January 10, 2019

Title: PREDECISIONAL ENFORCEMENT CONFERENCE WITH SOUTHERN CALIFORNIA EDISON COMPANY

Date(s) and Time(s): January 24, 2019, 02:00 PM to 05:00 PM

Location: Webinar

Category: This is a Category 1 meeting. The public is invited to observe this meeting and will have one or more opportunities to communicate with the NRC after the business portion of the meeting but before the meeting is adjourned.

Purpose: The purpose of this predecisional enforcement conference is to discuss two apparent violations of U.S. Nuclear Regulatory Commission (NRC) requirements. The apparent violations are related to an incident that involved a loaded spent fuel canister that was misaligned when being lowered into a storage vault and the important to safety lifting and rigging equipment was no longer supporting the canister weight. These apparent violations are discussed in NRC Special Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, 072-00041/2018-001, dated November 28, 2018 (ADAMS Accession ML18332A357).

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Participants:

NRC	External
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Webinar:

URL	Meeting Number	Password
https://attendee.gotowebinar.com/register/2491132005260879875	NA	NA

Docket No: 05000206
05000361
05000362
07200041

Comments: Interested members of the public should register for the webinar via the internet address provided above. After registering, a confirmation email will be sent with details for joining the webinar. During the meeting, participants will be able to see and hear the meeting on their computer or mobile device. There is also an option to listen via phone bridge, but participants must register for the webinar to obtain the call-in number. Public participation

regarding the San Onofre Nuclear Generating Station Special Inspection can be found at: https://www.nrc.gov/reactors/operating/ops-experience/songs-spec-insp-activities-cask-loading-misalignment.html.

PUBLIC MEETING AGENDA

PREDECISIONAL ENFORCEMENT CONFERENCE WITH SOUTHERN CALIFORNIA EDISON COMPANY

January 24, 2019, 02:00 PM to 05:00 PM

Webinar

Topic	Participants
Opening Remarks and Introductions	Scott Morris
Conference Process	Linda Howell
Licensee Opening Remarks	Southern California Edison
Enforcement Policy and Process	Michael Vasquez
Summary of Apparent Violations	Dr. Janine Katanic
Licensee Presentation	Southern California Edison
Questions and Discussion	All Conference Participants
NRC Caucus	NRC Participants
Questions and Discussion	All Conference Participants
Closing Remarks	Scott Morris

The time of the meeting is local to the jurisdiction where the meeting is being held.

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ADAMS Accession Number: ML19011A163

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Link to meeting details: https://www.nrc.gov/pmns/mtg?do=details&Code=20190029

Commission's Policy Statement on "Enhancing Public Participation in NRC Meetings"
67 Federal Register 36920, May 28, 2002
The policy statement may be found on the NRC website
http://www.nrc.gov/reading-rm/doc-collections/commission/policy/67fr36920.html

Rep. Mike Levin launches San Onofre task force

by Samantha Taylor, January 25, 2019



Rep. Mike Levin spoke to a full house at Monday's Dr. Martin Luther King Community Prayer Breakfast in Oceanside. Levin has launched a task force to investigate conditions at San Onofre Nuclear Generating Station. Photo by Pat Cubel

EDITOR'S NOTE: *This story has been updated to include a written statement by Southern California Edison in response to the press release.*

REGION — Rep. Mike Levin (D-San Juan Capistrano) has launched a task force comprised of local "stakeholders and experts" to address "safety challenges" at the decommissioning San Onofre Nuclear Generating Station (SONGS).

The group will meet on a regular basis, according to a press release from Levin's office. Its goal is to come up with solutions to move the spent fuel currently stored at San Onofre and safely store it somewhere else.

The task force's launch follows the recent publication of two reports by the Samuel Lawrence Foundation (SLF) that claim the nuclear waste storage facility at San Onofre is "fatally flawed" and could cost the region as much as $13.4 trillion over a 50-year period of time if a radiological catastrophe were to happen at the plant.

Southern California Edison has responded to the SLF reports, claiming that they contain "numerous false and misleading statements" and that there is "zero possibility" of a radiological catastrophe at San Onofre that would affect anything outside of the plant's boundaries.

A spokesperson for Southern California Edison issued the following statement in response to the formation of a congressional task force:

"Southern California Edison welcomes Congressman Levin's interest in the issues surrounding the long-term storage of spent nuclear fuel. The congressman and SCE share common ground in a desire to have the spent fuel at the San Onofre nuclear plant moved to a permanent geologic repository or a consolidated interim storage site. Any option to move the spent fuel takes action by the federal government to approve such a site, an effort that is now decades behind schedule. Achieving a long-term storage solution requires working together in the timeliest and most efficient manner."

JOHN DOBKEN, SOUTHERN CALIFORNIA EDISON (VIEW FULL STATEMENT HERE)

Retired U.S. Navy Rear Admiral Leendert "Len" Hering, Sr. will lead the task force along with former U.S. Nuclear Regulatory Commission Chairman Gregory Jaczko.

"Throughout my Naval career, I have learned that nothing replaces due diligence when risk management and safety are concerned," Hering said in an announcement about the task force.

Hering previously served as a nuclear weapons safety officer. He provided a scathing assessment of the SONGS storage facility's management practices in one of the two SLF reports.

"I look forward to applying my expertise in those areas and the skills I gained over 30 years in the U.S. Navy to help lead Congressman Levin's task force on San Onofre,"

Hering stated. “Failure to act is not an option and I am determined to drive solutions as a co-chair of the task force.”

Jaczko, an experienced physicist who served as science policy advisor to former U.S. Senator Harry Reid, said he has a “unique appreciation for the complexity of the challenges at San Onofre.”

“I know there are no easy solutions, but I am confident that Congressman Levin’s task force will play a key role in moving the ball forward,” Jaczko said in the release.

For Levin, it is “imperative” that those who live near SONGS “have a voice in the future of the facility.”

“A worst-case scenario disaster at San Onofre would be devastating for millions of people,” Levin said in the statement. “We cannot allow the status quo to continue indefinitely, which is why we must find new solutions to deal with the grave safety challenges we face.”

As a candidate and now elected representative for the 49th Congressional District, Levin has maintained that nuclear waste storage at San Onofre remains a “top priority” for him.

Edison Community Engagement Panel Chair Addresses Safety Concerns At San Onofre

Wednesday, January 9, 2019

By Alison St John



CREDIT: SOUTHERN CALIFORNIA EDISON

Above: Radioactive spent fuel rods in giant canisters being transferred from spent fuel pools to concrete silos on site at San Onofre, March 2018

kpbs midday EDITION



Aired 1/9/19 on KPBS Midday Edition

GUEST: David Victor, chair, Southern California Edition Community Engagement Panel

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Transcript

Southern California Edison has come under scrutiny for its handling of the spent nuclear fuel at San Onofre Nuclear Generating Station.

The Nuclear Regulatory Commission is currently investigating a near-miss accident that occurred while radioactive spent fuel was being transferred from cooling ponds to concrete bunkers near the beach.

The plant is being decommissioned but the spent fuel will remain on site, buried 100 feet from the ocean indefinitely, because Congress has failed to agree on a long term storage site for nuclear waste.

RELATED: Safety Concerns Mount As Edison Awaits NRC's OK To Bury Radioactive Waste

UC San Diego international relations professor David Victor chairs Edison's community engagement panel that is monitoring the decommissioning of the plant. Edison designated him to answer questions on Midday Edition Wednesday about what is happening at San Onofre.

No credible threat of radiation leak outside San Onofre, regulators, utility officials say



A large hydraulic crawler, called a HI-PORT, slowly moves 50-ton canisters of spent fuel at the San Onofre Nuclear Generating Station from “wet storage” pools to a newly constructed “dry storage” facility at the plant. (Photo courtesy of Southern California Edison)



Jeff McDonaldContact Reporter

There is virtually no scenario in which 3.6 million pounds of radioactive waste could pose a public-safety or economic threat to people who live miles away from the shuttered San Onofre nuclear plant, utility officials and federal regulators said Wednesday.

“The bottom line is that no credible accident mechanism exists for radioactive material to leave the San Onofre site, given how much the spent fuel has cooled off since the reactors were shut down for the last time,” said Scott Burnell of the U.S. Nuclear Regulatory Commission. “This means there is no basis for

examining potential economic effects of an accident beyond the site boundary, never mind out to 10 or 50 miles."

Burnell and officials from majority power plant owner Southern California Edison were responding to a pair of reports Tuesday by the Samuel Lawrence Foundation.

One said a worst-case accident could cripple transportation, close ports and cost the regional economy more than $13 trillion. The other questioned the process Edison is using to transfer nuclear waste into steel-lined canisters along the San Onofre shoreline, north of Oceanside.

Critics of the studies said its authors made key mistakes in their assumptions about the San Onofre Nuclear Generating Station or SONGS, which closed in 2012 amid a radiation leak. Edison is in the process of transferring millions of pounds of spent nuclear fuel from cooling pools to so-called dry storage at the site. The plan calls for dozens of steel-lined concrete casks to be filled with the used fuel assemblies and buried in a special storage facility on the San Onofre beach. The transfer was halted temporarily after a near-miss accident in August that resulted in a notice of violation issued by federal regulators.

Edison and the nuclear commission said the foundation researchers improperly compared the possibility of an accident at the closed nuclear plant to a similar event at a plant that is still producing electricity.

"The statements provided to Southern California Edison lack scientific or engineering basis and the subject matter has been discussed many times by the Community Engagement Panel," said Edison spokesman John Dobken in an email, referring to a utility-funded volunteer group that is monitoring the San Onofre decommissioning program. "The public should know the spent nuclear fuel canisters at SONGS are thicker than any other stainless steel spent fuel canisters in the United States. SCE chose to proactively make them 25 percent thicker and they exceed all regulatory requirements."

Scientists behind the foundation reports stood by their findings Wednesday.

They said the waste-transfer program already has proved problematic, citing the notice of violation the Nuclear Regulatory Commission issued against Edison after one of its 50-ton canisters was wedged inside a storage cavity 18 feet from the bottom for nearly an hour.

"These canisters are certified for drops of 11 inches," said Subrata Chakraborty, a University of California San Diego biochemistry professor and co-author of one of the foundation studies. "For a canister to drop 18 feet … that's a huge force to crack open, and if the the canister breaks, it's definitely going to have some effect, and I believe that would be serious."

Another co-author said it's not clear what would happen if a canister is exposed -- by being dropped, degraded by saltwater intrusion or gouges caused in the transfer process.

"There are really major questions about the stability of the spent fuel in these situations," said Tom English, a retired nuclear waste expert from Carlsbad. "It's not a clear-cut case at all. I wish it were. That's why it should be aired out in public, with public discussion and not such hearsay."

James Conca is a retired nuclear-waste expert based in Richland, Wash. He said the spent fuel from San Onofre already is much less dangerous than it was when the plant shut down because it has been cooling for seven years.

He also said if a canister fails, it would simply be replaced. Any health or environmental damage would be limited to the immediate area -- not spread to urban neighborhoods away from Camp Pendleton, which leased the San Onofre property to Edison.

“This debate has been going on for decades and decades, and we’ve never had a problem with spent fuel,” Conca said. “A lot of people want to be afraid of nuclear; they want some evil to have to worry about, but there’s never been any risk.”

Donna Gilmore, who runs a group called San Onofre Safety, said the canisters Edison selected for the spent fuel already have proved unsafe -- along with the fuel-transfer process that resulted in the violations issued to Edison.

Some parts of the spent-fuel assemblies stored inside the canisters -- cesium, plutonium and strontium -- will remain dangerous for hundreds or thousands of years, Gilmore said.

“You have roughly a Chernobyl disaster’s worth of cesium in one can,” she said. “It will travel wherever the winds blow” in case of an accident or explosion.

Dobken, the Edison spokesman, said there is no chance of an accident on the magnitude of the 1980s nuclear disaster in the former Soviet Union.

“Exposing spent fuel to air will not result in an explosion,” he said. “For example, spent fuel is handled in air at DOE facilities (hot cells), and is a proposed method for repackaging fuel for disposal at Yucca Mountain.”

David Victor, another UCSD professor who serves as chairman of the Community Engagement Panel for San Onofre, said the foundation researchers do not know enough about the project and processes to produce an authoritative report.

“The team is way out of their depth,” he said. “They have done an economic study that is based on an assumption that is fallacious. It’s really important that we study worst-case scenarios and that we prepare for the worst, but that goal is not served by people whose research is not grounded in reality.”

The Samuel Lawrence Foundation is a Del Mar nonprofit whose mission is to promote science, arts, medicine and education. President and co-founder Bart Ziegler has been a longtime critic of Edison’s management of the San Onofre nuclear plant.

Non-proprietary Summary of the Holtec Proprietary MPC-37 Drop Analysis in Holtec Report Number HI-2188261 Rev. 3, November 16, 2018

Drop Analysis for a Fully Loaded Multi-Purpose Canister (Model MPC-37)

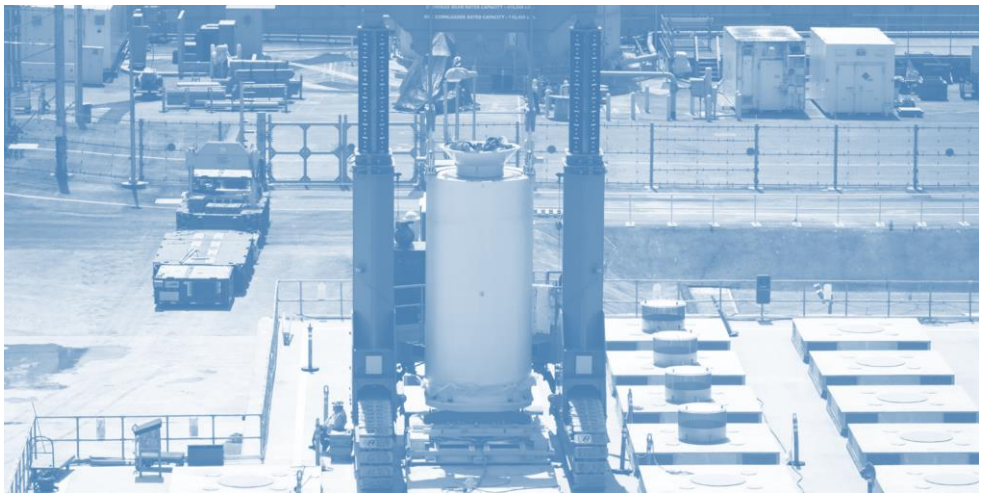
Holtec analyzed a hypothetical 25-foot drop of a fully loaded multipurpose canister (MPC) of the MPC-37 design used at SONGS for spent fuel dry storage. The hypothetical drop bounds the maximum distance that an MPC could drop if both the support slings suddenly provided no restricting force during the MPC lowering inside an Underground MAXimum storage (UMAX) Vertical Ventilated Module (VVM). This analysis conservatively considers a bounding upper weight for the loaded MPC and models the canister wall as 80% of its thickness. The analysis predicts that the stainless steel containment boundary of the canister would not be breached and no radioactivity from fuel stored inside the MPC-37 would escape, if such a drop occurred.

The Holtec analysis calculates that the most limiting mechanical strains in the MPC-37 from this hypothetical drop would be at the junction between the upper canister shell and the upper cover plate and at the lower canister shell and baseplate junction. The calculation was performed in a very conservative manner; nonetheless, the calculated strains are approximately 1/2 of the allowable value. Consequently, there is a factor of safety of almost two for this unlikely, hypothetical event. The MPC-37 design, without internal stiffening welds, distributes more evenly the energy associated with a drop resulting in lower peak strain and increased margin.

The modeling approach for this analysis was taken from NUREG-1864, "A Pilot Probabilistic. Risk Assessment of a Dry Cask Storage System," March 2007. The NUREG-1864 analyzes an MPC-68 design with stiffening internal structures welded to the canister. The MPC-37 design at SONGS does not have internal welded structures to stiffen it. Consequently, the NUREG-1864 MPC-68 drop analysis predicts higher peak strains than those calculated by Holtec in the SONGS plant-specific MPC-37 drop analysis.

Prepared by Southern California Edison
November 2018

Evaluation of Downloading Effects on Multi-Purpose Canister Integrity



Prepared by Southern California Edison

Dec. 12, 2018

Introduction

The Holtec UMAX System is designed for seismic support and for radiation shielding such that there is minimal clearance between the Multi-Purpose Canister (MPC) outer diameter and the inner diameter of the below-grade Vertical Ventilated Module (VVM) - in particular, the VVM divider shell shield ring and seismic restraints. Thus, considering the potential for minor variations in vertical alignment during centering of the download, it is likely that the MPC shell will make some amount of contact with the divider shell sub-components during the downloading process. On August 3, 2018, during the download of a Holtec UMAX MPC-37 design spent fuel dry-storage MPC (Serial Number 067) into its associated VVM, the MPC became misaligned and wedged allowing for the full weight of the loaded MPC to rest on the divider shell shield ring. The purpose of this paper is to describe the analyses and evaluations performed to determine the acceptability of surface effects resulting during download activities.

Worst-Case Predicted Scratch

Holtec performed an evaluation to demonstrate that the worst-case scenario of interaction between the wedged MPC and divider shell sub-components (i.e., the divider shell shield ring and MPC seismic restraints) could produce a scratch that is up to 0.010 inches deep and 0.125 inches wide. Other possible scratches due to incidental lateral rubbing of the other MPCs during downloading into the VVMs are less of a concern than this worst case scratch condition.

Worst-Case Baseplate Dent

An additional Holtec evaluation considered the full weight of an MPC resting on the divider shell shield ring guides (gussets). This evaluation demonstrated that the worst-case dent to the chamfered edge of the MPC baseplate would be 0.20 inches deep. Normal lateral forces or momentary bumps during downloading of other MPCs into their VVM storage cavities are less of a concern than the MPC Serial Number 067 due to lower possible loads against rubbing surfaces.

Holtec Manufacturing Acceptable Limits

In general, during the fabrication process of metal components, minor dents, scratches, and other handling marks are to be expected. Similarly, the manufacturing and handling process for an MPC can produce minor scratches and dents on the surface. Holtec has performed evaluations to determine maximum allowable levels of scratches and dents that would ensure applicable ASME code requirements are still met. The maximum allowable pre-approved depth of scratch for a SONGS MPC is 0.0625 inches and the maximum allowable pre-approved depth of dent to the MPC baseplate is 0.25 inches. The worst-case predicted scratch (0.01 inch) and dent (0.20 inch) that could have occurred on MPC Serial Number 067 are within the pre-approved limits and therefore ASME code requirements are maintained.

Susceptibility to Chloride Induced Stress Corrosion Cracking (CISCC)

In order for CISCC to occur to the Type 316L stainless steel canister containment boundary, a buildup of chloride contaminants, water, and tensile stresses must be present. The primary areas of concern for stress corrosion cracking for the shell wall of an MPC-37 design are the heat affected zones (HAZ) of MPC shell welds. This is because a through-wall tensile stress could exist adjacent to welds and this is one of the necessary factors to potentially permit CISCC to penetrate the wall and challenge the confinement integrity.

As a preventive measure for the initiation of CISCC in the MPC shells, SCE directed Holtec to laser peen all MPC closure welds and their associated HAZs. This was performed at Holtec's Manufacturing Division. Laser peening induces a compressive stress layer covering the underlying weld tensile stresses, preventing penetration of the layer by CISCC. The minimum depth of compressive layer achieved by Holtec was greater than 0.030 inches. Therefore, if a worst case scratch of 0.010 inches were to occur across the peened protective compressive stress layer, it would not completely remove the protective layer that prevents through-wall CISCC.

Protective Oxide Layer

The manufacturing process for stainless steel introduces a protective oxide layer. A scratch to the MPC surface would temporarily remove the oxide layer. In a dry, heated, storage environment in air (an MPC during initial storage period within the VVM), Type 316L stainless steel will re-passivate and redevelop its protective oxide layer in a short time (< a month). By the time that the MPCs will be cool enough to enable a potential corrosive environment to develop somewhere on the canister surface by absorbing sufficient moisture from the circulating air to cause wetting of accumulated dry deposits (several decades after storage begins), any temporary effect of localized scratches will be repassivated. Any localized residual stresses associated with the scratch will be very shallow (< 0.010 inches) and not a driver for through-wall cracking.

Industry Operating Experience

On May 24, 2017 the Sacramento Municipal Utility District (SMUD) performed an inspection of a canister with a known scratch in support of ISFSI license renewal. This canister was selected for inspection based on being the longest in-service canister (over 15 years). Upon inspection, the scratch showed no signs of degradation.

Aging Management Program

As part of the NRC License Renewal process to extend the service life of the Holtec HI-STORM UMAX System at SONGS beyond the initial license period, MPCs must be inspected in accordance with an Aging Plan Program. In addition, SCE has committed to providing an Inspection and Maintenance Program to the California Coastal Commission for the period of initial operation by October 2020. MPC Serial Number 067 has been identified as

having a surface condition that will be considered when selecting which MPCs to inspect at SONGS.

Conclusions

- Holtec's analyses have demonstrated that the worst-case scratch and dent are within acceptable limits that maintain compliance with applicable ASME code requirements.
- The calculated worst case scratch associated with the wedging of MPC Serial Number 067 temporarily in its VVM during initial downloading would be shallower than the depth of a protective peening layer over the containment boundary welds and would not negate this protective design feature.
- Possible disturbances (e.g., scratches) of passive stainless steel films during MPC downloading will be repassivated in a short time after entry into its dry-fuel storage VVM,
- Potential scratches and dents to MPC Serial Number 067 will be a consideration in determining which MPCs will be inspected as part of the Aging Management Program. These inspections will confirm the continued adequacy of the scratched and dented locations or identify any further actions required.

Additional information regarding Southern California Edison's analysis of scratches to Multipurpose Canisters (MPCs) during the downloading process

Jan. 13, 2019 FINAL

Defining the Worst Case Scratch

Normally, as the MPC is suspended vertically and slowly lowered between the clearances of the shield ring, there is very little sideways weight loading of the MPC wall as it contacts the cylindrical inner diameter of the shield ring. During some downloading operations the forces centering the MPC into the clearance may provide somewhat higher lateral loads due to realignment as the MPC cylinder passes the ring. However, all lateral contact of the MPC wall is against painted shield ring surfaces for which much research data was developed by SCE vendor Holtec that showed this special coating would protect the stainless steel from being scratched.

To calculate the worst case scratch, Holtec assumed an MPC weight about 14 percent above the maximum loaded SONGS MPC; maximized the angle that the MPC could be misaligned based on geometric modeling; and, the wall of the MPC was forced to maintain that angle and that load (about 2,400 lbs.) as it passed across the corner edge of the shield ring inner diameter. In actuality, the angle and load would lessen as the MPC realigned to pass by the shield ring. Still, to further maximize the test scratch, the protective paint layer was assumed to be absent. The result of the bare steel corner with a maximum possible angle and load was a scratch that was *0.010 inches deep* and *0.125 inches wide*. This is well within allowable limit for the American Society of Mechanical Engineers code for the 5/8 inch thick stainless steel canister walls of *0.0625 inches deep*.

To sum up, the worst case possible angle and load that could exist for the MPC against the edge of the shield ring was the one evaluated, including the absence of any protective paint coating. If a statistical set of cases would have been selected with very many calculations run with more likely lesser angles and loads against the edge of the shield ring, a much lower average scratch depth would be determined. Instead, only the worst case was assumed, since if that case was acceptable, all lesser cases for scratch depths would also be okay.

The Protective Oxide Film

At the end of the multipurpose canister manufacturing process, the outer diameter of the MPC is cleaned of any manufacturing debris and dried before the MPC is wrapped in protective covering for shipment. The stainless steel on the delivered component has a protective oxide film due to chromium oxide, which was formed in air before shipping. If a new scratch were to occur during downloading, in a non-corrosive environment like ambient air, and at the warmer temperatures seen for a loaded MPC, any scratching of the outer surface repairs itself very quickly.

What would it take to have corrosion develop around a fresh scratch? The scratch on the stainless steel material would need to be immediately exposed to a wet, corrosive environment *before* the film was reformed. In that case, the scratched area could corrode more than the unscratched area. However, no wet corrosive environment can occur inside a dry fuel storage module for many years after downloading due to the decay heat from the used fuel keeping the MPC surfaces dry in the recirculating ambient air.

To sum up, any incidental contact that occurs during the downloading of canisters is repaired through the self-healing of the protective oxide layer on the outside of the canister. (Note: SONGS canisters are manufactured out of 316L stainless steel, a highly corrosion-resistant form of steel often used in marine environments.)

Created by Southern California Edison | January 2019

SAN ONOFRE COMMUNITY ENGAGEMENT PANEL

14 December 2018

Dear Colleagues,

Our last meeting of the SONGS Community Engagement Panel (CEP) was tense and difficult as it dealt with an important yet highly contentious issue. The incident at hand concerned a used fuel canister getting wedged without support during downloading operations on 3 August, as well as the fact that something nearly similar happened in late July. The Edison team did not learn the right lesson from the July event—a canister hung up though properly supported—a lesson which could have prevented the event in August.

Today we write on two fronts.

First, we need your help to improve CEP community engagement.

On 29 November, led by Dan and Jerry, we tried a new process of soliciting questions about the main topic in advance (in addition to allowing on-the-spot public questions). Our sense is that worked relatively well, but needs streamlining—and the process of soliciting questions in advance must, as well, generate responses to all in-scope questions. We also tried two public comment periods including one solely dedicated to the central topic of the evening.

We welcome your observations and your input on how this process is working. More broadly, we invite your perspective on other potential reforms—for example, more small group meetings and interactive dialogues.

Second, we would like to summarize what we heard at the CEP meeting and the tasks that remain in front of Edison as it plans to restart fuel offloading.

Whenever emotions run high it is hard to focus on what we know and what to expect for the future. Moreover, before, during and after the CEP meeting many claims were made—claims about Edison stonewalling and not providing answers. SCE and the CEP are still in the process of getting all questions answered—both in-scope questions related to the downloading topic and out-of-scope questions related to matters such as insurance. Answers will be provided in writing, on the

website. Still other claims clearly were not rooted in robust technical analysis, such as the risk of catastrophic outcomes.

To that end, here is a short summary of what we heard during the last CEP meeting from three perspectives: a) what happened on 3 August; b) the key questions that have been answered; and c) most importantly, what to expect for the road ahead. This summary is not intended to replace what Edison said—they should speak for themselves, and our summary includes some hyperlinks to key documents they have presented—but rather to help us focus on what really matters, which is a solid program for improved fuel storage and downloading in the future.

What happened on 3 August.

On 3 August the SONGS team—a combined group of employees from Holtec, Holtec's subcontractors, and oversight by Edison—allowed a canister to get jammed during downloading into its cavity in the ISFSI. Misalignment allowed the jamming, but the crane operators kept lowering the slings—leaving the canister suspended about 18 feet off the bottom of the ISFSI cavity. The key facts of what happened are summarized on slides 14 to 17 of Tom Palmisano's canister downloading presentation.

To us, there are two key facts that really matter.

First, Edison and Holtec not only attempted to download the canister improperly but, astonishingly, created a situation that disabled the redundant drop protection system. At that point, nothing except for the fact that the canister was wedged kept the canister from dropping. That can't happen again.

Second, safe and reliable downloading is not a trivial process—not least because of the snug fit of the canister into the ISFSI cavity and the fact that many of the key steps in the downloading process are done "blind"—meaning the crane operator does not have a direct line of sight to the canister because it is lowered through a static transfer cask. Much better systems are needed so that this is done reliably, with defense-in-depth at SONGS and more generally in the industry. Doing better requires efforts on many fronts to create a nuclear safety culture—more on that below—and to facilitate learning from past events. For example, a similar event happened—jamming albeit without the slings being lowered—with

the previous canister (on 22 July) but the problem that the crew successfully spotted that day was never logged nor turned into a learning opportunity that could have helped the 3 August crew understand the risk of a jammed canister. What happened on 22 July is discussed on slide 18 of Tom's presentation. The Nuclear Regulatory Commission (NRC) also documents the severity of this failure—in its special inspection report, which you can find here.

Questions that have been answered.

We have heard lots of complaints about Edison and the NRC "stonewalling" at our CEP meeting and not giving fulsome answers to important questions. There likely always will be these kinds of disagreements, but on several fronts we think we actually heard a lot of new information from Edison and the NRC and many important questions were answered. Here are the key areas where we heard answers to questions posed:

- What happened in August and in July and why wasn't this information reported? The text above and its links summarizes this. At the same time, it is clear that Edison had a different interpretation of whether the August event required a report to the NRC and in what format—and that misunderstanding arose, in part, because a reportable event like this appears not to have happened before. At the time, Edison saw the August event as an industrial safety issue—a serious one—and they first reported it informally to the NRC the following business day (Monday, 6 August). This is not to excuse the event, and Edison subsequently has agreed with the NRC that the incident should have been formally reported within 24 hours. Edison also needs to sort out with the NRC whatever penalties arise because Edison didn't issue a formal report to the NRC until 14 September even though they informally talked to the NRC on 6 August as well as on a daily basis in the immediate period following the incident. All this matters for Edison and the NRC because this delay in formal reporting is one of the major violations cited by the NRC—something Edison needs to address through the enforcement process (below). The violations at SONGS related to this event are known in NRC parlance as "level 4" and two of them might be increased to "level 3." The NRC scale runs from 1 to 5, with 1 as the most severe. **But what really matters to us is focusing on the safety of the process going forward. Let's stay focused on that.** We have heard some groups claim that the July event should have been reported

formally. Edison and Holtec didn't think so; nor did the NRC. That's because the canister was never left unsupported during the July downloading process.

- Contingency plans and worst case outcomes. Several people have rightly asked: what could have happened if the canister dropped? Edison answered that, and we in the CEP have repeatedly asked Edison to make sure that their "drop analysis" has been independently verified. Edison has delivered that—publishing an analysis on our SONGScommunity.com website here while the NRC continues to analyze the "consequence analysis" as noted on page 3 of the executive summary of NRC's special inspection report available here. So far, we have heard nothing from the NRC to suggest they will disagree with Edison's analysis, and we have asked them to keep us informed on that matter. At the last CEP meeting some people demanded that Edison do actual drop tests rather than modeling of drops. While that idea makes intuitive sense, we are persuaded by the idea—standard in the nuclear and other industries such as aerospace—that models can examine more diverse potential real world conditions better than actual drop tests. Case in point, at our CEP meeting on 9 August 2018, we had an extensive discussion of crash tests for transportation casks to establish benchmarks for models to be widely used in future engineering analyses—see the discussion starting at 0:54:00 of the video located here. In the months after the 3 August incident some people have said in the media that a NRC "NUREG" document shows that the canister would have breached and claimed, therefore, that the Edison "drop analysis" is wrong. Those claims based on the NUREG document have ignored, willfully it seems, the fact that the NUREG study was for a different more rigid canister with a thinner wall and a different welded-in-place interior "basket" design that transfers more stress to the bottom and top welds in a drop. (Therefore, the canister in the NUREG analysis is more likely to fail.) We appreciate that these issues are complicated, but find it disturbing that even when these factual errors are pointed out, some people continue to make such claims in ways that seem designed to generate unwarranted panic and drama.
- Consequences of a canister breach. Some people continue to claim that there was no contingency plan in the event of a canister breach and release of radioactivity. This topic was addressed, but not in full depth, at our 3Q 2017 CEP meeting. See page 68 of the slide deck available here. And the

topic has come up in other ways as well. Edison has outlined its vision for what would be done if a canister were breached, how it would contain any material released, and why the contents inside the canister are not explosive—and thus there is no motive force that could cause a breached canister to atomize and release its solid-state nuclear material. Learning more about those plans has emerged as one element of the "extreme events" workshop that the CEP has been scoping with several members of the community—more about that in early 2019. We appreciate that this is a highly emotive issue, but we disagree with the claims being made that nobody has thought about or presented contingency plans in the event of worst case outcomes.

- Scratches during downloading. The claim has been made that all the Holtec canisters are now irreparably damaged and the warranty voided because of scratches to the stainless steel canisters during downloading into the ISFSI. Edison and Holtec have clearly answered this question on two fronts. First, they continue to believe that the Holtec system is superior for the SONGS site, especially given the severe seismic requirements at SONGS. Tom Palmisano stated this bluntly on multiple occasions. This was discussed when the Holtec system was first announced as the choice for SONGS and again when we held CEP meetings about the seismic risks in Southern California (see page 21 of the 1Q 2017 slide deck here). At our last CEP meeting Tom Palmisano said the same in response to public questions about why the Holtec system is still being used after the events in July and August (refer to 2:32:30 of the video available here). This is a topic that the CEP has examined extensively and repeatedly—with no reason to dispute that conclusion. Moreover, many regulatory authorities have examined this issue as well. Second, Edison and Holtec have argued that downloading scratches will self-heal through the reformation of oxide coatings on stainless steel. At our request Edison prepared a non-proprietary white paper on the effects of downloading on canisters which is available here. The NRC has also reviewed that work and, to our knowledge, not disputed its conclusions.

This list of answered questions is not to dispute that Edison and Holtec allowed a major error to occur on their watch and that has eroded the community's trust. Edison needs to rebuild that trust. This list of questions is not to dispute that the NRC needs to continue to explore ways to be more transparent. But as

the community figures out who to trust and what to watch lets focus on what really matters for the future.

The future.

Simply stopping offload work and leaving the fuel in pools is not a safe solution—the fuel is safer in dry storage. The longer this process drags out the longer the potential delays until the SONGS plant can be dismantled (but for the ISFSI) and the longer until the fuel can be shipped out of here if places for storage arise. Restart and completion of offloading is in our interest—only, of course, if it is done safely.

To that end, here is what we heard at our CEP meeting about the future, and the questions we as the CEP should keep asking:

- What will the NRC do during its pending enforcement actions, and will we learn any new insights about what caused the incident on 3 August and its remedies? How will the community learn about the assertions that Edison makes during those enforcement actions and the responses? We expect to learn more about this in the coming days.
- What exactly are Holtec and the industry doing so that the industry as a whole does a better job of learning about these kinds of events and creating a better nuclear safety culture? While it seems quite unlikely that an error like 3 August will happen again due to the extreme focus on countermeasures, what else lurks and how will they learn about it in a timely way—not just at SONGS but at other facilities whose operating experience could help SONGS do better?
- What does the new SYSTEM look like for offloading—new engineering, alarms, new training, new processes, and new oversight? What are the Holtec and Edison roles? How will the right people be retrained at the site? At the CEP meeting some members of the public claimed that the problem is engineering. We heard something different—that it is about all elements of the system and human performance.
- What will the NRC learn when it inspects Edison's dry runs—in December or in January—and how will its inspection and oversight processes change depending on what they learn?
- What is NRC's role going forward—after the restart begins? Will the NRC change its risk assessment of the plant during fuel transfers? Will NRC inspectors stay onsite for some or all of the offloading campaign? Several

members of the CEP have specifically asked the NRC to consider more onsite inspection capabilities, and we will explore that with the NRC in the coming weeks.

If you hear other vital follow up questions please do let us know. Meanwhile, we have put all these questions to Edison, Holtec, and the NRC, and will be following up regularly. We also are mindful that some members of the community are amassing their own technical information about oxide reformation, engineering of downloading systems, and other topics. We very much look forward to learning more about all that.

We in the CEP have asked Edison for updates at key milestones—such as the downloading dry runs it will demonstrate in rehearsal mode for the NRC, and on the schedule for resuming offloading. We have asked for a detailed summary of what the new offloading SYSTEM will look like. And we are in regular contact with the NRC and with elected officials in Washington DC with regard to the right kind of oversight going forward. In doing this we are mindful that what's before us all is not simply a technical issue but also one of building community awareness and, where deserved, confidence.

Sorry for the length of this note, but given everything that has been said and written about this matter in the last few months and about our most recent CEP meeting, we thought it helpful to summarize the highlights in one place.

All best

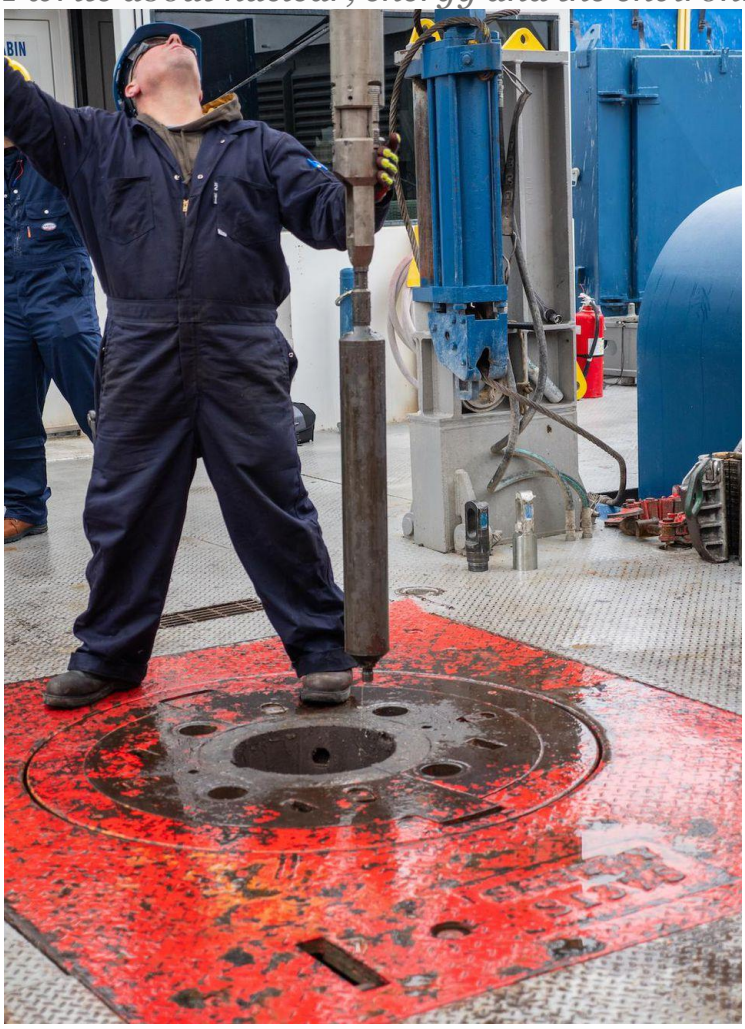
David, Dan, and Jerry

2,594 views Jan 31, 2019, 06:00am

Can We Drill A Hole Deep Enough For Our Nuclear Waste?



James Conca Contributor
Energy
I write about nuclear, energy and the environment



Workers position the Deep Isolation prototype nuclear waste canister over the test drill hole at a commercial oil and gas testing facility in Texas. The canister was lowered using a wireline and tractor assembly, commonly used to position tools and equipment in horizontal drill holes.

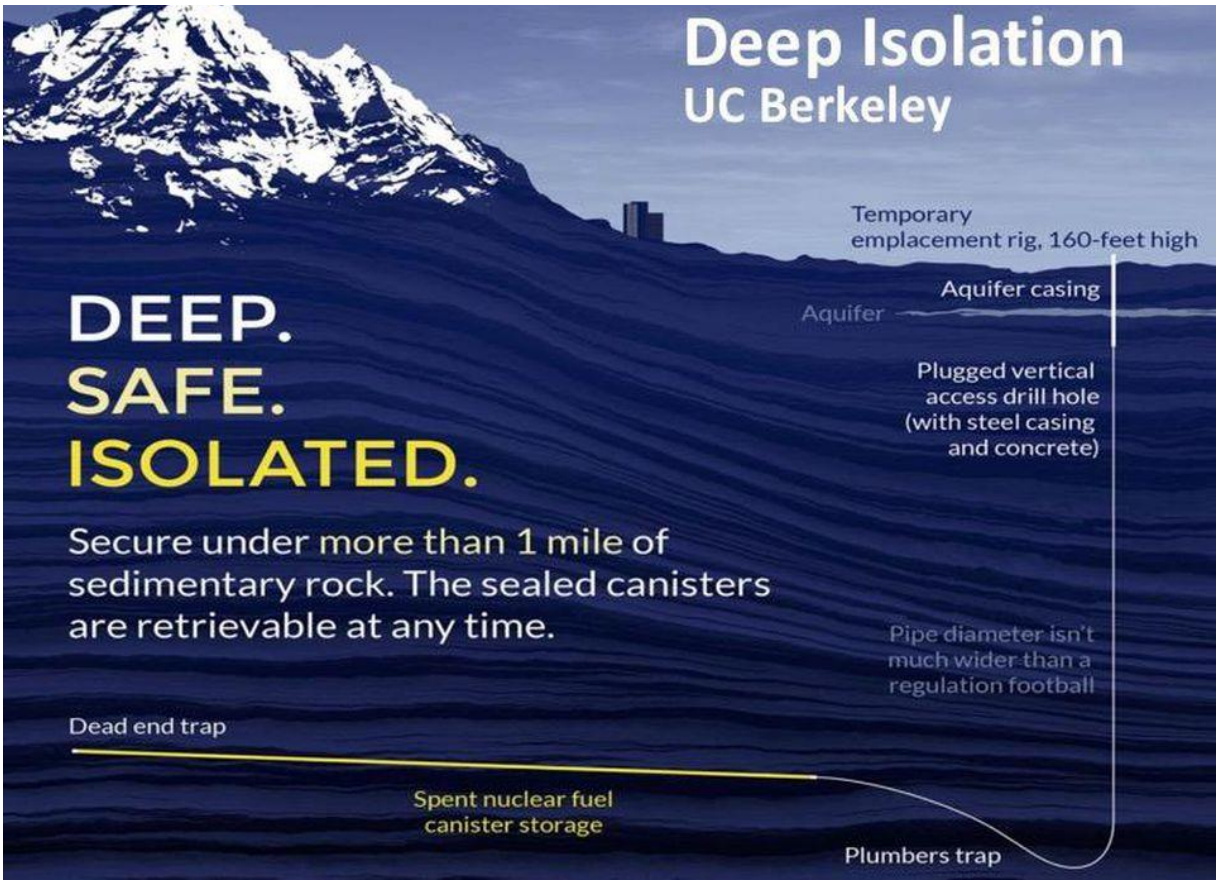
Yes we can! And it was just demonstrated. And it seems to have some bipartisan support.

The technology used was actually developed to frack natural gas and oil wells, but Elizabeth Muller understands that it could dispose of nuclear waste as well. The Chief Executive Officer and Co-Founder of Deep Isolation knows this is a great way to dispose of this small, but bizarre, waste stream.

Deep Isolation is a recent start-up company from Berkeley by Muller and her father, Richard, that seeks to dispose of nuclear waste safely at a much lower cost than existing strategies. The idea of Deep Borehole Disposal for nuclear waste is not new, but Deep Isolation is the first to consider horizontal wells and is the first to actually demonstrate the concept.

The technology takes advantage of recently developed fracking technologies to place nuclear waste in a series of two-mile-long tunnels, a mile below the Earth's surface, where they'll be surrounded by a very tight rock known as shale. Shale is so tight that it takes fracking technology to get any oil or gas out of it at all.

As geologists, we know how many millions of years it takes for anything to get up from that depth in the Earth's crust.



The Deep Isolation strategy begins with a one-mile vertical access drillhole that curves into a two-mile horizontal direction where the waste is stored. The horizontal repository portion has a slight upward tilt that provides additional isolation, and isolating any

mechanisms that could move radioactive constituents upward. They would have to move down first, then up, something that cannot occur by natural processes. DEEP ISOLATION

So what better way to use this technology than to put something back in that you want to stay there for geologic time. The demonstration occurred on January 16th, when Deep Isolation placed and retrieved a waste canister from thousands of feet underground.

This first-of-its kind demonstration was witnessed by Department of Energy officials, nuclear scientists and industry professionals, investors, environmentalists, local citizens, and even oil & gas professionals since this uses their new drilling technologies. No radioactive material was used in the test, and the location was not one where actual waste would be disposed.

Over 40 observers from multiple countries looked on as a prototype nuclear waste canister, designed to hold highly radioactive nuclear waste but filled with steel to simulate the weight of actual waste, was lowered over 2000 feet deep in an existing drillhole using a wireline cable, and then pushed using an underground tractor into a long horizontal storage section.

The canister was released and the tractor and cable withdrawn. Several hours later, the tractor was placed back in the hole, where it latched and retrieved the canister, bringing it back to the surface.

This is not just an exercise for the student. The cost of our nuclear and radioactive waste programs keeps rising astronomically. The Department of Energy recently projected the cost for their cleanup to be almost $500 billion, up over $100 billion from its estimate just a year earlier. Most of that cost is for the Hanford Site in Washington State where weapons waste that used to be high-level is no longer high-level.

The Government Accountability Office considers even that amount to be low-balled, as do I. Just look at the highly-fractured, variably saturated, dual-porosity volcanic tuff at Yucca Mountain with highly oxidizing groundwater which sits on the edge of the Las Vegas Shear Zone. Yucca Mountain was supposed to hold all of our high-level weapons waste and our commercial spent fuel.

The original estimate for that project was only $30 billion, but ever since we found out that we picked the wrong rock in 1987, the cost has skyrocketed beyond $200 billion. This is twice as high as could ever be covered by the money being set aside for this purpose, in the Nuclear Waste Fund, and it is unlikely Congress will ever appropriate the extra money to complete it.

The primary reason for the increasing costs are outdated plans that use technologies that are overly complicated and untested, and strategies that are overkill for the actual risks. Especially since the waste itself has changed its radioactivity dramatically through radioactive decay from the time when they began filling these waste tanks 70 years ago.

The hottest components of radioactive waste have half-lives of 30 years or less. Most of this stuff is only a fraction as hot as it was when it was formed.

"We're using a technique that's been made cheap over the last 20 years," says the elder Muller, who is also a physicist and climate change expert at UC Berkeley. "We could begin putting this waste underground right away."

Like all leading climate scientists, the Mullers now argue that the world must increase its use of nuclear energy to slow climate change and realize that solving the nuclear waste problem would help a lot.

When it comes to finding a permanent home for nuclear waste, the two biggest hurdles Deep Isolation, and everyone else, has observed is public consent and bipartisan agreement. The bipartisan nature of this particular effort is reflected in the company's advisory board and public support from experts on both sides of the aisle.

Deep Isolation's Advisory Board has a variety of industry leaders in nuclear and other fields, including Robert Bunditz and David Lochbaum, generally considered anti-nuclear watchdogs of the industry.

Furthermore, two Nobel Peace Prize winners, Steven Chu and Arno Penzias, an Emmy award winner, David Hoffman, and professionals from both sides of the aisle like Ed Fuelner of the Heritage Foundation and Daniel Metlay from the Carter Administration, sit on their Board.

Public consent just takes time and lots of meetings with state and local officials and the public wherever you think the project would work. And we have lots and lots of deep tight shales in America way below any drinking water aquifers.

Elizabeth Muller emphasized that "Stakeholder engagement is where our solution began. To prepare for this public demonstration, we met with national environmental groups, as well as local leaders, to listen to concerns, incorporate suggestions, and build our solution around their needs and our customers'."

In 2019, Deep Isolation is focused on both the U.S. and the international markets for nuclear waste disposal. According to the International Atomic Energy Agency, there are about 400 thousand tons of highly radioactive spent nuclear fuel waste temporarily stored in pools and dry casks at hundreds of sites around the world.

No country has an operational geological repository for spent fuel disposal, although France, Sweden and Finland are well along on their plan to open one. The United States does have an operating deep geological repository for transuranic weapons waste at the WIPP Site near Carlsbad, New Mexico, which was actually designed and built to hold all of our nuclear waste of any type.

Dr. James Conca is an expert on energy, nuclear and dirty bombs, a planetary geologist, and a professional speaker. Follow him on Twitter @jimconca and see his book at Amazon.com

Nuclear waste has been piling up across America with nowhere to go. Congress needs to act

By David G. Victor, Dan Stetson and Jerry Kern
JAN 24, 2019 | 3:05 AM



Nuclear waste is stored in underground containers at the Idaho National Laboratory near Idaho Falls, Idaho on May 11, 2015. (Keith Ridler / Associated Press)

At 74 sites around the country, radioactive waste from the nation's commercial nuclear reactors is accumulating with no place to go.

The long-standing problem is becoming a logistical and administrative nightmare. Financial pressures are forcing many reactors to close. Thousands of canisters packed with highly radioactive fuel remain.

There are closed nuclear reactors in at least 34 states, including Maine, Florida, Pennsylvania and New York. Some are near big cities, such as the San Onofre plant south of Los Angeles. The sites are monuments to decades of political neglect and mangled nuclear strategy.

But a solution finally appears to be within reach. Thanks to a growing grass-roots movement and new technology, consensus is building in Washington. A bipartisan coalition in Congress may soon be able to update the country's antiquated nuclear waste laws.

Any new law should allow communities to compete for investment in so-called interim storage.

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At the center of the debate is the Nuclear Waste Policy Act of 1982 — legislation that was predicated on the idea that our nuclear reactors, which reload with fresh fuel every 18 to 24 months, would send their spent fuel to at least one national permanent repository.

The 1982 law was passed with strong support, because the location of any repository was unknown. A few years later, the country settled on Nevada's Yucca Mountain, about 100 miles from Las Vegas.

Since then, our policy has been hamstrung by opposition in that state, with additional opposition coming from people who object to nuclear power altogether and think, wrongly, that blocking the creation of a permanent storage site would prevent more reactors from being built.

Other countries, including Canada and Finland, have avoided this kind of impasse. They invited local communities to compete for the investment and jobs that would come with a nuclear waste repository. By the time this better approach became conventional wisdom, American politics around nuclear waste had already been thrust into gridlock by Yucca Mountain.

New legislation could rectify all this, and some proposals are already in the works.
To be effective, any new law should allow communities to compete for investment in so-called interim storage. These new sites would be vast holding zones, most likely located in the desert and far from people, where spent fuel can sit in one location (rather than dozens) and await a permanent home.

Sites in New Mexico and Texas are already seeking licenses, enticed by a combination of industrial backers (who will profit) and local, well-informed civic leaders who want the jobs and investment. These sites are betting that Congress will change the law, and when that reform happens, more sites are likely to emerge.

New legislation should also ensure that shuttered sites like San Onofre are first in line to send away their spent fuel, ahead of reactors that are still operating.

Getting the votes for a new law will take some political engineering. Most Republicans want to open Yucca Mountain. They are motivated by stronger support for nuclear power and the $11 billion already spent to engineer the site. Democrats are more circumspect, with many questioning whether Yucca Mountain can withstand the scrutiny of rigorous licensing.

But a growing alliance across the two parties recognizes that the country can't keep stranding nuclear fuel, especially at reactors that have already closed.

In the last Congress, Republican-written legislation was easily passed in the House. Of the 109 sponsors, 21 were Democrats. Bipartisan support grew as the bill moved through the House and was amended to include more language on interim storage. In the new Congress, a Democratic-written bill could do the same, but with more safeguards that could make Nevada and the left a bit happier.

Enter the Fray: First takes on the news of the minute »

Just because it now seems *possible* to fix the nation's nuclear mess doesn't mean Congress will deliver. To get it done, the new House will need to focus on legislating, not grandstanding. The not-so-new Senate will need to get proactive. Sens. Lamar Alexander of Tennessee and Dianne Feinstein of California have been forging a compromise in the Senate Appropriations Committee, one that includes support for interim storage. But no serious bill has been drafted in the Senate.

New technologies could help. For instance, a technique that would inject spent nuclear waste into the Earth's crust — known as deep borehole drilling — is being tested and may offer alternatives to Yucca.

Regions with closed nuclear plants, including in Southern California, need to keep organizing and pressuring their legislators. The industry and the Decommissioning Plants Coalition, a political lobby also known as the Dead Plant Society, must talk less about the mechanics of closing plants and more about making the politics work.

As 2020 campaigning begins in earnest, new legislation on nuclear waste — a topic that has long been a radioactive third rail in American politics — could remind us what bipartisanship looks like.

David G. Victor is a professor of international relations at UC San Diego and a nonresident senior fellow at the Brookings Institution. Dan Stetson is head of the Nicholas Endowment and president emeritus of the Ocean Institute. Jerry Kern is a former member of the Oceanside City Council. Together they lead the San Onofre Community Engagement Panel, a volunteer group working toward the safe closure of the San Onofre Nuclear Generating Station.

What to do with used nuclear fuel, from Illinois to California

By Jeff Terry, December 14, 2018



Decommissioning work in progress on Unit 2 at the Zion Nuclear Power Plant. (Photo credit: ZionSolutions LLC.)

The largest operator of nuclear power plants in the United States, Exelon, closed two nuclear reactors in the city of Zion, Illinois in 1998 because of low demand, which in turn led to poor operating economics. Ever since, these two pressurized water reactors have sat unused on the Lake Michigan shoreline just north of Chicago. Exelon contracted the company EnergySolutions to decontaminate and decommission the site, and this fall it announced it was nearly done, with demolition of the two structures almost complete.

These two closed reactors have been a thorn in Zion's side since they shut down 20 years ago. The city lost $18 million in annual property tax revenue when the plants closed, and the shortfall had to be made up by local businesses and residents. Beyond the financial loss, the city can't use the site for parkland, redevelopment, or anything else. But now that decontamination and decommissioning are nearly complete, Zion should be able to reclaim the land and convert it to beneficial use—right?

Not just yet. There is still spent nuclear fuel at the Zion site—bundles of rods of uranium dioxide pellets contained within Zircaloy metal claddings. These used fuel assemblies have been placed in large cylindrical concrete containers, which will be stored at the site on a 3,000 square-meter pad, an area just larger than half a football field. There they will remain in limbo due to the Nuclear Waste Policy Act of 1982. That year, in its infinite wisdom, the US Congress enacted a law saying that "the generators and owners of high-level radioactive waste and spent nuclear fuel have the primary responsibility to provide for, and the responsibility to pay the costs of, the interim storage of such waste and spent fuel until such waste and spent fuel is accepted by the Secretary of Energy in accordance with the provisions of this Act." In other words, the power plant owner—in this case Exelon—has to hang on to the waste until the Energy Department agrees to accept it. The problem is that the Energy Department won't accept it, because it has never arrived at an acceptable political solution for dealing with used nuclear fuel. Back in the late eighties, Congress designated Yucca Mountain in Nevada as the nation's nuclear waste repository, but it has been the subject of political battles ever since, leaving the United States with no place for long-term disposal of nuclear waste.

Other countries have dealt with this problem. France reprocesses used nuclear fuel rods, extracting usable uranium and plutonium and immobilizing the leftover radioactive waste in hunks of glass. Finland has created the Onkalo repository for disposal in metal canisters deep underground. But since the US Energy Department doesn't have a plan for nuclear waste, it is destined to sit at the Zion site for years, if not decades. A similar fate will likely befall the used fuel stored at other closed nuclear plants around the country, like the San Onofre Nuclear Generating Station in California. As in Zion, the San Onofre plant is located on prime waterfront real estate that local and state government would like to see available for public use as soon as possible.

In general, the US Nuclear Regulatory Commission and nuclear scientists would prefer to come up with a long-term solution to nuclear waste, meaning one that will last for thousands of years. The Yucca Mountain site was supposed to serve that purpose. But they also recognize that short-term or "interim" storage—good for up to 100 years—may be required. The Energy Department and private companies have floated proposals to use temporary sites around the country for short-term

consolidated storage of waste from the current fleet of nuclear reactors. For example, Interim Storage Partners has proposed a consolidated storage site for Andrews County, Texas. Just over a decade ago, the American Physical Society released a comprehensive report, "Consolidated Interim Storage of Commercial Spent Nuclear Fuel," saying that while it tends to prefer a long-term solution, it does recognize that "Consolidated storage could facilitate the decommissioning of sites with reactors that have been shut down."

There are many closed nuclear plants in the United States that will undergo decontamination and decommissioning, but the Zion plant is an unusual situation, having nearly reached the point at which the land is entirely recoverable except for the lingering issue of used fuel. It is unreasonable to expect cities and towns to deal with land they can't use, yet can't collect tax on. Unfortunately, the problems Zion is about to face are just a harbinger of what is likely to happen around the country.

Proposed interim consolidated waste storage sites will probably face lawsuits from non-governmental organizations that don't like the idea of nuclear waste being stored at temporary locations. Cities and citizens will also likely object to used nuclear fuel being moved along interstate shipping routes, and sue to stop that from happening. Governors will complain about radioactive materials being shipped into their states. This will all increase the amount of time Zion will have to act as a *de facto* interim waste storage site, without any of the benefits of being an official storage site, such as the potential to attract jobs in waste disposal and possibly enrichment or reprocessing.

There is, though, another potential option. The used fuel at Zion can be stored on only 3,000 square meters of land, an amount that could easily be found at either of the two Energy Department facilities in Illinois, the Argonne National Laboratory and the Fermi National Accelerator Laboratory, both located west of Chicago. It should be possible to move the waste from Zion to either of these sites. No interstate shipping would be required. Either site could store the waste in the same storage casks, on a similar pad. Neither Argonne nor Fermilab are expected to close, and even if they did unexpectedly, it would be decades before the land could be reclaimed for other purposes, which would give plenty of time for the waste to be moved again.

Both of these Energy Department facilities have experience handling radioactive materials. Both have strong research groups focused on radiation damage. They have the expertise to monitor and perform research on any potential degradation of the dry concrete storage containers. In terms of land use, security, and availability of expert staff, Illinoisans would be far better off with the waste stored at one of these sites than sitting in Zion on the shore of Lake Michigan.

Storing the waste in this way would even offer a research advantage. The Energy Department could fully study and document the process of taking ownership of the used fuel. It would end up with a model of safe transportation, storage, and monitoring that could be used to finally establish a process for the spent fuel sitting at other American commercial nuclear reactors. Even if the federal government fails to come up with a final disposition site, California could follow the Illinois model, transferring waste from closed nuclear plants like San Onofre to Energy Department sites within the state, or potentially even Defense Department facilities.

As EnergySolutions has now demonstrated in Zion, the private sector has the ability to decontaminate and decommission closed reactor sites. These places can be returned to public use, but only if the Energy Department finally takes title to the used nuclear fuel as it was obligated to do 20 years ago. We are about to have a restored site that cannot be fully used by the local community due to used fuel. It could easily take more than 10 years for interim storage to open elsewhere, and cities and towns should not have to serve as nuclear waste storage sites in the meantime. The Energy Department should consider moving used fuel to its own facilities within the same state.