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SACRAMENTO, CA 95814
TEL (916) 651-4107
FAX (916) 642-8979

Life After SONGS: An Update on Decommissioning Plans

This is the third in a series of three informational hearings on the closure of the San Onofre Nuclear Generation Station (SONGS). The first hearing, in June 2013, focused on ensuring electric grid stability and reliability. The second hearing, in August 2013, generally addressed the decommissioning process, including the various obligations of ratepayers, the owner/operator (Southern California Edison, SCE) and state and federal regulators.

The primary goal of this hearing is to consider drafts of documents that SCE is required to submit to the Nuclear Regulatory Commission (NRC) within two years of shut-down: the Environmental Impact Evaluation (EIE), Decommissioning Cost Estimate (DCE), Irradiated Fuel Management Plan (IFMP) and, most importantly, the Post-Shutdown Decommissioning Activities Report (PSDAR). The PSDAR contains a description of, and schedule for, the planned decommissioning activities as well as justification for concluding that the environmental impacts of decommissioning will be “small” – a technical designation set forth in the decommissioning Generic Environmental Impact Statement (GEIS). An additional goal of this hearing is to consider the activities and intended outcomes of the newly established SONGS Community Engagement Panel (CEP), which serves as a conduit for information between SCE and local communities. Finally, this hearing will serve as an update on emergency preparedness, seismic safety, and the environmental impacts of once-through cooling associated with SONGS.

BACKGROUND

SONGS is located 4 miles south of San Clemente between I-5 and the Pacific Ocean, within the boundaries of the U.S. Marine Corps Base Camp Pendleton. The property on which the station is built is subject to an easement from the United States Government through the U. S. Navy. The nearest privately owned land is approximately 2.5 miles from the site. It is jointly owned by Southern California Edison (SCE, 78.2%), San Diego Gas & Electric (SDG&E, 20%), and the City of Riverside (Riverside, 1.8%). The City of Anaheim was previously an owner and, therefore, bears some financial burden for decommissioning even though it was not an owner at the time Units 2 and 3 were shut down.

SONGS consists of three nuclear-powered electric generator units. Unit 1 was commissioned in 1968. The reactor became less efficient and cost-effective as it aged, leading to its shutdown in 1992. SCE commenced dismantlement in 2000 and the aboveground structures have been removed. The reactor vessel will remain onsite until the decommissioning activities for Units 2



and 3 allow for its removal. The fuel remains stored onsite in the independent spent fuel storage installation (ISFSI), which will be expanded to store spent fuel from Units 2 and 3. A plan for terminating the license of Unit 1 will be addressed in the plan for decommissioning Units 2 and 3 (see below).

Units 2 and 3 started operating in 1983 and 1984, respectively, and together provided 2,200 megawatts (MW) of power capacity until they were prematurely retired in January 2012 due to damage caused by faulty steam tubes and economic considerations related to restarting the units. For a detailed explanation, please see SCE's white paper¹ and this committee's background documents for the SONGS hearings in 2013.²

Nuclear power plants that no longer produce power still pose a risk to the public, because radioactive material is stored on-site. As such, they undergo an extensive process of decommissioning intended to remove radioactive materials, deconstruct the reactors, and potentially remove the facilities from the site. The NRC regulates the licenses for nuclear materials in the U.S. and oversees the process of decommissioning from a nuclear safety perspective. The NRC process is focused on the disposal and/or containment of radioactive materials and is completed with the license termination and a release of the property for unrestricted use. NRC regulations do not permit the release of property until the radiation that is distinguishable from background radiation is 25 millirems (mrem) or lower per year³. Background radiation from air and food sources make up about 240 mrem of yearly exposure.⁴

The complex, multi-phase transition from operation to license termination is not unfamiliar to the state or the nuclear industry (see below). SONGS Units 2 and 3 represent two of five power reactors in California currently undergoing decommissioning, with the other three being SONGS Unit 1 (co-located in San Clemente), Humboldt Bay (Eureka), and Vallecitos (Sunol). The license termination plan for Rancho Seco, a plant formerly operated by Sacramento Municipal Utilities District (SMUD), was approved in 2007 and most of the site was released for unrestricted use in 2009; for more information, see Appendix B. Moreover, twelve other power reactors across the country also are undergoing decommissioning.⁵ Decommissioning is required by the NRC to be completed within 60 years of permanent shut down operation. One plant is already 51 years into this process. Hence the draft documents under consideration in this hearing have been informed by lessons learned at other plants, guidance from the NRC, as well as SONGS-specific knowledge gained during siting and operation.

¹ http://www.songscommunity.com/docs/Economic_Considerations_WhitePaper_Final.pdf

² <http://seuc.senate.ca.gov/20132014informationalhearings>

³ 10 CFR 20.1402

⁴ <http://www.epa.gov/radiation/understand/calculate.html>

⁵ <http://www.nrc.gov/info-finder/decommissioning/power-reactor/>

Decommissioning Status for Shutdown NRC-Licensed Power Reactors
 [Current as of June 2013]



RECAP OF 2013 SONGS HEARINGS

The committee’s July 10, 2013 hearing considered how to maintain grid stability and reliability while advancing the state’s greenhouse gas emissions reduction goals. Discussions about mid- and long-term procurement are ongoing and a combination of strategies – e.g., energy efficiency, demand response, solar photovoltaic, combined heat and power, fuel cells, energy storage, conventional power – is being pursued.

The first hearing also considered impacts on the SONGS workforce. SCE reports that the workforce will be reduced from 1,500 (while operating) to 462 (current) to 400⁶ (projected). Of those laid-off, 8 to 10 percent obtained other positions within SCE. The remaining ~90 percent were offered a severance package in accordance with SCE's severance plan. Some former SCE employees have since found work at other nuclear utilities (e.g., Diablo Canyon, Palo Verde), some administrative staff have found positions locally, and others remain out of work.

The committee’s August 8, 2013 hearing provided a general overview of the decommissioning process. As noted then, parties responsible for a nuclear power plant must submit a Certification of Permanent Cessation of Power Operations to the NRC within 30 days of deciding to permanently shut down that plant. SCE, as the operator and agent for the other co-owners,

⁶ SCE states that 300 of those 400 personnel will be security-related, which would enable the plant to meet its emergency response obligations and comply with NRC regulations.

submitted this document on June 12, 2013.⁷ After SCE certified on July 22, 2013 that radioactive fuel had been permanently removed from the reactor vessel, the NRC modified⁸ SCE's license such that SCE is no longer authorized to operate a nuclear reactor at the site. The next step in decommissioning Units 2 and 3 is the development, and submission to the NRC, of a Post-Shutdown Decommissioning Activities Report and companion documents.

SINCE THE LAST HEARING...

During the last year, SCE has conducted extensive planning and made efforts, collected at SONGScommunity.com, to engage local communities. To guide the long and complex process of decommissioning Units 2 and 3, SCE has established⁹ the following core principles:

- Safety – move the power plant's spent fuel, now cooling in pools, into dry cask storage as quickly and carefully as possible;
- Stewardship – leave the community better off; and
- Engagement – provide for an open and transparent process that ensures key interests are heard and included.

NRC REQUIRED DOCUMENTS

Post-Shutdown Decommissioning Activities Report (PSDAR) – The PSDAR is SCE's description of planned decommissioning activities, schedule for the completion of these activities, expected costs, and general discussion of environmental impacts. The PSDAR is reviewed by the NRC, but approval is not required; 90 days after submittal an NRC-organized public meeting is held near the plant and major decommissioning activities can commence. Note that the NRC does not regulate decommissioning activities except to ensure safety procedures are followed and to monitor radiation levels.

The NRC-approved options for decommissioning power reactor facilities are as follows:

- ENTOMB – radioactive structures, systems, and components are encased a structurally long-lived substance, such as concrete;
- SAFSTOR – radioactive structures, systems, and components are placed in a safe, stable condition; and
- DECON – radioactive structures, systems, and components are promptly removed.

With input from various stakeholders and given technical and economic considerations onsite, SCE has selected DECON to decommission SONGS Units 2 and 3.¹⁰ They propose a 20 year plan, which is substantially shorter than the 60 years allowed for decommissioning by the NRC.

⁷ <http://www.nrc.gov/info-finder/reactor/songs/permanent-cessation-letter.pdf>

⁸ From "operation" status to "possession" status

⁹ <http://www.songscommunity.com/docs/decommissioningprinciples.pdf>

¹⁰ For context, no nuclear power plant has selected the ENTOM option for decommissioning. Seventeen currently are in SAFSTOR or DECON. 100 others are in operation or being licensed.

The PSDAR notes SCE planned compliance with various programs and requirements, including those of the:

- Offsite Dose Control Manual;
- Radiological Environmental Monitoring Program;
- Federal, state, and local groundwater protection requirements;
- California State Lands Commission easement terms; and
- California Coastal Commission requirements.

Issues for the committee to consider:

- *What is the lead agency responsible for overseeing compliance?*
- *Given that the site is on federally owned land, what is the state's jurisdiction, if any?*

Environmental Impact Evaluation (EIE) – This document is summarized in the PSDAR, but not submitted to the NRC for review or approval. The objective is to determine, based on preexisting generic and SONGS-specific environmental impact statements (EISs) and post-construction environmental reports, whether the decommissioning activities outlined in the PSDAR will have small, moderate, or large impacts.

SCE worked with an independent contractor to complete the decommissioning EIE for SONGS Units 2 and 3. The following assumptions about decommissioning activities were made:

- Ocean conduits are left in place;
- No blasting occurs;
- Building/zoning designations are unchanged;
- No drinking water wells are in the “area of SONGS”;
- Pumping of groundwater from excavated areas as part of structure removal is limited to a 1000 ft. radius from site;
- Excavations are limited to the area excavated during original construction; and
- Diesel engines used to minimize air quality impacts.

Given these assumptions, SCE concluded that all key impacts assessed are “small,” meaning that they are “not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.” The “small” designation avoids additional environmental review(s). SCE states that of the eighteen environmental impacts assessed, dust, noise, and (truck and rail) traffic may well be the most significant.

Issues for the committee to consider:

- *What local, state, or federal entity is verifying SCE's determinations that all impacts are “small” and continue to be “small” as decommissioning proceeds?*
- *Why is leaving in place the ocean conduits not considered to be “detectable”?*
- *What is considered the “area of SONGS”?*
- *Can air quality impacts be mitigated by means cleaner than diesel engines?*
- *It is unclear what recourse is available should any of the aforementioned assumptions not be met. For example, if the decommissioning plan is revised to include the use of blasting, would a new decommissioning EIE be done?*
- *When will radioactive waste begin to be transported offsite?*

- *What is the projected frequency of these shipments, and what routes will they take?*
- *How will SCE integrate input from the community in making these decisions?*

Decommissioning Cost Estimate (DCE) – Nuclear power plant owners are required by the NRC to collect funds while the plant is operating to cover activities related to the radioactive decontamination of the plant post-shutdown.

SCE estimates that the total cost to decommission San Onofre Units 2 and 3 is \$4.41 billion. To date, \$3.96 billion has been collected from ratepayers of the utility co-owners. SCE states that it does not plan on needing further contributions. The difference between the two figures is expected to be made up by growth in the funds between now and when activities commence. Mellon Bank N.A. acts as the trustee for SCE and SDG&E Decommissioning Trusts by providing custody, record keeping, accounting, taxation, and reporting services on behalf of the trusts.

A monthly billing process will trigger the movement of funds from each co-owner's Trust to SCE's decommissioning account, which will be used to fund current-period decommissioning activities.

In previous plant decommissioning programs, cost estimates increased over time. For example, in 1991, cost estimates of the Rancho Seco decommissioning were \$281 million. Subsequent estimates increased, and in 2009, costs were estimated to be \$503.9 million. A portion of the total Rancho Seco cost is due to activities that are not considered "decommissioning activities" by the NRC, including non-radiological dismantlement and spent fuel storage. Costs of these activities add up to \$132.5 million and are dominated by spent fuel storage at the Rancho Seco Independent Spent Fuel Storage Installation (ISFSI).¹ Similarly, the Humboldt Bay costs of decommissioning were initially estimated at \$114.8 million in 1986, but had escalated to \$494.3 million by 2006.¹ While both of these estimates are smaller than the estimated amount for SONGS decommissioning, it is important to note that SONGS had significantly more generation capacity than either Humboldt Bay or Rancho Seco.

Issues for the committee to consider:

- *Are the funds sufficient for dismantling all infrastructure, not only that which is radioactively contaminated?*
- *Given that changes in the irradiated fuel management plan are possible, how will the Decommissioning Cost Estimate be revised? Who will independently verify the new estimate? Who will foot the higher bill, or will funds for restoration be reduced?*
- *How will SCE integrate input from the community about how the landscape is restored? If additional restoration (beyond SCE's plan) is requested, how will it be funded?*

Irradiated Fuel Management Plan (IFMP) – Pursuant to 10 CFR 50.54(bb), owner/operators are required to submit a plan for the "interim" management of irradiated fuel until possession of the fuel is transferred to the U.S. Department of Energy (USDOE) for its ultimate disposal. Think: Yucca Mountain. Specifically, the IFMP must identify the details, schedules, and costs of spent fuel management activities – e.g., salary for staff and maintenance costs over many decades – along with license termination and site restoration activities and costs.

A total of 1,726 irradiated fuel assemblies have been generated in SONGS Unit 2 and 1,734 irradiated fuel assemblies have been generated in SONGS Unit 3, for a total of 3,460. At present, 792 SONGS Units 2 and 3 assemblies have been transferred to the ISFSI. SCE proposes to move, starting in 2017 and ending in 2019, the remaining 2,668 assemblies from spent fuel pools (wet storage) to casks (dry storage) at the ISFSI. SCE proposed to isolate spent fuel pools from their normal support systems and replace them with stand-alone cooling and filtration units. Doing so, they state, will facilitate earlier system abandonment and parallel decommissioning activities.

One component of the aforementioned schedule is a year by which SCE expects the USDOE will begin accepting spent fuel from SONGS. In this IFMP, SCE assumes that that time will be 2024, and that transfer to the federal government will be complete by 2049. These two assumptions are important because they guide the decommissioning cost estimate insofar as more money will be required for more anticipated years of storage. SCE notes that there are adequate funds to cover all aspects of irradiated fuel management, as required by the NRC.

NRC reviews the document for completeness, technical accuracy, and then issues a Safety Evaluation Report. As a living document, the IFMP can be revised and updated as conditions onsite change during the course of decommissioning.

Issue for the committee to consider:

- *What is SCE's back-up plan if the 2024 and 2049 benchmarks are delayed?*

License Termination Plan (LTP) and Site Restoration – SCE must file a License Termination Plan (LTP) with the NRC two years before license termination, outlining remaining decommissioning activities and modifying the license footprint to the ISFSI site for long-term storage of spent fuel. SCE proposes that that time will come for SONGS 18 years from now, in 2032.

The LTP is subject to NRC approval, unlike the PSDAR. After the license is terminated, the NRC may release the property for unrestricted use, meaning it may be used for any purpose. The property will not be released unless radiation levels are below NRC's '25 mrem per year' standard.

Apart from meeting the radiological standard, noted above, the site may be restored to a non-industrial "greenfield" condition. The plant operators may decide, either at the direction of a state entity or upon agreement with land owners or community stakeholders, to dismantle facilities for non-radiological reasons. Doing so is not regulated by any federal agency. Dismantlement may entail anything from minimal deconstruction to complete "green-fielding". The NRC reports that some facilities across the US have been "green-fielded", meaning that buildings except the ISFSI have been removed and the site has been landscaped to seem similar to the surrounding land.

SCE, in consultation with the land owners (US Marine Corps Base Camp Pendleton), is planning to green-field SONGS in addition to meeting radiological standards established by the NRC to allow it to be released for "unrestricted use."

Issue for the committee to consider:

- *What are SCE and the land owner's scientific, recreational, and/or aesthetic goals for restoring the site to a green-field?*
- *How will community input be integrated into developing these goals?*

COMMUNITY ENGAGEMENT PANEL

Other nuclear power plants undergoing decommissioning have convened, or closely worked with independent, community groups. While the bodies have different names, e.g. community advisory board (CAB), common to most is a focus on open, multi-way communication as opposed to oversight to policy change.

The SONGS Community Engagement Panel (CEP)¹¹ does not provide recommendations, criticisms, or advocate for changes in policies or practices. Instead, it is a volunteer, non-regulatory, non-voting body intended to enhance and foster communication, public involvement, and education on SONGS decommissioning issues and activities. Quarterly public meetings of the 18-member body are chaired by Dr. David Victor, professor and director of the Laboratory on International Law and Regulation at the University of California, San Diego. The Honorable Tim Brown, Mayor of San Clemente, serves as Vice Chair and Mr. Dan Stetson, President/CEO of The Ocean Institute, serves as Secretary. Other members represent legislative, business, and community groups and were selected to reflect the diverse viewpoints of those in proximity to SONGS. Each member of the CEP will serve a two-year term; membership is renewable up to a maximum of six years.

In a July 15, 2014 NRC hearing in Washington, Chairman Victor opined that the CEP's "success, value so far" has been documenting every issue that comes up, what happens in public discussions, and providing links to resources that show how the co-owners have responded. He mentioned that the co-owners have been "enormously responsive to these questions that get raised, and I think that has been quite valuable". He also noted that since the co-owners convened the CEP themselves, they have a vested interest in its success, effectiveness, and efficiency.

In the same hearing, Chairman Victor requested guidance from NRC staff and community groups affiliated with other decommissioning nuclear power plants about what points in the decommissioning process the SONGS CEP can have the greatest effect – for identifying those opportunities "will be critical to maintaining the essentially volunteer institution's momentum". It was suggested that, in addition to facilitating communication between the utility and the community, specific opportunities for impact include the selection of dry casks, and the development of a spent fuel management plan that protects the interests of ratepayers, who funded the Decommissioning Trust Fund.

At the July 15, 2014 NRC hearing, Chairman Victor and other witnesses expressed concern that the NRC lacks a strategic framework for decommissioning, including guidance about what steps in the transition from operations to license termination are most important, and what steps are standardized vs. customizable to a particular plant. Witnesses called for an "integrated, risk-informed rulemaking with a stakeholder engagement process" in lieu of the current situation that

¹¹ http://www.songscommunity.com/docs/SONGS_Decommissioning_CEP_Charter.pdf

includes “gaps” and where “things of necessity are being done on an ad hoc basis [by license exemption] rather than by rule”.

The process is largely undefined because regulations were designed for operating plants and therefore may not be appropriate to plants undergoing defueling or decommissioning. Indeed, NRC Chairman MacFarlane admitted a “tendency to ignore the back end of the fuel cycle because it doesn’t make money. This reflects... where we are as a nation with respect to the final disposition for spent nuclear fuel.” In response, the NRC explained that their regulations are performance-based rather than specifying intermediate steps prescriptively. NRC approval is not needed for any part of decommissioning, but plant owners can be fined and required to revise their plan.

Issues for the committee to consider:

- *What feedback can be shared about the SONGS-2 & 3 PSDAR and related documents?*
- *Given that the co-owners can commence major decommissioning activities 90 days after submitting their plan to the NRC (without the need for approval from the federal regulator), what steps is the CEP taking to ensure community buy-in before activity commences?*
- *Has the CEP sought and/or received advice from community groups affiliated with other decommissioning nuclear power plants?*
- *What are the CEP’s objectives for its upcoming public meetings and workshops?*
- *Do the co-owners intend to continue the CEP beyond its initial two-year term?*

EMERGENCY PLANNING AND PREPAREDNESS

Federal regulations require nuclear power plants, surrounding counties, and states to have federally tested and approved emergency response plans. The NRC is responsible for the regulatory application of these guidelines at the nuclear power plant, which is referred to as “onsite”. The Federal Emergency Management Agency is responsible for ensuring adherence to emergency planning and exercise requirements by emergency response organizations outside of the power plant boundaries, which is referred to as “offsite”. Radiation releases are monitored and controlled by Environmental Protection Agency guidelines to keep the public and emergency responders safe.

SONGS co-owners must continue to fund the Interjurisdictional Planning Committee (IPC) and the State Nuclear Power Special Assessment Fund until AB 292 (Blakeslee, Chapter 492, Statutes of 2007) sunsets on July 1, 2019. For state fiscal year 2014-2015, they paid \$2,781,000 for emergency services support for SONGS through the California Office of Emergency Services. With this support, the California Office of Emergency Services - Radiation Preparedness Unit (CalOES RPU), the IPC, local emergency responders, and state agencies plan and participate annually in full-scale drills and exercises, which are evaluated by FEMA and reported to the public. CalOES RPU staff have commended the SONGS co-owners for maintaining an effective and collaborative relationship with the local and state offsite agencies which, staff say, results in extremely strong emergency management for the region.

Under AB 292, SCE currently is required to perform all of the following:

- a) Have a response organization that can be integrated with federal, state, and local government emergency response resources during a radiological accident;

- b) Develop and maintain radiological emergency preparedness and response plans in coordination with state and local government; and
- c) Have the primary responsibility for planning and implementing onsite emergency measures by:
 - (1) Performing accident assessments;
 - (2) Preparing public protective action recommendations for decision makers during the plume emergency phase;
 - (3) Providing information to the appropriate state and local government in support of their independent assessment of offsite radiological conditions relevant to protective action decisions during the plume emergency phase;
 - (4) Coordinating with state and local governments in maintaining nuclear power plant public education information; and
 - (5) Supporting state and local government in nuclear power plant planning, training, drills and exercises, and emergency preparedness efforts.

Apart from state law – and recognizing the significantly reduced risk associated with the plant being shut down as opposed to operating plus the tremendous commitment of personnel and financial resources to maintain the above activities – SCE has applied to the NRC for several emergency preparedness exemptions¹². Almost all nuclear power plant owner/operators seek emergency preparedness exemptions post-shutdown, arguing, usually successfully, that it is no longer realistic or cost-effective to continue emergency preparedness requirements that were designed for operating plants. The NRC has acknowledged receipt of SCE's requests, but a decision will not likely come for a year, given the in-depth review needed and the fact that three other nuclear power plants submitted their requests first. If exemptions are granted, potential changes include a reduction in staff, the combination of early-warning alarm systems, and the suspension of security operations in severe weather. At that time, the co-owners will retrain staff to implement the new emergency plan(s).

Issues for the committee to consider:

- *What data or other information were submitted to the NRC to justify the exemptions?*
- *Are emergency planning and preparedness efforts realistic and risk-based?*
- *If the NRC grants SCE exemptions will the Special Assessment Fund remain solvent?*
- *How will efforts shift from focusing on plume events to planning and preparing for emergencies around the spent fuels pools and dry casks?*

SAFETY INSPECTIONS

The NRC typically maintains a full-time resident inspector onsite during part of the first year after permanent shutdown. This inspector oversees the plant's transition by verifying that the owner/operator (SCE) complies with terms of the license, technical specifications, and procedures.

During the first year after shutdown, the NRC resident inspection staff is supplemented with special inspection expertise, as needed, which may include security, emergency response, health physics, environmental monitoring, and engineering. NRC inspections continue throughout decommissioning until SCE demonstrates that the site meets the license termination

¹² <http://pbadupws.nrc.gov/docs/ML1409/ML14092A332.pdf>

requirements.¹³ Specific oversight activities that NRC staff will be involved in throughout the decommissioning process are online and available to the public.

SEISMIC STUDIES

Assembly Bill 1632 (Blakeslee, Statutes of 2006, Chapter 722) directed the CEC to assess the vulnerability of the state's operating nuclear power plants to a major seismic event as well as plant aging, potential impacts of disruption, impacts of the accumulation of nuclear waste, and other policy issues. The AB 1632 report was a one-time assessment of these issues and was completed in 2008. In the report, the CEC recommended that SCE conduct 3-dimensional seismic studies and tsunami hazard studies. In early 2013, SCE initiated studies to determine the seismic vulnerability of SONGS.

The seismic studies previously deemed necessary (an initiated) assumed a plant in operation. Although a particularly large seismic event still could damage SONGS, seismic safety for a non-operating plant requires reconsideration. Accordingly, SCE has reduced the scope of its seismic activities to those that are required to fulfill NRC 50.54(f) requirements and/or are nearing completion. The status of the SONGS seismic projects is as follows:

Shallow Marine Surveys

- Low Energy Seafloor Sediment Sampling and Age Dating – cancelled;
- 2D Focused Fill-in Low Energy Geophysical Survey – completed, Spring 2014;
- Regional Low Energy Geophysical Survey – completed, Spring 2014;
- Bathymetry and Backscatter Survey – completed, Spring 2014; and
- 3D P-Cable Geophysical Survey – completed, Spring 2014

Data processing for these studies is in progress. Processed data are scheduled to be posted by October 31, 2014 on the public UT/Columbia Academic Marine Data Archive and at SONGScommunity.com.

Onshore Studies

- Deep 3D Geophysical Survey Project – cancelled;
- Paleoseismic Trenching Project – completed, December 2012; and
- Marine Terrace and Coastal Deformation Project – completed, September 2013

Historic Marine Geophysical Data Reanalysis Project – completed, Spring 2014

GPS Monitoring Project – completed, date unknown

NUREG-1738 Seismic Checklists (qualitative assessments) – in progress

High Energy 2D/3D Marine Acoustic Surveys – cancelled

¹³ <http://pbadupws.nrc.gov/docs/ML1330/ML13309B031.pdf>

Issue for the committee to consider:

- *Is this research plan adequate to ensure seismic safety?*
- *Which agencies have been consulted to answer that question?*

ONCE-THROUGH COOLING and ENVIRONMENTAL IMPACTS

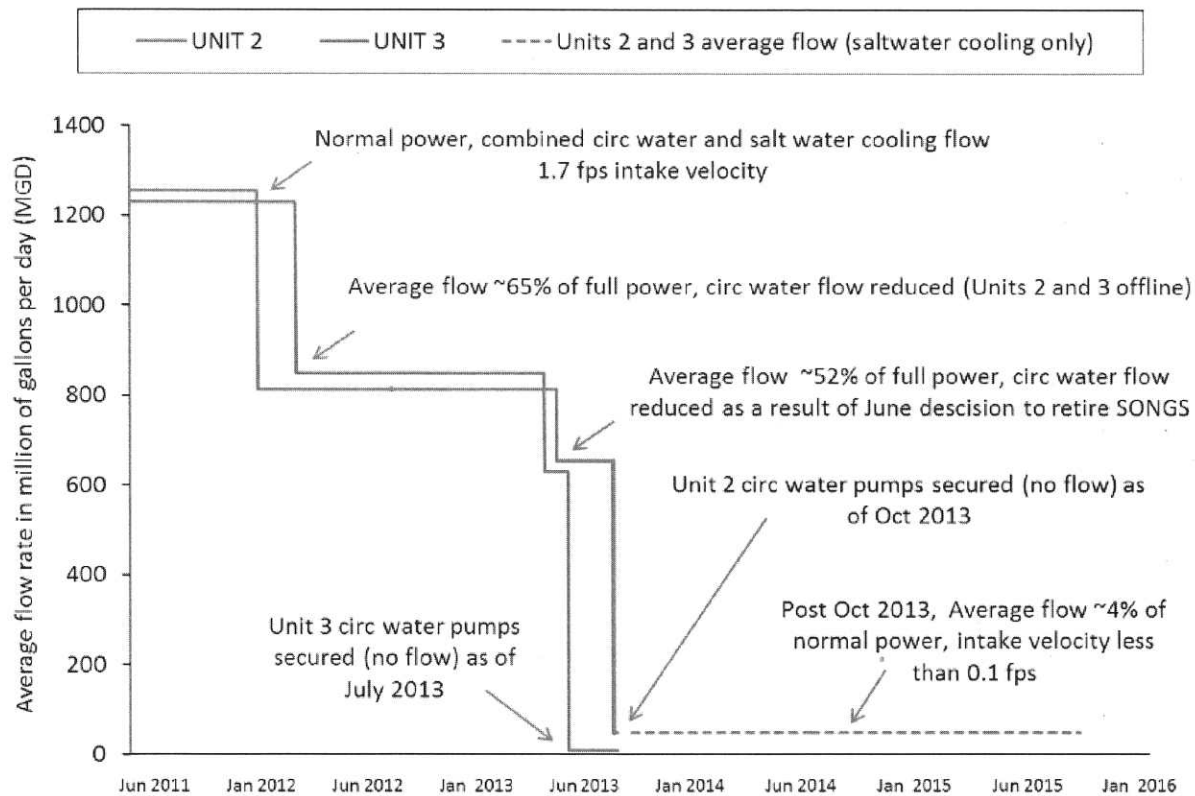
A once-through cooling (OTC) system draws in water from the ocean to absorb waste heat from generators and then pumps it back to the ocean. This method of cooling has been controversial because the intake brings in sea life along with water: larger plants and animals – kelp, seals, turtles, etc. – get caught on the intake screens (impingement) while small and microscopic organisms get carried through (entrainment) and are heated ~20 degrees. When the water and its contents are returned to the ocean, they physically alter the local environment and, potentially, have biological and ecological impacts on the organisms involved or adjacent. For example, a sea lion that is impinged on a screen, collected, and then returned to open water may not reproduce as much or live as long as one that never interacted with the power plant.

State regulations have established technology-based standards to implement federal Clean Water Act section 316(b)¹⁴ and reduce the harmful effects associated with cooling water intake structures on marine and estuarine life. The regulations require a minimum 93 percent reduction in intake flow rate and 0.5 feet per second (fps) through-screen intake velocity; SCE reports that SONGS is in compliance: it currently operates at 96 percent reduced intake flow rate and an intake velocity of 0.1 fps. See below for a timeline.

In other words, the volume of water now being pumped at SONGS for fuel cooling and wastewater discharge is about 98 million gallons per day, roughly 4 percent of the 2.2 billion gallons per day that was pumped during full operation. This is a dramatic reduction, but is still large in absolute terms – around 7 percent of all California Publicly Owned Treatment Works discharges based on 2005 data compiled by Heal the Bay.

¹⁴ http://www.waterboards.ca.gov/laws_regulations/docs/fedwaterpollutioncontrolact.pdf

Ocean Water Use and Flow Rate Reduction 2011-2013 and Projected Future Flows



Government and university-based monitoring projects¹⁵ have documented the mortality of various marine mammals, turtles, and larval fish associated with OTC at SONGS. Scientists currently are monitoring the mitigation process but, at this time, there are not studies being done to monitor marine life, or impacts on marine or estuarine ecology.

Scientists predict that the substantial reduction in flows will have positive effects on the physical environment and ecological communities. However, they strongly recommend monitoring programs to test this prediction.

Issues for the committee to consider:

- *How will SCE determine whether ongoing mitigation and monitoring practices are necessary?*

*Prepared by: Alexis C. Erwin, Ph.D.
Science and Technology Policy Fellow
Senate Energy, Utilities, and Communications Committee*

¹⁵ See <http://marinemitigation.msi.ucsb.edu/index.html> for one example.

Acknowledgements

Portions of this document were adapted from the websites of the U.S. Nuclear Regulatory Commission, the SONGS CEP, the background documents for the committee's hearings on SONGS in 2013, and several white papers, as referenced. The author thanks the scientists, technical experts, and emergency professionals who contributed their time and expertise.

Appendix A: Acronyms and Abbreviations

CalOES RPU – California Office of Emergency Services, Radiation Preparedness Unit
CEC – California Energy Commission
CEP – Community Engagement Panel
CPUC – California Public Utilities Commission
CWIS – Cooling Water Intake Structures
DECON – Plant is deconstructed and decontaminated
DCE – Decommissioning Cost Estimate
DTSC – Department of Toxic Substance Control
EIE – Environmental Impact Evaluation
ENTOMB – Plant is encased to allow for controlled radioactive decay
GEIS – Generic Environmental Impact Statement
IFMP – Irradiated Fuel Management Plan
IPC - Interjurisdictional Planning Committee
ISFSI – Independent Spent Fuel Storage Installation
LOED – Large Organism Exclusion Device
mrem – millirem (unit of radioactivity)
MW – Megawatt(s)
NRC – U.S. Nuclear Regulatory Commission
OTC – Once Through Cooling
PG&E – Pacific Gas & Electric
PSDAR – Post-Shutdown Decommissioning Activities Report
SACCWIS – Statewide Advisory Committee on Cooling Water Intake Structures
SAFSTOR – Plant is maintained in a stable condition until it is later decontaminated
SCE – Southern California Edison
SDG&E – San Diego Gas & Electric
SMUD - Sacramento Municipal Utilities District
SONGS – San Onofre Nuclear Generation Station
SRE – Santa Susana Sodium Reactor Experiment
USDOE – U.S. Department of Energy

Appendix B: Other Nuclear Reactors in California

The **Santa Susana Sodium Reactor Experiment** (SRE) was a small sodium-cooled experimental reactor built by Southern California Edison and Atomics International at the Santa Susana Field Laboratory, near Moorpark in Ventura County. It came on line in April 1957, began feeding electricity to the grid on July 12, 1957, and closed February 1964. This reactor used sodium rather than water as a coolant and produced a maximum of about 7.5 to 20 megawatts (electric). It was considered as the country's first civilian nuclear plant and the first "commercial" nuclear power plant to provide electricity to the public by powering the near-by city of Moorpark in 1957. On July 26, 1959, the SRE suffered a partial core meltdown. Ten of 43 fuel assemblies were damaged due to lack of heat transfer and radioactive contamination was released.

The Santa Susana Field Laboratory served as a test facility for rockets, missiles, ammunition, and nuclear power. While clean up of various chemical and radioactive materials on the site progressed for years under various state and federal agencies, Senate Bill 990 (Kuehl, 2008) authorized the Department of Toxic Substance Control (DTSC) as the primary agency to oversee clean-up of the site. The DTSC reports that seven of 12 buildings have been demolished¹⁶, and NASA (a part owner of the site) reports that it plans to remove 500,000 cubic yards of contaminated soil from the site¹⁷. Recently, consumer groups and environmental activists have filed a lawsuit against the DTSC claiming the state allowed low-level radioactive waste to be illegally disposed of in landfills instead of licensed waste disposal sites. The lawsuit was filed August 5, 2013.

The **Vallecitos Nuclear Center** near Pleasanton, California, was jointly built by PG&E and General Electric Company and operated from 1957 to 1967. This was a small, 30 megawatt power plant. On October 19, 1957, Vallecitos connected to the electrical grid and became the first privately funded plant to supply power in megawatt amounts to the electric utility grid. The plant was shut down in December 1967. The plant is in SAFSTOR, and there are no plans for any significant dismantlement in the foreseeable future. All nuclear fuel has been removed from the site.

The 63 MW Boiling Water Reactor at the **Humboldt Bay Nuclear Power Plant** in Eureka was in operation by PG&E from August 1963 to July 1976. It was closed because the economics of a required seismic retrofit could not be justified following a moderate earthquake from a previously unknown fault just off the coast. It was permanently shut down July 2, 1976, and retired in 1985. The plant was then placed in SAFSTOR (with spent nuclear fuel rods stored in water pools on site) until anticipated full decommissioning in 2015. In December 2003, PG&E formally submitted a license application to the NRC for approval of a dry-cask Independent Spent Fuel Storage Installation (ISFSI) at the Humboldt Bay site. A license and a safety evaluation for the Humboldt Bay ISFSI were issued on November 17, 2005. The transfer of spent fuel from the fuel storage pool to the ISFSI was completed in December 2008, and limited decontamination and dismantlement of Humboldt Bay Unit 3 decommissioning commenced.¹⁸

¹⁶ http://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/upload/SantaSusanaStatement080613.pdf

¹⁷ http://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/upload/SSFL_D-EIS.pdf

¹⁸ <http://www.nrc.gov/info-finder/decommissioning/power-reactor/humboldt-bay-nuclear-power-plant-unit-3.html>

As part of the decommissioning process, a Community Advisory Board was formed in 1998 to act as an advisory panel and watchdog. The board was formed of experts and lay people from the community including residents, activists, and academics. The board has since engaged in dialog with both PG&E and the community at large over clean-up concerns.

Rancho Seco Nuclear Generating Station, owned by Sacramento Municipal Utilities District (SMUD), initially went critical on September 16, 1974, and began commercial operation on April 18, 1975. Incremental decommissioning of the power plant began in early 1997 after being shut down by public referendum in 1989 and placed in SAFSTOR in 1995. Incremental decommissioning involved performing some decommissioning activities earlier than 2008, as described in the originally approved Decommissioning Plan. However, based upon the lack of suitable waste disposal options, SMUD elected to store Class B and C radioactive waste in an interim onsite storage building until a suitable disposal facility becomes available. SMUD was granted a license for an on-site ISFSI in 2000 and subsequently transferred all spent fuel from pool storage to dry cask storage. The SMUD license termination plan was approved in 2007, and most of the site was released for unrestricted use in 2009.

The **Diablo Canyon Power Plant** is owned and operated by PG&E and is located on California's central coast near San Luis Obispo. The plant has two nuclear reactor units. Unit 1 was commissioned in 1985 and has a license expiration date of 2024. Unit 2 was commissioned in 1986 and has a license expiration date of 2025. The two units have power capacities of 1,122 MW and 1,118 MW, respectively.

PG&E applied for a license renewal from NRC to extend the operating life of the plant beyond its current 2024 and 2025 expiration. In proceedings before the CPUC¹⁹, PG&E estimated the cost of the license renewal process to be \$85 million and submitted a further license renewal feasibility study. In the study, PG&E performed an aging analysis and assessed the costs of seismic studies and ongoing operations and maintenance of the Diablo Canyon facility through the life of the proposed license renewal. PG&E further assessed costs of alternative replacement power and by comparison deemed Diablo Canyon to be a cost-effective investment.

At the direction of the CPUC, PG&E suspended the license renewal process in order to complete a seismic study of the Diablo Canyon region. This study was prompted by the CEC's AB 1632 report and is not a requirement of the NRC license renewal process. PG&E has collected a wealth of seismic data from on-shore and off-shore studies. In order to detect deep fault lines, PG&E proposed to use high-intensity sound blasts off-shore that would penetrate several miles of earth. This proposal was rejected by the California Coastal Commission, who cited concerns over the impact of such high-intensity sound on local marine wildlife. As a result, PG&E is using data collected from less impactful studies in order to analyze the fault network of the region.

On June 26, 2013, maintenance workers noticed a small leak while working within the containment dome. The leak was located on the weld between two pipes, and leaked 3 drops of boric acid water per minute. The plant was powered down in order to fix the leak, which took a week to complete. The power plant was restarted and reached full power on the morning of July 4, 2013.

¹⁹ CPUC A.1001022