuclear Regulatory Commission. NUREG-0712. "Safety Evaluation Report related to the operation of San Onofre Nuclear Generating Station Units 2 and 3," February 1981. (ML19341C517)

Orano 2021 - Orano TN Americas, LLC, "Appendix A to Renewed Certificate of Compliance No. 1029 – Technical Specifications for the Standardized Advanced NUHOMS® System Operating Controls and Limits," August 6, 2021. (ML21067A173)

SCE 2020 - Southern California Edison, "Docket Nos. 50-206, 50-361, 50-362, 72-41, and 72-1040 - Registration of Dry Fuel Storage Canister and Certification of Permanent Removal of All Spent Fuel Assemblies from the Spent Fuel Pools San Onofre Nuclear Generation Station Units 1, 2 and 3 and the Independent Spent Fuel Storage Facility (ISFSI)," August 7, 2020. (ML20227A044)

SCE 2018 - Southern California Edison, "Fuel Transfer to Passive Dry Cask Storage," June 2018.

SCE 2016 - Southern California Edison, "LER 2016-001-00, Simultaneous Loss of Security Computer System in the Central Alarm Station (CAS) and Secondary Alarm Station (SAS) San Onofre Nuclear Generating Station (SONGS), Units 2 and 2, and the Independent Spent Fuel Storage Installation (ISFSI)," September 26, 2016. (ML16273A280)

SCE 2013 - Southern California Edison, "Southern California Edison's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) San Onofre Nuclear Generating Station, Units 2 and 3," February 27, 2013. (ML13066A036)

SCE 2012 - Southern California Edison, "Southern California Edison's Flooding Walkdown Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," November 26, 2012. (ML12332A072)

SCE 2011 - Southern California Edison, "San Onofre Nuclear Generating Station, Units 2 and 3 – Docket Nos. 50-361 and 50-362 – 60-Day Response to NRC Bulletin 2011-01," July 7, 2011. (ML11227A283)

SCE 2008 - Southern California Edison, "Docket Nos. 50-361 and 50-362 – NRC Bulletin 2007-01 – San Onofre Nuclear Generating Station, Units 2 and 3," February 11, 2008. (ML080440414)

SCE 2007a - Southern California Edison, "San Onofre Nuclear Generating Station, Units 2 and 3 - Docket Nos. 50-361 and 50-362 – NRC Generic Letter 2007-01 – Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients," May 7, 2007. (ML071350235)

SCE 2007b - Southern California Edison. "San Onofre 2&3 FSAR Updated," May 2007. (ML11145A032)

SCE 2005 - Southern California Edison, "San Onofre Nuclear Generating Station Units 2 and 3 - Docket Nos. 50-361 and 50-362 – NRC Bulletin 2003-01 – Response to Third NRC Request For Additional Information," September 8, 2005. (ML052550490)

SCE 2001 - Southern California Edison, "Docket Nos. 50-361 and 50-362 – 30-Day Response to NRC Bulletin 2001-01 – Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles – San Onofre Nuclear Generating Station, Units 2 and 3," August 31, 2001. (ML012500126)

SCE 1996 - Southern California Edison, "Docket Nos. 50-361 and 50-362 – Correction to the Response to NRC Bulletin 96-02, "Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety Related Equipment" – San Onofre Nuclear Generating Station Units 2 and 3," July 23, 1996. (ML20116A929)

SCE 1993 - Southern California Edison, "Individual Plant Examination Report for San Onofre Nuclear Generating Station Units 2 and 3 in Response to Generic Letter 88-20," April 1993. (ML20035H338)

SCE 1992 - Southern California Edison, "Docket Nos. 50-361 and 50-362 – Generic Letter No. 89-13: Service Water System Problems Affecting Safety-Related Equipment – San Onofre Nuclear Generating Station, Unit 3, April 24, 1992. (ML13302B838)

SCE 1989 - Southern California Edison, "Docket Nos. 50-206, 50-361 and 50-362 – Safeguards Contingency Planning for Surface Vehicle Bombs – Generic Letter 89-07 – San Onofre Nuclear Generating Station – Units 1, 2 and 3," November 27, 1989. (ML19332D296)

SCE 1981 - Southern California Edison, "Docket Nos. 50-361 and 50-362 – San Onofre Nuclear Generating Station – Units 2 and 3," August 31, 1981. (ML13308B948)

Chairman Resource

From: David Lochbaum <davelochbaum@gmail.com>
Sent: Sunday, September 26, 2021 9:08 AM
To: Chairman Resource; CMRBARAN Resource; CMRWright Resource
Subject: [External_Sender] Spent fuel dry storage at San Onofre
Attachments: 20210927-songs-lochbaum-commission-isfsi-bdbee.pdf

Dear Chairman Hanson, Commissioner Baran and Commission Wright:

Attached is a PDF of my letter and study regarding spent fuel in dry storage at San Onofre. I will mail a hard copy upon request.

My review of the situation leads me to conclude that a FLEX-like application to the SONGS ISFSI is as prudent as the applications mandated by the NRC for reactors and spent fuel pools following Fukushima.

As explained in the study, this vulnerability does not lend itself to be addressed under the agency's 2.206 petition process. Instead, it seems a policy decision by the Commission directing the staff to address this situation at San Onofre, and perhaps for ISFSIs elsewhere, is the more appropriate resolution pathway.

I appreciate your consideration of this issue and look forward to its resolution.

Sincerely,
Dave Lochbaum