

To: San Onofre Community Engagement Panel (CEP) and the Community

From: David G. Victor, CEP Chairman

Re: The process for setting outlier scenarios to be discussed at our May 28th meeting and beyond

Date: 18 May 2020

For the last seven years, since the creation of the CEP (see Appendix A for a list of current members), we have been exploring the issues surrounding safe long-term storage of spent nuclear fuel at the site. The so-called “ISFSI” (independent spent fuel storage installation) is designed to store the spent fuel used in the reactors, and the original plan was to permanently dispose of that fuel at Yucca Mountain in 1998. The federal government has failed to honor that plan—federal law, actually. A Blue Ribbon Commission on America’s Nuclear Future explored various ideas for “interim” storage facilities and two now are taking shape but remain in the regulatory permitting phase. Many of us in the CEP have advocated heavily for needed changes in federal law and appropriations to help make interim storage viable. Southern California Edison’s (SCE) leadership has done the same; so have many in the California Congressional delegation, including Representative Scott Peters, Senator Dianne Feinstein, and Representative Mike Levin.

We must prepare for the possibility that the spent fuel will be here for some time—maybe decades. In that context, the CEP has devoted at least one meeting per year to the topic of “defense-in-depth” at the ISFSI—to understand the layers of design, fabrication, monitoring, remediation/repair and other activities that, together, give confidence in the integrity and safety of the ISFSI. We have also been getting questions about what, even with robust defense-in-depth, are some of the worst things that might happen at the ISFSI? If they happen, what might be the consequences and responses? It is clear from massive technical analysis by the industry and by independent groups, notably at the US National Academies of Sciences, that if the spent fuel is stuck on site for now the best place for it is in a robust and passively cooled ISFSI. And it is clear from the decisions made around the expansion of the SONGS ISFSI that the system we have is extra-engineered, in particular to address seismic risks and the marine environment. Still, as Paul Wyatt, CEP Member and Dana Point Council Member, asked at a CEP meeting earlier this year: “If a member of the public wants to know what can go wrong, what do I tell them?”

On May 28th we will have a CEP meeting to address this question more fully. Not every event can be examined in full depth given time constraints and thus the May 28th meeting will be organized around a few scenarios of greatest consequence and interest. In addition to that public discussion of scenarios, along with response strategies, the CEP leadership and SCE are building a library of fact-based resources related to these scenarios, such as peer-reviewed papers and expert reports. That will provide a durable, evolving location for helpful resources

on these scenarios—even what might be “postulated” as going wrong even when there aren’t particularly credible scenarios to end up at that outcome.

This memo is about how a long list of scenarios was created and the processes we organized to winnow that list to a small handful that will be the main focus of the May 28th meeting. It is also about how we have engaged with volunteer experts to help guide that process; some of those experts will also serve as guest speakers on May 28th. All of them have offered extraordinary insight and help with our process.

Developing a list of scenarios and a provisional agenda

In the fall of 2018, the CEP had a sustained discussion around the need for a public dialogue on possible outlier events at the SONGS ISFSI. For several years we had been discussing defense-in-depth and also the imperative of off-site storage or disposal to help move the spent fuel offsite. We also had, in March 2018, a petition brought forward by local activists asking for discussion of extreme events that might occur at the site (see Appendix B for the petition).

Based on these discussions, it was the sense of the CEP leadership that we should hold a meeting on the topic. SCE committed, as well, to support and hold a public meeting. The CEP leadership formed a Working Group to help with planning; that group met first on Oct. 12, 2018 and had a far-ranging conversation (see Appendix C for an agenda and presentation material). That Working Group included local activists who had been highly interested in this topic, CEP members, SCE leadership, and a representative from SCE’s Expert Team that was advising on long-term management of spent fuel (Tom Isaacs). As chairman of that meeting it became clear that we needed help narrowing the large number of imagined possible natural and manmade events at the site (a total of 9 scenarios at that time), which ranged from meteor strikes to terrorism to shaking from demolition of the plant nearby) into a list that was both shorter and reflected plausible real-world outlier events. Just as a plan was emerging to engage a group of outside experts, the Working Group suspended while SCE focused on a more immediate and appropriate task of reworking its canister downloading procedures. After that was complete, around late summer 2019, the Working Group began preparations to meet again and reconvened on Nov. 22, 2019 (see Appendix D for the Nov. 22 agenda and Appendix E for a “status and next steps” document). We invited additional input into lists of scenarios. Discussions at that meeting resulted in the exclusion of some scenarios (e.g., meteor strikes) and added more discussion of sea level rise, possible terrorism scenarios and a variety of other concerns. Once again it was apparent that we needed some help to organize the lists of possible scenarios and some expert input on what was plausible.

Based on the discussions at the first two Working Group meetings, the CEP leadership asked SCE staff to compile a list of possible scenarios. To avoid tunnel vision, our request to SCE was to look not just at the scenarios that emerged from the Working Group (and thus reflected public comments and concerns) but also a wider array of “beyond design basis” events that were the normal part of risk analysis at a site like this. During a members-only meeting of the CEP on Jan. 9, 2020, some of the local elected officials who serve on the CEP expressed an

interest in being better equipped to address questions from their constituents regarding the risk and consequences of outlier scenarios—so that the CEP and SCE could offer more useful answers to members of the public who were wondering about the implications of being stuck with spent fuel onsite for a protracted period of time. Since dry storage of commercial nuclear fuel began in 1986, there has never been an instance of spent fuel in dry storage affecting the health of people or the environment. That is not widely known but perhaps it can be through the efforts of the CEP. To get a better sense of what potential concerns local officials are hearing from at least some people in the community, on Feb. 27, 2020, we began polling City Managers in several cities in south Orange County and north San Diego County for their perspectives (a sample letter to City Managers is at Appendix Q).

By the end of the second Working Group meeting it was also clear that the public event (at the time, we planned a workshop; now it is a full CEP meeting) would need to have at least two major segments: one focused on scenarios and the other focused on responses. With regard to the latter, we asked leadership from Orange County and San Diego County first responders, along with SCE's internal response team to plan commentary on the scenarios, their responses and the layers of resources available at the site, local, state and federal levels. That commentary—about existing plans to handle outlier events—would comprise the “response strategies” part of the CEP meeting.

Enlisting a group of experts

Through the Working Group brainstorming we compiled a long list of possible experts, but we needed help identifying the nation's best team. The Working Group established the standard for choosing experts as “individuals with extensive, practical experience with design, engineering, regulation, and/or management of ISFSI systems.” That standard (captured in Appendices E and G) was discussed at the second Working Group meeting on Nov. 22, 2019. Following that meeting, in early 2020 I asked the leadership of the Nuclear and Radiation Studies Board at the National Academies of Sciences—Board Director Charles Ferguson—for help identifying the right people. Through that process a list of nine leading experts emerged. On Jan. 16, 2020, I circulated that list to the entire Working Group for any comment, in advance of our third Working Group meeting on Feb. 13, 2020 (see Appendix F for an agenda and Appendix G for an updated “status and next steps” document prepared for that meeting). I then invited everyone on that list of nine people to join. The full list, their bios, and an example of my invitation letter is at Appendix H. Three declined for various reasons.

That yielded a list of six highly qualified experts from diverse backgrounds. It is extraordinary to see so many civil servants willing to devote so much time and attention to a public service like this. Let me underscore, as well, that what we have asked the experts to do is far outside the normal comfort zone for experts. We have asked them to help us make assessments around the plausibility and consequences of outlier events.

The expert-driven assessment process

As a reminder, the agenda and scenarios for our May 28th meeting are not only expert driven. They are also designed to look at concerns of broader public interest. The discussion in this section is about just the expert portion of that process.

We established a four-step process to gain expert review of these outlier scenarios.

Step 1: we invited the experts to a kickoff call and sent them the formal charge for the group, including the list of possible scenarios. The kickoff call held Feb. 24, 2020 (see Appendix I for the agenda) allowed them to ask any questions and make recommendations to revise the charge where needed (see Appendices J and K for a pair of emails that show, in part, how the charge evolved so that it would focus more on consequences and less on traditional risk assessment). Some experts asked for information about the specific design of the SONGS ISFSI—important for considerations of groundwater intrusion and sea level rise as well as seismic events and shaking from dismantlement work. Others asked for the petition.

Step 2: after that kickoff call, I clarified the charge to focus on consequences and SCE supplied any and all requested documentation. I asked each expert individually to report their assessment privately—to help avoid groupthink. Those individual assessments are attached as Appendix L.

Step 3: based on those individual assessments I compiled a short internal draft discussion memo (see Appendix M for the memo) that identified themes in the analyses and thus topics that would likely merit top attention at our CEP meeting. (At the time, we were planning this for the March CEP meeting. The complexity of planning made that timeline very challenging; the arrival of pandemic sealed its fate: the public meeting would be pushed to late May.)

That short memo became the basis for a second call with the experts on March 6, 2020. It was clear from that call that a set of very high priorities were emerging for the CEP meeting, with some fast-unfolding scenarios (versus those that emerge slowly over time), notably terrorism, that warranted being a focus of the meeting. Other topics elicited a range of views by the experts—for example, we included a “postulated undetected through-wall crack in a canister” as one of the scenarios because there had been a lot of discussion by activists around what might happen if a canister cracked without notice even as the most likely route to cracking (chloride-induced stress corrosion cracking, CISCC, had already been discussed extensively in CEP meetings, was the subject of an ongoing monitoring program, and was one of the scenarios already). Enough of the experts thought that canister degradation and related issues deserved attention that we included it on the agenda for the CEP meeting. Scenarios that were ranked of lesser importance for discussion at the CEP meeting would be addressed by posting relevant material online. During the expert calls it was repeatedly stressed that we needed to keep these online resources fresh and that a few slides would need to be included as part of the CEP meeting materials to draw attention to the available resources.

The focus on consequences and the speed at which response strategies could be developed helps to explain why none of the experts put topics such as sea level rise at the top of their list of concerns. That wasn't because those aren't serious issues—they are—but because they are slow to develop, and good monitoring and planning will readily mitigate them. Also ranked low were vibration from dismantlement work and intrusion of groundwater—not because vibration or groundwater flows are not possible but because the phenomena have been well-assessed and it does not pose a threat to the ISFSI.

The expert process urged that we focus on terrorism as the risk of greatest consequence. That risk, though extremely low, reflects a broad consensus of the expert team, but the variation in views is also important (see individual responses in Appendix L). In particular, I note that many experts did not see any of the outlier events as major reasons for concern. And one expert (Ed Lyman) has underscored the need to explore the role of “insiders” and it was agreed the topic would be included in the realm of terrorism. On the call on March 6, 2020 it was also agreed that SCE would include as part of the meeting materials some information (omitting classified “safeguards” information) about how it defends against attack and screens internal threats including controlling the flow of materials into the ISFSI. That internal security memo will be posted on the library for the May 28th meeting.

The terrorism issues are particularly difficult to handle in a non-classified setting. To that end, it became clear that one of our experts—Kevin Crowley—would be vitally important to engage for the public meeting because he served as the senior board director for the Nuclear and Radiation Studies Board at the National Academies that produced both classified and non-classified reports on terrorism in the context of commercial nuclear sites in the wake of the 9/11 attacks.

During the March 6, 2020 meeting, we also provided the experts with the results from the City Managers' survey (see Appendix R for the results).

Step 4: after the second experts call, I invited any final comments on the process and outcomes. On March 5, 2020, I sent an email (see Appendix M for the email) summarizing expert assessments of scenarios to the expert group. That email, which reflected the expert discussions, aimed to stratify the scenarios:

- Terrorism, including internal sabotage
- A second set of scenarios were viewed as potentially important to address at the CEP meeting: canister drop, canister degradation due to CISCC including a postulated undetected through-wall crack in a canister that allows water to enter with hydrogen production, and seismic / tsunami events
- A third set of scenarios were deemed as somewhat less important to address at the CEP meeting because robust response strategies are available to address them, and the events unfold slowly: vibration from dismantlement work and sea level rise
- A fourth category was down-weighted heavily because impacts are minimal and response strategies are robust: groundwater daylighting

In addition, some experts and City Managers added other outlier events to the list for consideration: risk of refined products/natural gas nearby generating an explosion, internal sabotage, aircraft impacts/jet fuel fire, and even potential staffing shortages due to the pandemic. (Per above, the matter of internal sabotage will be addressed as part of the topic of terrorism.) The other matters have been down-weighted. Fires, airplane crashes (including the prospect of jet fuel pooling and catching fire in the vertical ISFSI modules) all have been assessed in previous studies. (We have asked Kevin Crowley to include a brief discussion of this topic in his remarks on May 28th). With respect to nearby pipeline explosions, a full probabilistic analysis found “no undue risk to the plant and, subsequently, to the health and safety of the public exists” (refer to section 2.2.3.1.3 of Appendix N). On the matter of the coronavirus, a pandemic protocol is in place at SONGS (as well as other nuclear sites across the country) that is informed by guidance from a variety of sources including a protocol prepared by the Nuclear Energy Institute (the protocol is available at Appendix O).

We then hosted a call for the Working Group (the final meeting of that group), the full membership of the CEP, and the experts to allow a fuller conversation, held on March 19, 2020 (the agenda is available at Appendix P).

That meeting focused on terrorism, longer-term events including sea level rise and canister degradation over long periods, and seismic/tsunami events as key points of discussion for the CEP meeting. On that call it became clear that the public interest would be best served by focusing on topics that were new—seismic and tsunami were risks that had been analyzed extensively and the subject of several CEP meetings and thus materials from those public discussions would be added to the library and brief mention would be made of them in the agenda for the May 28th meeting. It also was emphasized by a member of the Working Group (and widely agreed) that the CEP meeting should include pre-circulation of materials well in advance so that the views of the experts could be understood. That would facilitate efforts to formulate questions and, perhaps, to elicit a robust list of questions in advance of the meeting. This memo is one contribution to that important role of transparency; advance materials for the May 28th meeting will be posted so that early engagement and question-asking can proceed. The CEP leadership envisions that we will put rosters of questions to the experts before the meeting so that they can adjust their comments to be responsive. In addition, the May 28th meeting will have a period of public comment devoted directly to the matters at hand for the meeting, along with a period that is not structured so that people can raise whatever issues may be on their mind and merit public comment.

That final Working Group meeting also identified the importance of making unclassified studies available in advance, providing a non-classified SCE summary of security, addressing how security will change after all fuel is in the ISFSI and the risk profile is reduced, as well as considering possible follow-up activities and address new, related questions. All of those materials will be part of the library.

Polling local cities

As noted above, the experts and the CEP members thought it would be useful to solicit input from City Managers. We already had a lot of input from CEP Meetings, from CEP Members (most of whom are local elected officials, for a current roster see Appendix A), and from the activist petition (Appendix B). But we did not know, systematically, the questions that elected governing bodies were getting from the public. The polling helped fill that gap.

SCE wrote the manager of every city in the broad SONGS area (from Solana Beach in the south to Laguna Beach in the north). We also included CEP members from those elected bodies in the query to help ensure a response and then followed up repeatedly (from the CEP, Jerry Kern was the key point of contact). Of nine cities polled, six responded. A sample of the letter to City Managers is available at Appendix Q and a summary of the responses is at Appendix R.

The results confirmed what we had heard at CEP meetings over time, but they also indicated a sense of priority. The top concerns among the neighboring cities were (1) terrorism, (2) seismic event/tsunami, and (3) a spent fuel handling incident. Sea level rise was not on that short list, but many other inputs had flagged this as a concern. Based on that information, I think it is important that we include a couple slides to summarize prior meetings and information about seismic and tsunami risk. And it is important that we have a slide pointing to library resources about a spent fuel handling incident. The expert analysis has looked at that as well and has concentrated less on the causation of damage to a canister and more to a crack that went undetected for a long period of time (allowing for postulated water intrusion) and progressed through the canister shell, regardless of the particular event (spent fuel handling, CISCC, something else) that caused the crack.

An integrated list of scenarios, plus focal scenarios for May 28th.

This whole process, then, has led to a long (and expanding) list of plausible scenarios. Topics such as insider sabotage, potential for nearby gas pipeline explosions, aircraft impacts and jet fuel fire, postulated zirconium fire and postulated staffing shortages due to COVID-19 were discussed with experts. That expanded list of 14 scenarios is reproduced in Table 1. In the preparations for the May 28th meeting, information about each of those scenarios and responses will be organized and posted to the library.

Table 1

Outlier Scenarios	Agenda Topic	Library
Fast-Occurring Events		
Terrorism	✓	✓
Insider sabotage	✓	✓
Seismic events	✓	✓
Tsunami	✓	✓
Canister drop		✓
Nearby pipeline explosion		✓
Aircraft impacts/jet fuel fire		✓
Slowly Emerging Events		
Canister degradation (CISCC)	✓	✓
Postulated water intrusion, hydrogen build-up, ignition	✓	✓
Postulated zirconium fire		✓
Sea-level rise		✓
Groundwater daylighting		✓
Vibration from dismantlement activities		✓
Postulated staffing shortage due to COVID-19		✓

Of that long list, the scenarios that have attracted systematically the most attention can be grouped into three main topics:

1. terrorism and insider sabotage;
2. seismic events and tsunamis; and
3. canister degradation including postulated undetected cracking, water intrusion resulting in a hydrogen explosion.

Based on all of the above, the May 28th meeting will include a slide or two that will set the scene for the long list of scenarios and provide a hyperlink to the online library with materials on each. Those setup slides will include a little more depth on scenarios that at least some people ranked as high concern for which extensive analysis and public discussion has already occurred—seismic, tsunami and sea level rise. A couple of slides will ask Tom Isaacs to comment on the long list in the framework of the speed with which the scenarios unfold and their consequences. After that, we will have a series of briefings by the other experts outlining the top few scenarios and their consequences in the context of spent fuel stored in the ISFSI. A draft agenda is shown in Table 2.

Table 2

Agenda Topic	Presenter
Overview of process and events in and out of scope	David Victor
Assessment methodology and top priorities	Tom Isaacs
Canister degradation, postulated undetected cracking / water intrusion / hydrogen build-up / ignition	Mike Corradini Ed Lyman
Terrorism	Kevin Crowley
Terrorism in the context of internal sabotage	Ed Lyman
SONGS ISFSI-only security posture and ISFSI design basis	Ross Quam (SCE)

The unusual nature of this meeting and the importance of an evergreen approach

A final note: I am struck that nothing like this assessment and CEP public meeting has ever happened in the industry to my knowledge. We need to make sure we stay tethered to facts and analysis while also being responsive to opinions. That is key to making this a public service.

The online library

The process for preparing this meeting has generated a HUGE amount of information of interest to the public, which tightly wants to know what life looks like if the spent fuel stays here at SONGS for a long period of time. Thus, in addition to the meeting itself Edison is putting together an organized evergreen library to offer a useful and lasting resource to the community.

Appendices

- Appendix A Community Engagement Panel – Current List of Members
- Appendix B Petition to CEP for a meeting devoted to Emergency Disaster Planning, March 3, 2018
- Appendix C CEP Workshop Scoping Session #1 - Agenda & Presentations, October 12, 2018
- Appendix D CEP Workshop Planning Meeting #2 – Agenda, November 22, 2019
- Appendix E CEP Workshop Planning Meeting - Status and Next Steps Document, November 15, 2019
- Appendix F CEP Workshop Planning Session #3 - Agenda, February 13, 2020
- Appendix G CEP Workshop Planning Meeting - Status and Next Steps Document, February 13, 2020
- Appendix H D. Victor’s E-mail to Working Group; C. Ferguson Expert Recommendations, Jan. 16, 2020
- Appendix I CEP Workshop Planning Meeting with Experts - Agenda, February 24, 2020
- Appendix J D. Victor's Original Email Request to Experts for Assessments, February 18, 2020
- Appendix K D. Victor's Follow-up Email Request to Experts for Assessments, February 22, 2020
- Appendix L Assessment by Mike Corradini, February 28, 2020
- Appendix L Assessment by Kevin Crowley, March 2, 2020
- Appendix L Assessment by Tom Isaacs, February 28, 2020
- Appendix L Assessment by David Lochbaum, February 27, 2020
- Appendix L Assessment by Ed Lyman, March 5, 2020
- Appendix L Assessment by Arthur Motta, March 5, 2020
- Appendix M D. Victor Email Summary of Expert Assessments, March 5, 2020
- Appendix N SONGS ISFSI Final Safety Analysis Report
- Appendix O Nuclear Energy Institute Pandemic Protocol
- Appendix P CEP Outlier Topic Planning Update Meeting - Agenda, March 19, 2020
- Appendix Q Example Letter to City Managers Requesting Input, February 27, 2020
- Appendix R Local City Manager Response List for CEP Workshop, March 10, 2020