

# **AB 1632 NUCLEAR POWER PLANT ASSESSMENT**

## **DRAFT STUDY PLAN**

*Prepared For:*  
**California Energy Commission**

*Prepared By:*  
**MRW & Associates, Inc.**

November 30, 2007  
Docket No. 07-AB-1632

# INTRODUCTION

California's two operating nuclear power plants, Diablo Canyon and the San Onofre Nuclear Generating Station (SONGS), contribute a significant portion of California's electricity supply.<sup>1</sup> However, these plants also pose risks to the state. Much of the risk arises because the plants are located in seismically active zones along California's central and southern coast and they generate spent nuclear fuel. The spent fuel is currently stored at the plant sites since the development of a federal waste disposal repository has been delayed.

California Assembly Bill 1632 (Blakeslee, Chapter 722, Statutes of 2006; Public Resources Code (PRC) 25303) directs the Energy Commission to compile and assess existing scientific studies (from experts in the subject areas) to determine the potential vulnerabilities of SONGS and Diablo Canyon to a major disruption due to a major seismic event or plant aging. AB 1632 also directs the Energy Commission to assess the impacts of such a disruption, to assess the costs and impacts from nuclear waste accumulating at these plants, and to evaluate other major issues related to the future role of these plants in the state's energy portfolio.

This document lays out for public review and comment an overall Study Plan for the Nuclear Power Plant Assessment required under AB 1632. The Study Plan details the topic areas to be covered, the scope of assessment for each topic, scientific studies to be reviewed, and a schedule for completing major components of the overall assessment.

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<sup>1</sup> The Palo Verde Nuclear Generating Station in Arizona, which is partially owned by several California utilities, also supplies nuclear power to the state.

## SCHEDULE AND WORK PRODUCTS

Two work products required by AB 1632 will set the schedule for the Nuclear Power Plant Assessment. The first of these is the Energy Commission's AB 1632 Report, which must be adopted by November 1, 2008. The second is the related chapter in the *2008 Integrated Energy Policy Report (IEPR) Update*, which is expected to be adopted in the last quarter of 2008. The project timeline and deliverables must support the preparation and completion of these reports.

Energy Commission staff and the Energy Commission's contractor will conduct the research and technical activities associated with the tasks outlined below. Each task will result in a preliminary assessment prepared by the contractor for review by Energy Commission staff and other reviewers and experts as appropriate. The separate task assessments will be finalized by the contractor after receiving and incorporating comments from Energy Commission staff. The contractor then will prepare a draft Consultant Report based on the task assessments. Comments on the draft Consultant Report will be incorporated into a revised draft Consultant Report. A draft Energy Commission Staff Report, building on the Consultant Report and Energy Commission staff work, will be released and a public workshop held to receive input. Following the workshop a proposed Energy Commission Report will be released and proposed for adoption by the full Commission in late October 2008.

Table 1 lays out the proposed schedule for research and technical activities and preparing the reports associated with the Nuclear Power Plant Assessment.

**Table 1: Proposed Schedule for the AB 1632 Nuclear Power Plant Assessment**

Public workshop on study plan	December 12, 2007
Begin research and technical tasks	January 2008
Release final study plan	January 2008
Provide preliminary assessments to Energy Commission	mid-March through early May
Release draft Consultant Report for public review	early June
Receive comments on draft Consultant Report	early July
Release Energy Commission AB 1632 draft Staff Report for public review	early August
Public workshop on Energy Commission AB 1632 draft Staff Report	mid-August
Release Energy Commission AB 1632 Final Report	end September
Commission adoption of AB 1632 Committee Report	October 22, 2008
2008 IEPR Update Report	4 <sup>th</sup> quarter 2008

# TECHNICAL TASKS

The following technical tasks will be completed to support the Nuclear Power Plant Assessment. These tasks were specified in AB 1632, which was codified in PRC sections 25303(a)(8)(A-D) and 23303(c). The task numbers presented here (beginning with Task 2), match the Energy Commission’s Request For Proposals (RFP) #150-07-101, “AB 1632 Nuclear Power Plant Assessment.”<sup>2</sup>

The task descriptions below identify the topic areas to be addressed and the scope of the assessment to be conducted for each task. Additionally, each task description includes a representative list of studies and documents from government agencies, industry, academia, and other experts that the contractor expects will be reviewed in the course of completing the AB 1632 assessment. These lists illustrate the types of documents that the contractor will review and are not intended to be comprehensive.

## Task 2: Seismic Vulnerability Assessment

In this task, the contractor will review studies that assess the vulnerability of Diablo Canyon and SONGS to a major disruption due to seismic or tsunami hazards and identify the cumulative damage that is anticipated at each plant as a result of earthquakes and tsunamis of various magnitudes. A team of experts from the California Department of Conservation, California Seismic Safety Commission, and California Coastal Commission will act in an advisory role to the contractor for this assessment.

### Scope of Seismic Vulnerability Assessment

Topic Areas	Scope of Assessment
1. Review Diablo Canyon and SONGS seismic studies	<ul style="list-style-type: none"><li><input type="checkbox"/> Compile and review existing studies to describe the tectonic/seismic setting for both plants based on an assessment of available evidence.</li><li><input type="checkbox"/> Review the scientific evidence related to the faults in the vicinity of each plant and consider information regarding the seismic setting of the surrounding area that might impact access to the plant and the transmission of power.</li><li><input type="checkbox"/> Compare existing studies based on date of analysis, methodology used, scope of the study, purpose, summary results, similarities and differences as compared to other studies, strengths and weaknesses, and implications for plant operation and local impacts.</li></ul>

<sup>2</sup> Task 1 in RFP #150-07-101 is the creation of this Study Plan.

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Topic Areas	Scope of Assessment
<p>2. Identify seismic vulnerabilities of Diablo Canyon's and SONGS' components</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify the seismic design of each major plant component and identify the major plant components that are vulnerable to damage during a major seismic event. Consider safety systems, nuclear steam supply systems, and balance of plant systems and structures. Identify the level of ground motion that could be sustained by key plant systems and structures and discuss the probability of these levels being exceeded.</li> <li><input type="checkbox"/> Summarize seismic design information, including design basis information, for each plant. Describe a safe shutdown earthquake and, if appropriate, the operating basis earthquake.</li> <li><input type="checkbox"/> Characterize systems, components, and structures according to distinct categories of "time to repair/replace."</li> <li><input type="checkbox"/> Identify and discuss the seismic vulnerability of the key plant systems and structures to a major disruption.</li> <li><input type="checkbox"/> Consider the vulnerability of transmission systems and access roadways, including evacuation routes, near the plant.</li> </ul>
<p>3. Assess the Vulnerability of Plants to Major Seismic/Tsunami-Caused Disruptions</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Create a table of critical components for each plant, their seismic capacities (fragilities), and their vulnerabilities to flood-induced damage. For each component in the table, determine the time to repair or replace the item for each ground motion level at the plant and for various-sized tsunamis. Describe the cumulative damage anticipated for a given seismic or tsunami event at the plant.</li> <li><input type="checkbox"/> Compile similar information for infrastructure components such as transmission facilities and access roadways.</li> </ul>
<p>4. Assess the Impact of the Hosgri Fault and Other Faults on the Diablo Canyon Site</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review the most current information available on the Hosgri Fault, as well as other faults in the area, with respect to their implications for causing an extended shutdown at Diablo Canyon.</li> <li><input type="checkbox"/> Summarize the current state of knowledge regarding these faults, compare this information with the current seismic risk reports available for Diablo Canyon, and determine whether assessments of the plant's vulnerabilities and seismic frequencies require updating or modification.</li> <li><input type="checkbox"/> Summarize the implications of thrust faulting as contrasted with slip/strike faulting on the vulnerabilities identified from available assessments. Particular attention will be paid to the influence of uncertainty in the determination of the displacement and the mean recurrence interval of significant seismic events.</li> </ul>
<p>5. Identify Seismic Vulnerability Assessment Update Triggers</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Discuss the specific types of new information that could trigger a requirement to update the seismic risk of the plants. Examples include the occurrence of new earthquakes or the discovery of new faults or fault characteristics.</li> <li><input type="checkbox"/> Assess the relative likelihood of the discovery of such new information.</li> </ul>

## **Representative List of Studies to be Reviewed for Seismic Vulnerability Assessment**

1. Diablo Canyon and SONGS seismic studies, such as the following:
  - a. Individual Plant Examination of External Events (IPEEE) reports for SONGS and Diablo Canyon
  - b. *The Application of Probabilistic Techniques to Seismic Risk Analysis of the Diablo Canyon Plant*, PG&E
  - c. *Diablo Canyon Seismic Response Utilizing Logic Models to Determine Plant Response to External Events*, PG&E
  - d. *Final Report of the Diablo Canyon Long-Term Seismic Program*, PG&E
  - e. *A Probabilistic Seismic Safety Assessment of the Diablo Canyon Nuclear Power Plant*, N.M. Newmark
  - f. *Seismic Evaluation for Postulated 7.5M Hosgri Earthquake, Units 1 and 2, Diablo Canyon Site*, Docket Nos. 50-275 and 50-323, NUREG Vols. 1 through 7, PG&E
2. Safety and risk assessment studies, such as the following:
  - a. NRC Safety Evaluation Reports
  - b. NRC “State of the Art Reactor Consequence Analysis for Diablo Canyon”
3. Other resources, such as the following:
  - a. Studies and data produced by PG&E and SCE in response to the 2007 IEPR data requests
  - b. Reports and information from government agencies, including the California Coastal Commission, California Seismic Safety Commission, California Geologic Survey, the U.S. Geological Survey, and the County of San Luis Obispo

### **Task 3: Plant Aging Vulnerability Assessment**

In this task, the contractor will evaluate the potential vulnerability of Diablo Canyon and SONGS to a major disruption due to plant aging. This assessment will consider the impacts on plant reliability from aging plant components and a retiring plant work force. It will also compile and review existing studies to identify trends at Diablo Canyon and SONGS related to extended, unplanned plant outages and compliance with federal plant maintenance requirements, and it will assess the robustness of each plant’s “safety culture.”<sup>3</sup>

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<sup>3</sup> Safety culture is defined here as plant management’s encouragement for plant workers to come forward to identify any problems or recommend improvements regarding plant safety, security, maintenance, and operations.

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## **Scope of Plant Aging Vulnerability Assessment**

<b>Topic Areas</b>	<b>Scope of Assessment</b>
1. Review scientific literature	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify and review available information regarding historical plant performance with respect to reliability, maintenance, aging, and power outages lasting longer than 6 months.</li> <li><input type="checkbox"/> Consider events involving the repair or replacement of major equipment that resulted in outages or extensions of outages.</li> <li><input type="checkbox"/> Assess plant maintenance programs using data from the U.S. Nuclear Regulatory Commission (NRC).</li> <li><input type="checkbox"/> Review plant-specific staffing and maintenance plans pertaining to staffing levels and contingency plans for plant access and recovery of major equipment. Use plant-specific information if available or generic industry information.</li> </ul>
2. Review the implications for Diablo Canyon and SONGS of degradation of major plant components	<ul style="list-style-type: none"> <li><input type="checkbox"/> Examine the implications for Diablo Canyon and SONGS of the failure or serious degradation of major plant components based on the experience and lessons learned from other nuclear power plants that have had failure or serious degradation of major plant components.</li> <li><input type="checkbox"/> Review the long-term impact of radiation on system components and structures with particular focus on the potential for accelerated aging.</li> <li><input type="checkbox"/> Review the potential of regulatory impacts due to the occurrence of a major event at another plant.</li> </ul>
3. Summarize safety culture assessments at Diablo Canyon, SONGS, and Palo Verde	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review information, assessments, and programs at Diablo Canyon, SONGS, and Palo Verde related to the safety culture at these plants.</li> <li><input type="checkbox"/> Examine the NRC's Multiple System Responses Program (MSRP) results to infer any safety culture issues at Diablo Canyon or at SONGS.</li> </ul>
4. Summarize NRC findings and reports on maintenance compliance	<ul style="list-style-type: none"> <li><input type="checkbox"/> Assess Diablo Canyon's and SONGS' compliance with NRC plant maintenance requirements.</li> </ul>
5. Assess implications of replacing retiring workers on plant performance, safety and reliability	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review plant staffing plans with particular attention paid to how the plants will maintain an adequate number of trained personnel in the operations, safety, and maintenance groups.</li> <li><input type="checkbox"/> Examine the projected availability of replacement workers in light of the possibility of extending the operations of SONGS and Diablo Canyon beyond current license periods.</li> <li><input type="checkbox"/> Consider the range of skills, training, and expertise required by plant employees, including technicians, operators, engineers, and safety personnel. Summarize and assess the quality of the training programs at the plants for maintaining a skilled and trained workforce.</li> </ul>
6. Identify trends in radioisotope detection	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review generic and plant-specific information regarding any trends in increased detection of radioisotopes in either the primary system or the environment.</li> </ul>

## **Representative List of Studies to be Reviewed for Plant Aging Vulnerability Assessment**

1. Studies and reports on nuclear plant aging, such as the following:
  - a. Development and Demonstration of Methods for Nuclear Power Plant Aging Risk Analysis, *Plant-Specific Data Collection and Interpretation*, PLG-0717, Volume1, Rev. 1, prepared for EG&G Idaho, Inc., Idaho National Engineering Laboratory
  - b. Aging PSA Guide, *Final Report of the Mitsubishi Heavy Industries, Ltd., Aging Probabilistic Safety Assessment Report*, prepared for Mitsubishi Heavy Industries, Ltd., PLG-1098
  - c. Lochbaum, David. *Walking a Nuclear Tightrope: Unlearned Lessons of Year-plus Reactor Outages*, Union of Concerned Scientists, September 2006.
  - d. Nuclear Plant Aging Research Program Plan, NUREG-1144, NRC
2. Reports and studies from federal agencies, including NRC Licensee Event Reports, the Nuclear Operations Analysis Center (NOAC) report, the Multiple System Responses Program report, and studies from the Office of Nuclear Regulatory Research and the U.S. Government Accountability Office
3. Reports on aging of equipment and components such as the following:
  - a. *Aging Assessment of Component Cooling Water Systems in Pressurized Water Reactors (Phase 2)*, NUREG/CR-5693
  - b. *Evaluations of Core Melt Frequency Effects Due to Component Aging and Maintenance Risk Assessment*, NUREG/CR-5510
  - c. *Aging Effects on Time-Dependent Nuclear Plant Component Unavailability: An Investigation of Variations from Static Calculations*, R.D. Radulovich
  - d. *BWR Control Rod Drive System Aging, presentation at 19th Water Reactor Safety Information Meeting*, R.H. Greene

### **Task 4: Impact of a Major Disruption**

AB 1632 requires an analysis of the impacts on system reliability, public safety, and the economy of a major disruption at California's nuclear power plants. In this task, the contractor will review studies on Diablo Canyon and SONGS reliability and examine the system, environmental, and economic impacts of a prolonged, unexpected outage caused by a major seismic event or a major plant component failure.

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## **Scope of Assessment for Impact of Major Disruption Analysis**

<b>Topic Areas</b>	<b>Scope of Assessment</b>
1. Assess plant reliability studies	<ul style="list-style-type: none"> <li><input type="checkbox"/> Provide a summary of the available studies on plant reliability for Diablo Canyon and SONGS, with an emphasis on plant-specific local and system reliability issues.</li> </ul>
2. Define “major disruption”	<ul style="list-style-type: none"> <li><input type="checkbox"/> Develop a definition of a “major disruption” in operations at Diablo Canyon and SONGS. Factors that may be considered in the definition include outages at multiple units/multiple sites, length of disruption, external causes of disruptions (e.g., earthquake, wildfires), and steps required to return the plant to service.</li> <li><input type="checkbox"/> Review historical data on major power generation disruptions in California and the western U.S. and other geographic areas as needed.</li> <li><input type="checkbox"/> Develop a set of plant shutdown duration categories that characterize the frequency and nature of potential major disruption events, e.g., disruptions lasting 3-6 months, 6-18 months, or permanent shutdown. Include scenarios where SONGS and Diablo Canyon are shut down simultaneously.</li> </ul>
3. Identify transmission issues associated with a major disruption	<ul style="list-style-type: none"> <li><input type="checkbox"/> Working with policymakers, grid operators, and utilities, identify the current transmission issues associated with a potential loss of power at SONGS or Diablo Canyon. Describe the role of SONGS and Diablo Canyon in maintaining system reliability.</li> <li><input type="checkbox"/> Identify short-term impacts on the transmission system from a prolonged outage at SONGS and Diablo Canyon, considering seasonal variations in power demand. Identify the electric contingencies that would need to be addressed should a prolonged outage occur.</li> </ul>
4. Assess the availability of replacement power	<ul style="list-style-type: none"> <li><input type="checkbox"/> Perform a reliability study in order to determine how much new transmission or generation capacity would be required in order to maintain reliability of the transmission system and adequate power supply in the event of extended outages at Diablo Canyon and/or SONGS. Use a production cost model to determine incremental power costs during such an outage.</li> <li><input type="checkbox"/> Consider the impact of the loss of California's nuclear power plants on each utility's planning reserve margin and local and system capacity requirements. Provide general parameters of the type and cost of incremental investments that might be needed in the event of extended nuclear power plant outages or retirements.</li> <li><input type="checkbox"/> Perform an economic analysis of the costs of replacement power.</li> <li><input type="checkbox"/> Complete these analyses for the years 2008 and 2012.</li> </ul>

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Topic Areas	Scope of Assessment
5. Assess the public safety and economic impacts of an extended outage	<ul style="list-style-type: none"> <li><input type="checkbox"/> Determine the public safety and economic impacts of an extended outage at Diablo Canyon or SONGS. Include the cost of replacement power and the incremental costs of repairs and replacements in this assessment.</li> <li><input type="checkbox"/> Perform a sensitivity analysis by running the production cost model using different input assumptions relating to load, natural gas price, and/or other input parameters.</li> </ul>
6. Assess reserve margin implications	<ul style="list-style-type: none"> <li><input type="checkbox"/> Assess the seasonal adequacy of reserve margins and the impact of a major disruption at Diablo Canyon and/or SONGS on the western grid's system stability and the owners' planning reserve margins.</li> </ul>
7. Assess environmental and economic implications	<ul style="list-style-type: none"> <li><input type="checkbox"/> Assess the seasonal environmental and economic impacts of relying on replacement power sources and the time required to develop these power sources.</li> </ul>
8. Assess the economic implications of license extensions for Diablo Canyon and SONGS	<ul style="list-style-type: none"> <li><input type="checkbox"/> Assess the economic implications of relying on Diablo Canyon and SONGS for 20 years past their current operating license expiration dates. Consider several scenarios to take into account a range of plant expenditures and a range of capacity factors at the plants.</li> <li><input type="checkbox"/> Compare the cost of the continued operation of the nuclear power plants to the cost of replacement power alternatives. Include in these cost estimates the costs of any transmission system upgrades or extensions that would be required in order to make use of the generation portfolio.</li> </ul>

**Production Cost Modeling Approach:**

The economic impacts of an extended outage at Diablo Canyon, at SONGS, and at both these plants will be assessed using the MarketSym production cost model.<sup>4</sup> The contractor will assume that the outage occurs in the year 2012 and lasts for one year. The contractor will use the Energy Commission's Scenario 1(b), which was prepared for the 2007 IEPR, as the base case and will also consider the possible retirement of aging gas-fired plants in Southern California, as identified in the Energy Commission's Scenario Analysis. In addition, the contractor will be cognizant of issues raised by the Ocean Protection Council in their assessment of the possible retirement of plants that use once-through cooling.

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<sup>4</sup> MarketSym was used in the hourly dispatch analysis for the Energy Commission's Scenario Analysis.

## **Representative List of Studies to be Reviewed for Impact of Major Disruption Analysis**

1. Studies on the social and economic risks of a possible disruption, such as the following:
  - a. Analysis of the Risk to the Public from Possible Damage to the Diablo Canyon Nuclear Power Station from Seismic Events, Units 1 and 2, Diablo Canyon Site, PG&E.
2. Studies on the cost of major outages at nuclear power plants and the impacts of aging on operating costs, such as the following:
  - a. *Review of Palo Verde 2005 Outages*, Report of GDS Associates, Inc. on Behalf of Utilities Division, Arizona Corporation Committee, August 2006
  - b. *An Analysis of Nuclear Power Plant Operating Costs: A 1995 Update*, Energy Information Administration, April 1995
3. Reports on PG&E and SCE reserve margins, such as the following:
  - a. PG&E and SCE Long-Term Procurement Plans
  - b. *2006 Resource Adequacy Report*, CPUC, March 16, 2007.
  - c. Energy Commission energy demand forecasts
4. Studies on the cost and environmental impacts of generation and transmission in California, such as the following
  - a. *Comparative Costs of California Central Station Electricity Generation Technologies*, Energy Commission, 2007
  - b. *Scenario-Based Assessment of Resource Plans Predicated on Large Penetration of Preferred Resources*, Energy Commission, 2007
  - c. *Strategic Transmission Investment Plan*, Energy Commission, 2005 and 2007
  - d. *Environmental Performance Report*, Energy Commission, 2003-2007

### **Task 5: Nuclear Waste Accumulation Assessment**

In this task, the contractor will evaluate potential state and local costs resulting from the steadily accumulating spent fuel and low-level waste at Diablo Canyon and SONGS. This assessment will rely on scientific studies related to the safety and security risks posed by extended, high-density spent fuel storage at reactors as well as potential offsite transportation impacts.

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## **Scope of Nuclear Waste Accumulation Assessment**

<b>Topic Areas</b>	<b>Scope of Assessment</b>
1. Quantify amounts of radioactive waste at Diablo Canyon and SONGS	<ul style="list-style-type: none"> <li><input type="checkbox"/> Quantify and describe the amounts of radioactive waste generated at Diablo Canyon and SONGS over the plants' operating license periods. Consider the amounts of spent fuel and the amounts of each grade of low-level waste (i.e., Classes A, B, and C, and Greater than Class C) generated at each site.</li> </ul>
2. Assess plans for and costs of waste storage and disposal	<ul style="list-style-type: none"> <li><input type="checkbox"/> Build upon assessments already completed in the 2005 and 2007 IEPR proceedings that evaluated the plans for storage, transportation, and disposal of nuclear waste from Diablo Canyon and SONGS.</li> <li><input type="checkbox"/> Review DOE's requirements for transportation casks and the need for repackaging. Assess the costs associated with DOE's proposed requirement to transfer spent fuel into Transportation, Aging and Disposal (TAD) canisters at reactors before transport to a repository.</li> <li><input type="checkbox"/> Develop cost estimates for the Diablo Canyon and SONGS waste storage and disposal plans.</li> </ul>
3. Assess costs to build and operate ISFSIs, capacity of ISFSIs, and NWF payments	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review cost estimates to build, maintain, and protect the dry cask storage facilities at Diablo Canyon and SONGS.</li> <li><input type="checkbox"/> Assess the capacity of the ISFSIs to store all the spent fuel that will be generated through the initial reactor operating licenses and through an additional 20 years of license extension.</li> <li><input type="checkbox"/> Compare historic costs to damage amounts that the utilities have been awarded resulting from their breach of contract lawsuits against DOE.</li> <li><input type="checkbox"/> Estimate the payments that California ratepayers have made to the federal Nuclear Waste Fund in order to pay for the transport, storage, and disposal of Diablo Canyon and SONGS spent fuel.</li> </ul>
4. Assess seismic and terrorist risk to onsite waste storage	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review and summarize available documents on the seismic capacity of Diablo Canyon's and SONGS' spent fuel pools and dry cask storage containers. Discuss the magnitude of a seismic event necessary to cause functional damage to the spent fuel pool and storage containers, as well as the damage/failure modes. Consider the potential role of recovery actions to prevent or mitigate damage.</li> <li><input type="checkbox"/> Review and summarize available documents on terrorist threats to spent fuel pools and storage containers. Identify the possible nature, type, and magnitude of terrorist attacks necessary to cause functional damage, as well as the damage/failure modes and the potential role of recovery actions to prevent or mitigate damage.</li> </ul>
5. Assess transportation costs of spent fuel transport	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review available industry, plant specific, and other relevant documents to assess the costs associated with waste storage onsite and transport offsite to a federal storage or waste disposal facility.</li> </ul>

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Topic Areas	Scope of Assessment
6. Assess risks of spent fuel transport	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify the potential risks involved with the eventual transport off site of the spent fuel, which will involve movement of hazardous material over existing rights-of-way near populated areas, introducing the potential for an accidental or terrorist-caused release of radionuclides.</li> </ul>
7. Assess costs and impacts of ongoing emergency preparedness if waste sites become semi-permanent	<ul style="list-style-type: none"> <li><input type="checkbox"/> Review and evaluate local and state emergency management plans for dealing with nuclear plant emergencies. Focus on elements of these plans as they relate to spent fuel storage and how these plans might change if the spent fuel was removed from the site.</li> <li><input type="checkbox"/> Summarize the potential emergency preparedness cost implications if spent fuel remains at the plant site for an indefinite period of time.</li> </ul>
8. Assess cost and impacts of land use, coastal access, and property values and tourism if waste sites become semi-permanent	<ul style="list-style-type: none"> <li><input type="checkbox"/> Evaluate the long-term impacts of semi-permanent waste sites on surrounding land uses and coastal access by comparing existing and planned uses and projecting how those future uses might be impacted if the nuclear waste remains onsite.</li> <li><input type="checkbox"/> Analyze the impacts on property values, tourist revenues, and local economies. Determine land use impacts by examining the most recent and appropriate literature and studies and applying the conclusions to the sites being considered.</li> </ul>
9. Assess status of reprocessing and Yucca Mountain	<ul style="list-style-type: none"> <li><input type="checkbox"/> Provide an update on the status of the U.S. reprocessing initiatives (e.g. GNEP), federal waste management, and high level waste disposal activities.</li> </ul>

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### **Representative List of Studies to be Reviewed for Nuclear Waste Accumulation Assessment**

1. Reports on the current spent fuel storage installations, such as the following:
  - a. *Diablo Canyon Independent Spent Fuel Storage Installation Safety Evaluation Report*, Center for Nuclear Waste Regulatory Analyses
  - b. Diablo Canyon Independent Spent Fuel Storage Installation (ISFSI) Submittal of Geologic Data Reports (11), in Response to U.S. Nuclear Regulatory Commission Docket No. 72-26, prepared for Pacific Gas & Electric Company, William Lettis & Associates, Inc.
2. Data produced by PG&E and SCE in response to 2007 IEPR data requests on radioactive waste generated at the nuclear plants and plans for and cost of waste storage and transport
3. Studies on the cost and risks associated with waste storage and transport options, such as the following:
  - a. Bunn, et. al. *Interim Storage of Spent Nuclear Fuel: A Safe, Flexible, and Cost-Effective Near-Term Approach to Spent Fuel Management*, Harvard University-University of Tokyo Joint Report, June 2001
  - b. Bunn, et. al. *The Economics of Reprocessing vs. Direct Disposal of Spent Nuclear Fuel*, Harvard University, December 2003
  - c. Shropshire, et. al. *Advanced Fuel Cycle Cost Basis*, Idaho National Lab, April 2007
  - d. PG&E and SCE rate filings
  - e. National Academies' review of safety and security of spent fuel storage (2005) and transport (2006)
4. Studies and local planning data related to the local economic impacts of spent fuel storage, such as the following:
  - a. *The impacts of nuclear facilities on property values and other factors in the surrounding communities* by Roger H. Bezdek, Robert M. Wendling, International Journal of Nuclear Governance, Economy and Ecology (IJNGEE), Vol. 1, No. 1, 2006
  - b. General Plans and websites for the Cities of Atascadero, Morro Bay, Pismo Beach and the City and County of San Luis Obispo.
5. Studies, testimonies, and presentations related to Yucca Mountain and spent fuel transport by DOE, the State of Nevada, and the State of California
6. Information on and reviews of DOE's reprocessing initiative, such as the following:
  - a. DOE reports and presentations

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- b. *Review of DOE's Nuclear Energy Research and Development Program, National Academies, 2007*

### **Task 6: Assessment of Other Nuclear Power Policy and Planning Issues**

In this task, the contractor will consider a number of additional policy and planning issues that should be examined as part of the Nuclear Power Plant Assessment. These will include examining the life cycle costs and environmental impacts of nuclear power plants compared with energy alternatives, assessing the impact of certain rising prices on the cost of nuclear power, assessing local economic impacts of nuclear power and alternative power sources, and evaluating the costs and benefits of obtaining license extensions for California's nuclear plants.

## Scope of Nuclear Power Policy and Planning Issues Assessment

Topic Areas	Scope of Assessment
1. Compare life cycle costs and environmental impacts	<ul style="list-style-type: none"> <li><input type="checkbox"/> Compare the life cycle costs and environmental impacts of nuclear power to the life cycle costs and environmental impacts of alternative baseload power sources that could be added in California.</li> <li><input type="checkbox"/> Evaluate the impacts of once-through cooling and greenhouse gas emissions related to nuclear power generation.</li> </ul>
2. Examine options for baseload replacement power	<ul style="list-style-type: none"> <li><input type="checkbox"/> Examine the potential sources for additional power in the state and construct a reasonable portfolio of resources from those potential sources.</li> </ul>
3. Assess impacts of rising fuel costs, personnel costs, and security costs	<ul style="list-style-type: none"> <li><input type="checkbox"/> Use publicly available information to analyze the impact of rising nuclear fuel prices on the cost of power from Diablo Canyon and SONGS.</li> <li><input type="checkbox"/> Evaluate the supply-demand balance in the labor market for nuclear power plant workers and provide a high-level assessment of the availability of workers for Diablo Canyon and SONGS.</li> <li><input type="checkbox"/> Monitor proceedings at the NRC related to security measures at nuclear power plants and spent fuel storage facilities. If additional security requirements are imposed, assess the economic impacts of these requirements on Diablo Canyon and SONGS.</li> </ul>
4. Assess local economic impacts of nuclear power and alternatives	<ul style="list-style-type: none"> <li><input type="checkbox"/> Provide an update to the 2001 Environmental Performance Report prepared by the Energy Commission which included a detailed analysis of local economic impacts from California's power plants, including its two nuclear facilities.</li> </ul>
5. Assess costs, benefits, and impacts of license extensions for Diablo Canyon and SONGS	<ul style="list-style-type: none"> <li><input type="checkbox"/> Use the cost and impact data compiled as part of Task 5 to assess additional costs, benefits, and impacts to state and local governments from extending the life of SONGS and Diablo Canyon through license renewal.</li> </ul>

### Representative List of Studies to be Reviewed for Nuclear Power Policy and Planning Issues Assessment

1. Reports on power generation life cycle costs, such as the following:
  - a. *Comparative Costs of California Central Station Electricity Generation Technologies*, Energy Commission 2007
  - b. *Scenario-Based Assessment of Resource Plans Predicated on Large Penetration of Preferred Resources*, Energy Commission 2007
  - c. *Alternatives to the Indian Point Energy Center for Meeting New York Electric Power Needs*, National Academies, 2006

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- d. Data produced by PG&E and SCE in response to 2007 IEPR data requests on costs of Diablo Canyon and SONGS
  - e. Shropshire, et. al. *Advanced Fuel Cycle Cost Basis*, Idaho National Lab, April 2007
2. Reports on the nuclear labor market, such as the following:
- a. NRC and U.S. Department of Labor reports, data, and presentations on the supply-demand balance in the nuclear plant labor market
  - b. Leonard Bond, Kevin Kostelnik, and Richard Holman, *Addressing the Workforce Pipeline Challenge*, ANS Winter Meeting and Nuclear Technology Expo, INL/CON-06-11700 November 2006
3. NRC reports and decisions related to reactor and spent fuel storage security, including from the following proceedings:
- a. Docket 72-26: Diablo Canyon dry cask storage licensing
  - b. State of Massachusetts and State of California petitions for rulemaking PRM 51-10 and PRM 51-12: Environmental impact assessments of spent fuel storage (including impacts of sabotage)