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Comment On: NRC-2009-0552-0026

Diablo Canyon Power Plant, Units 1 and 2; Notice of Intent to Prepare an Environmental Impact Statement

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General Comment

See attached file from San Luis Obispo Mothers for Peace

Attachments

scoping comments FINAL

SUNSI Review Complete

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To the NRC Re: Environmental Scoping Topics for Docket ID NRC-2009-0552

www.regulations.gov

From: **San Luis Obispo Mothers for Peace**

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The Nuclear Regulatory Commission (NRC) intends to develop and publish an environmental impact statement (EIS) for the proposed license renewal of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, and seeks public comment on environmental issues to be included in the report. San Luis Obispo Mothers for Peace (SLOMFP) submits comments below.

The energy produced from Diablo Canyon nuclear plant is not needed. Renewable energy alternatives exist.

The consideration of energy alternatives is a site-specific issue, as the need for energy is relevant only to California. New information shows that there is a range of renewable alternatives that negates any need for license renewal for the Diablo Canyon plant. PG&E has skewed its new analysis of energy alternatives to ignore or reject a wide range of renewable energy options available to replace the power generated by Diablo Canyon.

Mark Cooper is Senior Fellow for Economic Analysis at the Institute for Energy and the Environment at Vermont Law School. He is an expert in the field of economic and policy analysis with a focus on energy, technology, and communications issues.

Mark Cooper's Declaration in Support of SLOMFP's Motion to File New Contentions Regarding Adequacy of Environmental Report for Diablo Canyon License Renewal Application is available at

<http://pbadupws.nrc.gov/docs/ML1509/ML15096A614.pdf>

In this report, Mark Cooper points out that

"PG&E's focus on 'standalone' energy sources reflects two irrational and unsupported biases: first, towards reliance on "baseload" generation by a single source, and second towards "utility-scale" generation. But these biases have been outdated by the ongoing transformation of the electric utility sector. As one prominent financial firm that specializes in analysis of the electricity sector, UBS, put it, 'Large-scale power generation . . . will be the dinosaur of the future energy system.' 1 They are: 'Too big, too inflexible, not even relevant for backup power in the long run.' 2 While UBS ties the shift to the spread of battery technology other major firms see the shift being driven by the development of other technologies including solar, 3 wind, 4 efficiency, 5 as well as the increasing ability to actively integrate and manage supply and demand. 6"

1. UBS, 2014, Global Utilities, Autos & Chemicals Will solar, batteries and electric cars re-shape the electricity system?, August 20, p. 1. UBS "is considered the world's largest manager of private wealth assets," <http://en.wikipedia.org/wiki/UBS>
2. Id
3. Bernstein Energy and Power Blast: If solar wins, Who Loses?, Bernstein Research, April 2. Lazard, 2013, Levelized Cost of Energy Analysis – Version 8.0, June.

4. Eggers, Dan, et al., 2014, A Thought... The Transformational Impact of Renewables, Credit Suisse, December 20; CITI Research, 2012, Shale & Renewables: A Symbiotic Relationship, September 12.
5. Eggers, Dan, 2013, A Thought... Energy Efficiency: The Reality of Slower Power Demand Growth, Credit Suisse, February 11; McKinsey and Company, 2010, Energy Efficiency: A Compelling Global Resource
6. UBS, 2014, Global Utilities, Autos & Chemicals Will solar, batteries and electric cars re-shape the electricity system?, August 20; Frankel, David, Kenneth Ostrowski, and Dickon Pinner, 2014, "The disruptive potential of solar power: As costs fall, the importance of solar power to senior executives is rising," McKinsey Quarterly, April.

In another paper, Mark Cooper makes the case that "Nuclear reactors old and new are far from a necessary part of a low-carbon solution. Nuclear power, with its war against the transformation of the electricity system, is part of the problem, not the solution."

http://www-assets.vermontlaw.edu/Assets/iee/Power_Shift_Mark_Cooper_June_2015.PDF

California has a goal, set by the California Energy Commission and Governor Brown, to increase the proportion of renewable, carbon-free energy to 33% by 2020. See <http://www.energy.ca.gov/renewables/index.html> Diablo Canyon's electrical output will be an obstacle to reaching that goal, because nuclear is not a flexible source of energy. It is unsafe to ramp down the level of output of a nuclear plant, so when there is an overabundance of energy available to the Western Grid, it will be the more flexible renewable sources that have to be shut down. See article by David Howarth and Bill Monsen, with MRW & Associates, LLC in Oakland, California titled *Renewables Face Daytime Curtailments in California*.

http://www.chadbourn.com/Renewables-Face-Daytime-Curtailmentsin-California_projectfinance/

Paragraph 5:

"The California Independent System Operator (CAISO) is concerned that there may be times when there is so much variable wind, solar and other renewable energy being scheduled onto its system that the other generators who will have to adjust to accommodate it will not have the flexibility needed to do so."

Paragraph 8:

"Some generators, such as nuclear, small hydroelectric and most geothermal and combined heat and power plants, need to run and have little ability to shut down because they have limited flexibility."

SLPMFP contends that California has all the renewable energy it needs to replace the power from the dirty, dangerous, and expensive Diablo Canyon.

Furthermore, the Environmental Protection Agency does not believe that nuclear power is needed in order to combat climate disruption. According to the recently-released Clean Power Plan, the following measures will be taken:

- Nuclear reactors under construction are not counted in the emissions targets, but neither are existing nuclear reactors, including the 6% of uneconomical, "at-risk" nuclear reactors. By the same token, relicensed reactors do not count either.
- ONLY new reactors that actually operate before 2030 (the five in construction or any others) and power uprates of existing reactors can count toward meeting emissions goals.

That means there is no INCENTIVE under the rule to keep uneconomical reactors operating and no incentive to complete building new reactors. States can achieve compliance with new nuclear (but not with existing nuclear), and they are given no justification for preferring nuclear over renewables. In fact, there are several statements in the rule that indicate just the opposite.

- Existing reactors cannot qualify as emissions offsets for fossil fuel generation, at least so far as compliance with the Clean Power Plan is concerned.

States could create a subsidy for new reactors or power uprates for existing reactors, but there is no incentive for them to do so.

There are significant seismic concerns.

The original siting of the Diablo Canyon reactors was a mistake, for the area is riddled with a multitude of active faults. If PG&E were to come to the NRC today to request a construction permit, it would certainly be denied.

PG&E is ignoring the fact that its licensing basis requires it to prove it can manage a Double Design Earthquake shutdown. PG&E points out that no other nuclear plant has such a requirement. That is because no other nuclear plant has been given an operating license despite being sited within two and a half miles of a known major, active earthquake fault – the Hosgri Fault. This is a site-specific issue, pertaining only to the geographical specifics of the Diablo Canyon site.

Pacific Gas & Electric Company (PG&E), operator of Diablo Canyon nuclear plant, attempts to placate the public with assurances that the aging facility can withstand the ground motion of any seismic event from any of the 13 faults – some of them intersecting - surrounding the plant. It also claims that the facility is safe from a tsunami despite its location on the California coast. SLOMFP contends, however, that PG&E's program to protect against earthquake/tsunami impacts is inadequate because severe risks have been greatly understated.

PG&E's Severe Accident Mitigation Alternatives Analysis for Diablo Canyon fails to resolve important questions about the potential for earthquakes very near the plant, and for potentially very large earthquakes. Clearly these are site-specific issues, being unique to the Diablo Canyon plant.

PG&E's seismic hazards analysis fails to account for reasonably foreseeable earthquakes located nearer to the DCP than PG&E has assumed. For instance, the seismic stations used to locate earthquakes on the Shoreline Fault are all onshore, east of the fault, so that the fault's east-west location is highly uncertain. Thus the fault could be closer to or further from DCP than assumed in DC03.

PG&E's understatement of magnitude stems from its reliance on "scaling relations", which are equations relating magnitude to rupture length or rupture area. But scaling of earthquake magnitudes from fault geometry has been demonstrated to be unsupportable, because the mapped fault length is no limit to the ultimate rupture length. Many earthquakes have ruptures exceeding the length of the faults on which they started. Even PG&E implicitly acknowledges this: examples listed in the SSC Report at page 6-6 include the 2002 Denali, AK (magnitude 7.9), the 1992 Landers, CA (magnitude 7.3), and the 1999 Hector Mine, CA (magnitude 7.1). Other major earthquakes occur on previously unknown faults, even in areas with extensive prior geological study: the 1989 Loma Prieta earthquake (magnitude 7.1; Spudich, 1996); the 1994 Northridge, CA (magnitude 6.7); and the 2010 Darfield, NZ (magnitude 7.1) earthquakes. Perhaps the most astounding example was the 2012 magnitude 8.6 strike-slip earthquake off the coast of northern Sumatra (Ishii et al., 2013). Nevertheless, PG&E disregards this information and unjustifiably relies on the scaling relationships to estimate maximum magnitude from fault length.

PG&E's assertion that Diablo can survive anything Mother Nature comes up with is a hopeful projection, not a prediction that can be backed up with any certainty. The catastrophic consequences of a large earthquake should not be imposed on citizens for the sake of PG&E's bottom line.

<http://mothersforpeace.org/data/2015/2015-04-15-new-contention-regarding-adequacy-of-severe-accident->

Emergency plans are woefully inadequate.

Emergency planning for the communities surrounding the Diablo Canyon nuclear plant should be classified as a site-specific issue because the population density, roads and bridges, geography, and earthquake potential of the Central Coast is unique.

Natural versus Technological Disasters and Panic: Emergency response plans for a *nuclear* disaster are generally modeled after studies of responses to *natural* disasters, but research makes it clear that people tend to respond differently in technological disasters. Studies indicate that panic often does not occur in a natural disaster. Panic in an emergency situation is most likely to occur when there is a perception that:

- the danger is increasing rapidly; (Radiation is unseen, it seems mysterious, it can cause major health problems, and there is no way of knowing how fast the plume will arrive or how long it will remain.)
- the escape routes are closing off. (In the communities surrounding Diablo Canyon nuclear plant, the escape routes are very limited and people know that they could easily be closed off by accidents or the rush of traffic. This is a small town area with a highway system built for an area of small towns, but it is also a major tourist locale that can easily draw 150,000 people for an event. It would be impossible to evacuate all of the tourists and homeless people from the area. Furthermore, homeless people and tourists in the many camp grounds would have no way to shelter.)

Protective Action Zones and Shadow Evacuations: Protective Action Zones are central to the Diablo Canyon Emergency Response Plan, and it is assumed that people will follow the instructions given for their zones – but this might not be the case in a real nuclear emergency. In contrast to the reluctance by some people to evacuate during natural disasters, people sometimes overreact in technological disasters. This is particularly true when radiation is involved because, as noted above, people panic when the event seems mysterious; the threat cannot be seen or felt. Research in the 1980s indicated that evacuations by zones were not likely to work.

Cutter, S.L. (1984). Emergency preparedness and planning for nuclear power plant accidents. *Applied Geography*, 4, 235-245.

Zeigler, D.J., Brunn, S.D., & Johnson, J.H., Jr. (1981). Evacuation from a nuclear technological disaster. *Geographical Review*, 71, 5-7.

In March of 2013, the Government Accountability Office (GAO) issued a requested report to Congress that was publically released April 10, 2013, claiming that the NRC needs to better understand the effect of **shadow evacuations**, the voluntary evacuation of people from areas outside a declared evacuation area. Shadow evacuees congest roadways and interfere with the departure of the targeted group. The NRC disagreed with that recommendation, but GAO responded:

“To better inform radiological emergency preparedness efforts, GAO recommends that NRC obtain information on public awareness and likely public response outside the 10-mile zone, and incorporate insights into guidance, as appropriate. NRC generally disagreed with GAO's finding, stating that its research shows public response outside the zone would generally have no significant impact on evacuations. GAO continues to believe that its recommendation could improve radiological emergency preparedness efforts and is consistent with NRC guidance.” (<http://www.gao.gov/products/GAO-13-243>)

According to an article in *The Professional Geographer*:

"The 10-mile emergency planning zone is a politically arbitrary distance. It has no bases in meteorology, radiation releases mechanisms and human behavior. In fact studies of human behavior following the Three Mile Island accident in 1979, where a limited evacuation advisory was issued by Pennsylvania Governor Thornberg, provides evidence that people will be spontaneously leaving their homes well beyond the current 10-mile planning zones." ("Evacuation Behavior In Response To Nuclear Power Plant Accidents," by Donald Zeigler and James Johnson, Jr. in the May, 1984 issue of *The Professional Geographer*)

After the Three Mile Island accident, pregnant women and preschool children in the area around the plant were advised to evacuate (about 2,500 people). An estimated 144,000 people (39% of the population) actually left (Zeigler, Brunn, & Johnson, 1981).

Role Conflict: Emergency response plans rely on the assumption that first responders function efficiently despite being personally impacted by the disaster. These first responders, however, are susceptible to the same fears and concerns as the general public and face "role conflict".

"Research conducted in the vicinity of the now closed Shoreham nuclear power station on Long Island, NY questioned bus drivers and volunteer fireman. 'What do you think you would do first if an accident requiring a full scale evacuation of the population within 10 miles of the nuclear reactor were to occur?' The results found that 68% of 291 fire fighters, 73% of the 246 bus drivers indicated that family obligations would take precedence over emergency duties.

Additionally, during the TMI accident, role conflict was documented among many emergency workers including the exodus of physicians, nurses, and technicians required to staff both the short term and long term medical facilities."

<http://www.nirs.org/reactorwatch/emergency/emergencyplanning71301.htm>

Fire Emergency: San Luis Obispo County Fire Chief Robert Lewin examined the emergency management of the Fukushima disaster and applied what he learned to nuclear facilities in the United States. He determined that the small PG&E fire-fighting crew would not be able to manage a fire emergency coupled with a radiation release.

"The lesson those power plants teach is clear: Protection of nuclear facilities by skilled full-time onsite fire departments and well trained and equipped offsite fire departments needs to be significantly increased. The US Nuclear Regulatory Commission (NRC) must require that industry, local, state and federal firefighting services review and participate in comprehensive improvements to the way nuclear power plants are protected. If US firefighters are expected to follow the example of what Japanese firefighters did to stabilize damaged reactors, then comprehensive changes must occur at and around nuclear power plants...

Offsite firefighters are essential to the protection of a nuclear power plant and they must be ready to protect their communities by containing a radiological emergency at its source. While the NRC requires training of offsite responders, that training is not rigorous enough. The training must include responding to a hostile fire and responding to a nuclear power accident. Whether the local fire department is all-volunteer or from a large municipality, that fire department needs to be educated and ready.

In the event of a hostile radiological fire or a reactor losing its cooling, it would take more than a single engine company to handle the disaster. Hundreds of firefighters would need to rotate in and out of the

fight to limit their exposure to radiation. Again, fire commanders must understand and practice the strategy of time, distance and shielding to protect their firefighters while still putting them into the fight.”

<http://www.hstoday.us/focused-topics/emergency-managementdisaster-preparedness/single-article-page/in-the-shadow-of-fukushima-facing-the-fires-of-a-meltdown/242a4119dabc5511e28a97a206016ef6.html>

The reactor pressure vessels at Diablo Canyon are embrittled.

The reactor pressure vessels at Diablo Canyon are embrittled. In a letter from the NRC to Entergy Nuclear Operations, Inc. dated April 18, 2013, the NRC states that Diablo Canyon’s Unit 1 is on the list of the top five most embrittled pressurized water reactors. The letter states: “The NRC currently estimates that the following plants will exceed the PTS screening criteria of 10 CFR 50.61 during their 20-year period of operation beyond their original 40-year licenses.”

<http://pbadupws.nrc.gov/docs/ML1310/ML13108A336.pdf> - pg. 5

Embrittlement happens over time as the steel in the reactor pressure vessel becomes weakened by intense long-term neutron bombardment from the radioactive fuel inside. As the reactors age, they become increasingly vulnerable to “pressurized thermal shock risks.” Rapid severe cooling plus sudden re-pressurization could shatter the weakened reactor vessel and allow intense radioactivity to escape. There is speculation that an earthquake can be the initiating factor in this shattering.

<http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/prv.html>

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1806/v2/>

A 2014 report "Irradiation Embrittlement of Reactor Pressure Vessels (RPVs) in Nuclear Power Plants" states, “While this degradation mechanism was factored into the initial design and considers in the selection of materials of the RPV, a failure of the RPV by rupture or brittle fracture is **beyond the design basis of the plant.**” (emphasis added)

"Irradiation Embrittlement of Reactor Pressure Vessels (RPVs) in Nuclear Power Plants": Editor: N Soneda 22 Aug 2014, Woodhead Publishing, ISBN: 9781845699673

“Thus far, the industry has not created any method by which it can directly measure the neutron bombardment to the wall of the nuclear reactor other than to sample the coupons of metal welds put inside each vessel when it is manufactured. These capsule coupons were designed to be removed periodically, so that each one may be subjected to destructive testing in order to directly measure the vessel’s level of embrittlement.

Declaration of Arnold Gundersen - United States of America Nuclear Regulatory Commission before the Atomic Safety and Licensing Board – Dec. 1, 2014

SLOMFP asserts that this site-specific issue must be thoroughly studied. The impact from earthquakes and high burn-up fuel on the embrittled RPV must be considered.

PG&E has lost its credibility.

The Japanese Parliament concluded that collusion between regulator, industry, and government officials was the root cause of the ongoing Fukushima nuclear catastrophe.

https://www.nirs.org/fukushima/naiic_report.pdf

Frighteningly, the Diablo Canyon plant is operated by PG&E, a company under multiple federal indictments for safety violations in the recent fatal explosion of its San Bruno, CA gas pipeline, and embroiled in an evolving

scandal about illegal back-channel communications with the state's Public Utilities Commission.
http://www.mercurynews.com/business/ci_27785310/pg-e-executives-harvest-pay-raises
http://www.bizjournals.com/sanfrancisco/morning_call/2015/05/pge-cpuc-federal-grand-jury-email-san-bruno-blast.html

This is a site specific issue, relating only to the owner of the Diablo Canyon nuclear facility.

Diablo Canyon is vulnerable to terrorist attack.

Security issues must be considered site-specific in the case of Diablo Canyon facility because of its unique geographical vulnerabilities.

Attack by air

No plant in the United States – including Diablo Canyon – is prepared for a large-scale attack by air.

On August 15, 2013, the Nuclear Proliferation Prevention Project (NPPP) at The University of Texas at Austin's LBJ School of Public Affairs released a report titled "Protecting U.S. Nuclear Facilities from Terrorist Attack: Re-assessing the Current 'Design Basis Threat' Approach".

One of the authors of this report, Prof. Kuperman, commented: "More than 10 years have come and gone since the events of September 2001, and America's civilian nuclear facilities remain unprotected against a terrorist attack of that scale. Instead, our civilian reactors prepare only against a much smaller-scale attack, known as the "design basis threat," while the government fails to provide supplementary protection against a realistic 9/11-type attack. It would be a tragedy if the United States had to look back after such an attack on a nuclear reactor and say that we could have and should have done more to prevent the catastrophe."

<http://www.utexas.edu/lbj/news/2013/study-us-nuclear-reactors-vulnerable-terrorist-attack>

Water-borne attack

Diablo Canyon is vulnerable to water-borne attacks. A small boat may be able to evade the coast guard long enough to get close enough to the plant to launch a missile. The waste storage area is not covered by a protective dome and is most vulnerable to that kind of attack.

One possible protection is a boat barrier. Wave Dispersion Technologies, Inc. – a manufacturer and marketer of floating security barriers and floating wave attenuators, pointed out that "Boat barriers provide a visible physical deterrent for inadvertent recreational boat traffic from entering the security zone. Boat barriers also establish a physical layer of security to deter, deny and delay terrorists utilizing water-borne improvised explosive devices (WBIED) delivered via a small boat." <http://www.whisprwave.com/category/nuclear-security/>

There are no such water barriers at the Diablo Canyon plant. Although boats and ships are directed to stay more than a mile away from the plant that does not always happen. Fishing craft have been sighted within Diablo Cove by members of Mothers for Peace while touring the plant site with the Diablo Canyon Independent Safety Committee. (Jane Swanson, janeslo@icloud.com)

During that incident, the Coast Guard appeared from around a breakwater shortly after the PG&E guide explained that the yellow craft appearing to be within a hundred yards of the intake structure was a PG&E craft. The Coast Guard ship used a megaphone to tell the craft that it was in waters not allowed, and ordered the fishing vessel to turn out to sea. The Coast Guard then escorted that vessel out beyond the mile mark.

Drones

Drones present yet another potential threat to Diablo Canyon nuclear plant.

“Recent security breaches with small unmanned aircraft systems (“sUAS”) have garnered much attention. Last fall, UAS overflew 13 of France’s 19 nuclear power plants in an apparent coordinated fashion. In January, a private UAS crashed onto the lawn of the White House. In April, Japanese security forces found a UAS on the roof of the Japanese prime minister’s office carrying a small camera and a bottle containing radioactive Cesium-137.

Nuclear facility operators now operate sUAS under Federal Aviation Administration (“FAA”) exemptions for beneficial purposes, including electrical facility inspections, but others may operate UAS for destructive and subversive purposes. sUAS could be used to monitor a facility’s security activities, divert security forces’ attention from a second threat to physical security, or carry and release destructive conventional, chemical, biological, or radiological payloads. As sUAS become more popular and less expensive, it is likely that nuclear and other sensitive facilities will face an increasing number of potentially-problematic flyovers.” (May 28, 2015, <http://www.uaslawblog.com/2015/05/28/uas-and-nuclear-power-plant-security/#more-102>)

“Drones can pose a number of problems for nuclear facilities. Flyovers could be used for reconnaissance by hostile actors, for example in the collection of photos and video footage of guard movements and the site layout. This could help to prepare for a ground-based attack. Drones could also provide air support in the event of an actual ground-based attack: They could drop explosives to damage power or communications networks, or could deliver weapons to insiders within the plant. Drones could also be used to bomb spent-fuel pools, which are less well protected than reactor cores.” <http://www.newsweek.com/drones-threat-nuclear-plants-294458?piano t=1>

Force-on-Force Drills

Force-on-Force drills must be considered a category 2 issue because each plant has unique susceptibilities related to plant design and geography.

Force-on-Force drills should retain an element of surprise, and they should use independent “mock attackers” not connected with the utility. But that does not happen at nuclear facilities. In fact, the NRC has been weakening the drills instead of strengthening them.

“In response to industry complaints, the NRC already has reduced the number of FOF exercises per inspection from three to two and is proposing to reduce it to only one by 2017. In exchange, the NRC will give more credit to licensee-run security drills and will observe one such drill in each inspection cycle. This is a slippery slope toward the industry’s ultimate goal: to take control of the process and eliminate the potentially embarrassing FOF exercises altogether. Even worse, the NRC commissioners have directed the staff to review the entire FOF program with an apparent eye toward weakening it even further.” [\(http://allthingsnuclear.org/the-nrcs-security-inspections-at-nuclear-power-plants-are-again-under-attack/\)](http://allthingsnuclear.org/the-nrcs-security-inspections-at-nuclear-power-plants-are-again-under-attack/)

There are an unacceptable number of human performance deficiencies at the Diablo Canyon site, particularly involving identification and resolution of problems.

There were 29 violations documented by the NRC at Diablo Canyon Nuclear Power Plant in 2014, and overwhelmingly, the root cause of these violations pointed to human performance deficiencies. This must be

considered a site-specific issue because the workforce is unique to PG&E's employees at the Diablo Canyon site.

The violations involved fire protection, inoperable emergency diesel generators, occupational radiation safety, poor maintenance planning on safety-related equipment, failure to follow procedures, problems with design control, and multiple instances of failure to identify and evaluate system interactions regarding seismically-induced systems. Eleven of the violations involved security or materials control. One finding identified a violation dating back to the original construction welding process from 1974 - over 40 years ago.

Three of the violations involved the corrective action program - identifying and resolving problems. There is an enormous backlog of problems involving operable but longstanding, degraded conditions at the plant. Some problems were simply not identified in a timely manner, some disregarded and not put into the corrective action program, and others inappropriately delayed.

As of August 2014, there were 29 documented degraded conditions affecting safety-related equipment - the oldest dating from June 2008. The median age of the problems was 1,176 days **post-identification**. In the words of the NRC from the inspection report, there exists "a large number of longstanding degraded or non-conforming conditions, some of which had not been appropriately addressed by compensatory measures or interim corrective actions."

A more recent blunder was revealed in May of this year. 19 of its 34 dry casks used to store spent fuel were not loaded to the manufacturer's technical specifications, particularly as they relate to the proper ratio of older and newer spent fuel. The root cause was determined to be Reactor Engineering personnel misinterpreting the technical specifications.

While TS 2.1.2 specifies that "fuel assemblies with the longest post-irradiation cooling times shall be loaded into fuel storage locations at the periphery of the basket," the reactor engineers misinterpreted this to mean assemblies with low decay heat and did not use post irradiation cooling time as the applicable criterion. This misunderstanding overrode the review of the procedure and calculations, and the discussion of loading criteria, including cooling time, that occurred in the technical pre-job brief prior to performing this task. <http://pbadupws.nrc.gov/docs/ML1518/ML15187A239.pdf>

Once-Through-Cooling degrades the marine environment.

Diablo Canyon uses a once-through cooling (OTC) water system that withdraws 2.45 billion gallons of raw seawater from the Pacific Ocean per day through shoreline intake and discharge structures. It discharges back into the ocean at a separate location and 20 degrees warmer. In this process, three major environmental impacts occur:

- Entrainment ~ smaller organisms such as larvae and eggs are drawn through the cooling system and destroyed
- Impingement ~ larger organisms are trapped against the intake screens
- Thermal effects ~ the release of heated water affects the plants and animals populations in the vicinity

Intensive monitoring over the years of operation (since 1976) has generated tremendous amounts of evidence that the OTC system has resulted in significant degradation to the marine environment in Diablo Cove.

According to the EPA (7/09), "These OTC systems, many of which have been in operation for 30 years or more, present a considerable and chronic stressor to the State's coastal aquatic ecosystems by reducing important fisheries and contributing to the overall degradation of the State's marine and estuarine environments."

In 1972, Congress passed the Clean Water Act. While it focuses mostly on the discharge of pollution, the law also regulates cooling water intake structures. It requires the EPA to issue regulations requiring "best technology available for minimizing adverse environmental impact."

In 2001, the EPA ordered new plants to use "closed-cycle cooling" where water withdrawn from a natural body of water is circulated through condensers to remove the plant's heat, then circulated through cooling towers, and then sent back to the condensers. This closed-cycle cooling system reduces total water withdrawals by about 95%, resulting in a corresponding reduction in the impact on fish and other species. The EPA, however, has not mandated existing power plants to modernize and phase out once-through cooling.

In 2010, the California State Water Resources Control Board adopted a policy requiring power plants to comply with the federal Clean Water Act. Power plants have choices regarding compliance.

1. Cooling Towers: The use of cooling towers is the most effective method for reducing the impacts of OTC. It is, however, costly. They, too, would cause their own severe environmental impacts because the installation of the towers would require major excavation of a mountain behind Diablo Canyon.
2. Modification: One alternative is to modify the existing OTC system to include additional mesh screens and to bury the intake pipes offshore to reduce the number of larvae that enter the system.
3. Mitigation: Another option is to offset environmental damage by implementing mitigation projects. These projects would strive to increase the overall health and productivity of the ocean (development of rocky reefs, marine reserves to enhance fish stocks and increase biodiversity, etc.
4. Plant Closure: The immediate and permanent closure of Diablo Canyon would end the problems of impingement, entrainment, and thermal pollution.

Resolution is pending. SLOMFP asserts that the cumulative impacts on the marine environment from years of operation of Diablo Canyon Nuclear Power Plant under current licenses is unacceptable; this is a site-specific environmental issue that must be rectified.

There is a risk of a devastating tsunami at Diablo Canyon.

PG&E and the NRC claim that the tsunami threat is baseless because of the 85 foot cliff and the placement of the snorkels, but that is a site-specific issue which needs greater examination.

In a report which the NRC held private for 11 years, *A preliminary Numerical Study of the Hazard for Local Landslide Tsunami Scenarios at the Diablo Canyon Site in Central California*, published November 22, 2003, the investigator Dr. R.T. Sewell concluded that, "the existing tsunami design bases and perceptions of tsunami risk for the Diablo Canyon site no longer reflect modern scientific understanding and methods; there is compelling evidence to suggest that the tsunami threat may be considerably more significant than held in these existing bases and perceptions; and correspondingly, such existing bases and perceptions no longer appear adequate."

Dr. Sewell made 6 recommendations in his concluding comments, one of them being that the licensee of the Diablo Canyon site "justify and/or re-evaluate the tsunami design bases and perform a state-of-the-art assessment of tsunami hazard and risk (including DCP and DC-ISFSI) within the umbrella of its existing long-term seismic program (LTSP)."

When combining the effects of tsunami, tide, storm surge, and winds, all of Sewell's 13 postulated scenarios in his investigation produced waves that go beyond Diablo Canyon's design basis. In fact, all 13 scenarios produced wave heights that could impact the seawater intake.

<http://pbadupws.nrc.gov/docs/ML1429/ML14293A559.pdf>

Have we learned from Fukushima?

An NRC task force provided studied the events of the Fukushima accident and formulated recommendations to enhance U.S. reactor safety. ALL of these recommendations must be implemented before considering license renewal at Diablo Canyon nuclear facility.

<http://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard/priorities.html>

There are safety issues with the Holtec dry cask canisters being used at Diablo Canyon.

With no permanent repository on the horizon, "interim" storage will for all intents and purposes become permanent at the Diablo Canyon site. There are numerous concerns about the qualifications of the casks used at Diablo Canyon - both for storage and eventually, possibly, for transportation by truck and rail through major cities.

The casks have not been designed for extended use.

The dry storage canisters at Diablo Canyon are just 5/8" thick stainless steel. In other countries, such as Germany, 14" to 20" thick ductile cast iron canisters/casks are used, such as the CASTOR V/19.

The NRC claims fuel must be reloaded into new canisters every 100 years, unless there is a permanent repository. However, there is data that indicates a much sooner potential failure rate:

- NRC metallurgist Darrell Dunn claims that cracks of the thin stainless steel spent fuel containers may initiate in 16 years.
- Vendor claims of longer storage times are not supported by data.

There is not an effective method for monitoring the casks for cracks.

The nuclear industry has not been routinely inspecting installed dry storage canisters and has yet to develop a method to inspect them for cracks. A 2014 inspection of only two Diablo Canisters ranging from just 2 to 3.5 years in service found sea salt crystals on one canister that had only been loaded for two years. Sea salts and low temperatures are needed to initiate the stress corrosion cracking — this one obviously much sooner than the NRC expected.

Dry cask nuclear waste storage at Diablo Canyon is troubling. The salt fog environment of the coast has corrosive effects on metal – which could lead to failure and radiation release. This is a site-specific issue facing Diablo Canyon nuclear facility.

<http://energy.gov/sites/prod/files/2013/12/f5/INLFacilitiesDry%20StorHBUFViabilRptR1b.pdf>

<http://www.nwtrb.gov/meetings/2014/aug/boyle.pdf>

There are problems with leaks in dry casks.

Below are some remarks made by Dr. Kris Singh, CEO of Holtec International, the manufacturer of dry casks at Diablo Canyon. These quotes are from a video made October 14, 2014 at a public meeting of Southern California Edison in San Juan Capistrano and available at

<https://www.youtube.com/watch?v=euaFZt0YPi4&feature=youtu.be>

*"...It is not practical to repair a canister if it were damaged... if that canister were to develop a leak, let's be realistic; you have to find it, that crack, where it might be, and then find the means to repair it. **You will have millions of curies of radioactivity coming out of the canister**; we think it's not a path forward...*

*and...**A canister that develops a microscopic crack (all it takes is a microscopic crack to get the release), to precisely locate it... And then if you try to repair it (remotely by welding)...the problem with that is you create a rough surface, which becomes a new creation site for corrosion down the road. I don't advocate repairing the canister.**"*

Instead, Dr. Singh states

*...**"you can easily isolate that canister in a cask that keeps it cool and basically you have provided the next confinement boundary, you're not relying on the canister. So that is the practical way to deal with it and that's the way we advocate for our clients."***

However, there are many problems with Dr. Singh's solution of putting cracked and leaking canisters inside [transport] casks.

- **There are no NRC approved Holtec specifications** that address Dr. Singh's solution of using the "Russian doll" approach of putting a cracked canister inside a [transport] cask.
- **NRC requirements for transport casks require the interior canister to be intact for transport.** This NRC requirement provides some level of redundancy in case the outer cask fails. Does this mean this leaking canister can never safely be moved? Who will allow this to be transported through their communities? How stable is the fuel inside a cracked canister? And where will the cracked canister go? There is no repository for high level radioactive waste in the US.
- **What is the seismic rating of a cracked canister** (even if it has not yet cracked all the way through)? The NRC has no seismic rating for a cracked canister, but plans to allow up to a 75% crack. There is no existing technology that can currently inspect for corrosion or cracks. The NRC is allowing the nuclear industry 5 years to develop it. It is likely to be inadequate due to the requirement the canisters must be inspected while in the concrete overpacks.
- **What is the cost for the transport casks** that will be needed for storage? Will they be on-site? Where is this addressed? Transport casks are intended to be reusable because of their higher cost. How and where will they be stored and secured on-site?
- **How will the leaking canisters be handled** by the Department of Energy at the receiving end of the transport? The DOE currently requires fuel to be retrievable from the canister.

A better solution is to use casks that are not susceptible to cracks, that can be inspected and repaired and that have early warning monitoring systems that send out an alert **before** radiation leaks into the environment.