D.5 Geology, Soils, and Paleontology

D.5.1 Environmental Setting for the Proposed Project

This section presents a discussion of the regional physiography, geology, soils, seismicity, and mineral and paleontological resources in the project area. Baseline geologic information was collected from published and unpublished geologic, seismic, and geotechnical literature covering the Proposed Project area and the potential RSG transport routes. The literature review was supplemented by a field reconnaissance of the possible routes and the project area at SONGS. The literature review and field reconnaissance focused on the identification of specific geologic hazards and paleontologic resources.

The project is located in the west-central part of the Peninsular Ranges Geomorphic Province of Southern California. The Peninsular Ranges Geomorphic Province is generally characterized by northwest trending mountain ranges that extend into Mexico, interspersed with alluvial filled basins and coastal plains. The project area is located primarily along the northwest trending coastal plain just west of the foothills of the Santa Margarita Mountains. The gently sloping coastal plain in the project area consists primarily of a series of marine terraces that has been uplifted by tectonic forces over the last 500,000 years or so. Remnants of older marine terraces are located with the western foothills. The foothills of the Santa Margarita Mountains have been modified by erosion and dissected by numerous small drainages and several moderate sized stream channels. The Peninsular Ranges are a product of tectonic forces that continue to influence the geological and topographic development of the region. Folding, faulting, and uplift are all active agents that have competed with erosion in shaping the mountains and coastline.

The geology and most geologic hazards have limited ability to affect much of the Proposed Project because of the transitory nature of the proposed activities. The proposed and alternative transport alignments are roughly parallel, in parts overlapping along the coast, and they cross the same geologic materials/ units. Geologic and seismic conditions along the separate alignments are similar, if not identical in areas, therefore the following geologic discussion applies generally to all three alignments. Geologic conditions for the two potential sites for the onsite OSG Storage Alternative are also discussed in these sections.

D.5.1.1 Physiography

The physiography of the Proposed Project is dominated by its location on a relatively narrow, gently seaward sloping coastal plain. The topography of the coastal plain in the project area is dominated by a series of marine terraces that reach elevations of at least 800 feet. The proposed Beach and Road Route and I-5/Old Highway 101 Route Alternative range in elevation from near sea level at the Camp Pendleton Del Mar Boat Basin and along the beach to approximately 180 feet above mean sea level (msl) along the marine terrace just north of Horno Canyon. The MCBCP Inland Route Alternative begins at near sea level at the Camp Pendleton Del Mar Boat Basin and rises to approximately 245 feet as it passes near the base of the foothills. The operational area of the SONGS plant itself lies on a cut pad at an average elevation of approximately 25 feet. The potential OSG Storage Facility site near Unit 1 ranges in elevation from 25 feet on the cut pad adjacent to Unit 1 to 75 feet on the marine terrace above the cut pad. The other potential OSG Storage Facility site, in the Mesa Area, is at an approximate elevation of 100 feet on a marine terrace. Near the plant, the coastal plain narrows as it approaches the San Joaquin Hills in Orange County to an approximate width of 1,500 to 1,800 feet. A steep sea cliff, the San Onofre Bluffs, has developed along the marine terrace south of SONGS and ranges in height from about 60 to 125 feet.

D.5.1.2 Geology

The geology of the project area and transport route alignments is described briefly in the PEA (SCE, 2004), and this section briefly summarizes the salient points. The proposed and alternative transport alignments are roughly parallel along the coast and cross the same geologic materials/units. The southern California coastline from San Onofre to Oceanside is dominated by prominent marine terraces that extend inland several miles. The broadest terrace, extending from San Onofre to south of Oceanside, is located at about 60 to 100 feet above sea level. These marine terraces were formed by a combination of sea level changes and vertical tectonic movement (Norris & Webb, 1976). The terraces are capped by moderately consolidated sedimentary deposits of primarily sand and gravel.

Geologic units at the SONGS project site, and along the proposed transport routes are summarized in Table D.5-1. This table lists each geologic formation, a description of the formation's general rock type or lithology, where the formation occurs within or along the project, and age of the unit. Geology at and near the SONGS site is presented in Figure D.5-1.

Table D.5-1. General Descriptions and Characteristics of the Geologic Formations

Formation Name	Lithologic Description	Occurrence in Project Area	Age
Beach deposits	Unconsolidated sand and some gravel.	Along beach segments of Beach and Road Route	Recent
Younger alluvial fan deposits	Silty sand with gravel and clay.	Only located along northern portion of MCBCP Inland Route	Holocene
Younger alluvial river deposits	Unconsolidated to poorly consolidated sand and gravel deposits in active washes of streams.	Occurs at all active stream/drainage crossings	late Holocene
Older alluvial deposits	Primarily moderately well consolidated, poorly sorted, flood pain deposits.	Occurs within large stream/river drainage crossings for the I-5/Old Highway 101 and MCBCP Inland Routes	late Pleistocene (<500,000 yrs old)
Very old alluvial deposits	Alluvial flood plain deposits of well -indurated, poorly sorted, clay and sand.	Primarily located near edges of drainage crossings	early Pleistocene (>500,000 yrs old)
Older terrace deposits	Moderately consolidated marine and non-marine deposits of silty sand and gravely sand with varying amounts of clay and silt.	Underlying most of Beach and Road Route north of Las Pulgas Road. Also underlies most of I-5/Old Highway 101 Route. Underlies most of MCBCP Inland Route from approximately 1 mile north of the intersection with Las Pulgas Road. Underlies both alternative OSG Storage Facility sites	late Pleistocene (<500,000 yrs old)
Very old terrace deposits	Moderately consolidated marine and non-marine deposits of sandstone, siltstone, and conglomerate.	Underlies small areas of MCBCP Inland Route north of Las Pulgas Road	early Pleistocene (>500,000 yrs old)
San Mateo Formation	Marine, massive coarse-grained, light yellow brown to light gray, arkosic sandstone; with conglomerate and conglomeritic lenses. Contains no fossils.	Underlying SONGS site and exposed along bluffs south of SONGS facility. Small areas along south side of Los Flores Creek along all 3 routes. Small areas along north side of Santa Margarita River flood plain along I-5/Old Highway 101 and MCBCP Inland Routes	late Pleistocene to late Miocene
San Onofre Breccia	Marine breccia, conglomerate, fine to coarse-grained sandstone, and conglomeritic sandstone with sandy siltstone lenses and interbeds. Primarily poorly cemented, but is locally well cemented.	Underlies small areas of MCBCP Inland Route north of Las Pulgas Road	middle Miocene

Source: Kennedy, 2001; Moyle, 1973; and Tan, 1999a and 1999b.

Figure D.5-1. SONGS Local Geology
CLICK HERE TO VIEW

This page intentionally blank.

D.5.1.3 Soils

The San Diego Area soil survey identifies the two main soil types along the potential transport routes: the Huerhuero and Salinas Series soils. These soils developed on the gently sloping coastal plain in alluvial and terrace deposits. Lesser amounts of Carlsbad and Elder Series soils are located along the route alignments. The Carlsbad and Elder soils along the transport route alignments are generally found along paved road areas and are not likely to affect transportation of the RSGs. The SONGS plant area has been graded and disturbed and is underlain by engineered fill and sedimentary bedrock (San Mateo Formation). The potential OSG storage site near Unit 1 is partial cut pad underlain by San Mateo Formation and partial marine terrace capped by Carlsbad Series soils. The potential OSG storage site at the Mesa Area is underlain by Diablo Series soils. The Soil Survey mapping is generalized and may not reflect the local and specific conditions at the project site and along the transportation routes.

Soil types and characteristics are significant to a proposed project if agricultural soils are to be taken out of service or potential service, or if the soils pose particular engineering problems. According to the 1973 San Diego Area soil survey by the USDA Soil Conservation Service (SCS, 1973), some areas suitable for agriculture would be crossed by the range of transport alternatives. However, in these areas transport would be limited to previously disturbed dirt or paved roadways, which would not impact the potential for agricultural use. The potential areas for the OSG Storage Facility are located on property already utilized by the SONGS facility and, therefore, would not affect current or potential agricultural use.

The Soil Survey (SCS, 1973) lists the erodibility of Huerhuero soils as severe, of Carlsbad soils as moderate, of the Salinas soils as slight to moderate, and of Diablo soils as slight. Huerhuero soils are generally loamy soils in the project area susceptible to wind and water erosion. Carlsbad soils near SONGS are generally composed of gravelly loamy sand and would potentially be susceptible to wind and water erosion during construction of the OSG Storage Facility. Salinas and Diablo soils in the project areas consist of clay and clay loams which are not susceptible to significant wind or water erosion due to their high clay content. Also prone to significant erosion are the unconsolidated beach deposits located along the southern portion of the proposed Beach and Road Route. Transport vehicles could loosen and displace soil/sediments along unpaved portions of the transport routes making them more susceptible to wind and water erosion. However, Applicant-Proposed Measures to protect surfaces and minimize disturbance of loose sediments and soils by placing heavy-duty matting and traveling at low speeds would reduce the potential erosion impact to negligible.

Other soil characteristics that could pose potential construction issues include shrink-swell (expansion potential) and corrosion potential. Shrink-swell is the potential for volume change resulting from change in moisture content. The risk for corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete, and is primarily dependent on soil moisture, soil pH, and sodium and sulfate content. Expansion potential is low for Carlsbad soils, and high for Diablo soils at the potential OSG Storage Facility sites. Corrosion potentials for Carlsbad soils in the project area are moderate for both uncoated steel and concrete, whereas the corrosion potential for Diablo soils are high for uncoated steel and low for concrete.

D.5.1.4 Seismic Hazards

Seismic hazards in the vicinity of the project include ground shaking, surface rupture, liquefaction, slope instability, and tsunami runup. The project area will be subject to ground shaking primarily associated with earthquakes on faults of the San Andreas system and offshore faults. Active faults of the San Andreas

system are predominantly strike-slip faults accommodating translational[1] movement. Active onshore right lateral strike slip faults in the San Diego area capable of producing ~~significant~~ seismic shaking in the project area include the Rose Canyon (onshore segment), Elsinore, San Jacinto, and San Andreas, all associated with the San Andreas fault system. ~~Significant a~~Active offshore faults include the Rose Canyon fault (offshore segment), Coronado Bank Fault Zone, San Diego Trough Fault Zone, and San Clemente Fault Zone.

Southern California is characterized by numerous geologically young faults. These faults can be classified as historically active, active, potentially active, or inactive, based on the following criteria (CGS, 1999):

- Faults that have generated earthquakes accompanied by surface rupture during historic time (approximately the last 200 years) and faults that exhibit aseismic fault creep[2] are defined as Historically Active.
- Faults that show geologic evidence of movement within Holocene time (approximately the last 11,000 years) are defined as Active.
- Faults that show geologic evidence of movement within the Quaternary (approximately the last 2,000,000 years) are defined as Potentially Active.
- Faults that show direct geologic evidence of inactivity during all of Holocene time or longer may be classified as Inactive.

Although it is difficult to quantify the probability that an earthquake will occur on a specific fault, this classification is based on the assumption that if a fault has moved during the Holocene epoch, it is likely to produce earthquakes in the future.

Significant active faults in the project area considered to be potentially significant seismic sources for local groundshaking and other earthquake related phenomena are listed in Table D.5-2. Data presented in this table include the fault name, type of fault, and the estimated earthquake magnitude.

Table D.5-2. Significant Active Faults in the Project Area

Fault Name[(a)]	Fault Type	Estimated Maximum Earthquake Magnitude[(b)]
Newport-Inglewood (offshore segment)	Right Lateral Strike Slip	6.9
Rose Canyon	Right Lateral Strike Slip	7.2
Coronado Bank	Right Lateral Strike Slip	7.6
Palos Verdes	Right Lateral Strike Slip	7.3
Elsinore (Temecula segment)	Right Lateral Strike Slip	6.8
Elsinore (Glen Ivy segment)	Right Lateral Strike Slip	6.8
Newport-Inglewood (onshore segment)	Right Lateral Strike Slip	7.1
Elsinore (Julian segment)	Right Lateral Strike Slip	7.1
San Jacinto (San Jacinto Valley segment)	Right Lateral Strike Slip	6.9
San Andreas (San Bernardino segment)	Right Lateral Strike Slip	7.5

(a) Faults listed in order of approximate distance from SONGS site, closest to furthest.

(b) Estimated Maximum Earthquake Magnitude – the maximum earthquake that appears capable of occurring under the presently known tectonic framework, using the Richter scale. Values from the 2002 CGS Revised Probabilistic Seismic Hazard Assessment California Fault Parameters.

1 Fault block movement in which the blocks have no rotational component, parallel features remain so after movement.

2 Movement along a fault that does not entail earthquake activity.

The closest fault to the SONGS site and the only fault crossed by the transport routes is the Christianitos fault. The Christianitos fault lies approximately one mile southeast of the SONGS facility and is considered inactive. The fault is a low angle normal fault offsetting approximately 15-million-year-old (myo) Monterey Formation on the south against approximately 5-myo San Mateo Formation on the north. The fault is truncated by 120,000-year-old overlying undisturbed marine terrace deposits, indicating that it has been at least 120,000 years since movement on the Christianitos fault. Several small faults/shears with displacement of 3 to 6 inches were identified during excavation for the SONGS site, but they did not offset the overlying terrace deposits, also indicating no movement in at least the last 120,000 years. Although several minor earthquakes (magnitudes 3.3 and 3.8) occurred in January 1975 near to, but not on, the trace of the Christianitos fault (30 km north of SONGS), no compelling evidence has been found to indicate the fault is not inactive, as concluded by the NRC and the California Coastal Commission (CCC, 2000). Therefore this fault is not considered a potential source for future earthquakes.

Groundshaking

Of all the potential hazards, ground shaking associated with an earthquake on one of the nearby faults is the most likely to affect the Proposed Project. The map of Seismic Shaking Hazards in California produced by the California Geological Survey (CGS) indicates that the estimated Peak Ground Acceleration (PGA) for the majority of the coastal area between Oceanside and San Onofre is 20-30%g, where g is the acceleration of gravity (CGS, 2005). The CGS Probabilistic Seismic Hazards Mapping (PSHM) Ground Motion web site (updated in 2003) was used to calculate an estimated maximum expected PGA of approximately 30%g at the SONGS site. These PGA values are based on a probabilistic analysis considering a 10% probability of exceedance in 50 years and were calculated based on "soft rock" or soil type Sc for the SONGS site. The CGS ground motion values were interpolated from a 0.05-degree spaced grid of calculated values for California.

Ground shaking could trigger landslides; landslides are discussed in the next section. The effects of ground shaking during an earthquake could include damage to facilities, and/or cracks in the roads, slumping of the road, and landslides along the bluffs, which could affect transport of the RSGs. In addition, if an earthquake occurs while construction activities or heavy lifting are underway, the ground shaking could cause equipment, scaffolds, cranes, and trailer loads to become temporarily unstable.

Fault Rupture

No known active faults immediately underlie the areas of Proposed Project activities; therefore, the potential for fault surface rupture along the proposed transport routes and at the SONGS site is low.

Liquefaction

Liquefaction of saturated beach deposits and loose stream channel deposits could potentially occur along the beach during a seismic event. The geologic materials underlying the remainder of the project alignments consists of primarily of relatively dense, semi-consolidated to consolidated sedimentary deposits not likely to undergo liquefaction (SCE, 2003).

Tsunami Hazards

An offshore earthquake with sufficient magnitude could trigger a tsunami resulting in surge waves and flooding along low-lying areas of the coast. Areas likely to be affected by a tsunami include the Camp Pendleton Del Mar Boat Basin and the beach. The coast of southern California is characterized by a broad

off-shore shelf which would reflect most of the energy of distantly generated tsunamis back out to sea. Due to this minimizing effect of the broad continental borderland on distantly generated tsunami waves, local offshore fault zones are the most likely generators for significant tsunami waves at SONGS and along the transport route (SCE, 1998). The anticipated wave height for a tsunami triggered by an earthquake on one of the local offshore faults is approximately 6 feet based on calculations conducted for the San Onofre 2 & 3 FSAR (1998 Update). The calculations assumed an approximate 7-foot vertical displacement of the sea floor at a distance of 5 miles from the shore. A worst-case scenario would couple ~~this~~ the tsunami occurring simultaneously with high tide and storm surge resulting~~s~~ in a possible maximum runup to about 15½ feet (SCE, 1998). In the unlikely event of a tsunami occurring along the California coastline, the Pacific Tsunami Warning Center (operated by the National Oceanic & Atmospheric Administration, NOAA) would likely be able to provide advance notice, thereby providing time for project-related activities to prepare.

D.5.1.5 Landslide Hazards

Due to the general gentle slope of the project area, landslide hazards potentially affecting the project area are limited to portions of the transport routes that run atop the San Onofre Bluffs, south of the SONGS facility and along the Beach and Road Route adjacent to the coastal bluffs. Numerous landslides are mapped along the San Onofre Bluffs area for a distance of approximately 3 miles (Tan, 1999b) through San Onofre State Beach. The transport routes in this area could approach within about 200 feet of the edges of the bluffs along Old Highway 101. There is a potential that the significant weight of the transport trucks could trigger a landslide in this area. An image of the existing landslides along the San Onofre Bluffs is provided in Figure D.5-2.

The bluffs along the proposed Beach and Road Transport Route are composed of well-cemented San Mateo Formation sandstone and well-cemented terrace deposits that tend to waste by rockfall or debris fall. Additionally, no significant debris falls or landslides have been mapped along this segment of bluffs (Kennedy, 2001; Tan, 1999b). The transport of the RSGs on the beach is not likely to affect the stability of the nearby bluffs and cause rockfalls or debris falls.

D.5.1.6 Mineral Resources

A review of mines and mineral production maps (CDMG, 1999) indicates that no significant mineral resources are located in the project area.

D.5.1.7 Paleontology

Paleontologic resources are considered significant if they include the fossilized remains of terrestrial animals, especially vertebrate animals or plants. There are no geologic formations at the site or along the potential transport routes that are known to contain such fossils — most of the geologic formations are Quaternary and Tertiary marine and river terrace deposits and alluvial fan deposits.

D.5.2 Applicable Regulations, Plans, and Standards

Geologic resources and geotechnical hazards are normally governed by local jurisdictions. The conservation elements and seismic safety elements of city and county general plans contain policies for the protection of geologic features and avoidance of hazards. Local building codes and ordinances normally implement these policies. The project proponent must also comply with several additional federal, State,

and local applicable statutes, regulations, and policies. Relevant and potentially relevant statutes, regulations, and policies are discussed below.

Federal and State Standards

The NRC has sole jurisdiction over the regulation of nuclear power plants and the associated safety issues. NRC regulations in 10 CFR 62 specify criteria for low-level radioactive waste disposal facilities, and 10 CFR 72.102, 103, and 128 specify the geological and seismological characteristics for facilities storing high-level radioactive waste. The NRC is required by 10 CFR 100 to consider the geology and seismic setting for any nuclear power plant site and to require adequate compensating engineering safeguards to minimize the risk of accidents or an inadvertent release of radioactive materials.

NRC regulations (10 CFR 50.59) allow a licensed power plant to make modifications to the original design and equipment without seeking re-certification only if the modification will allow the plant to function within the parameters specified by the Final Safety Analysis Report (FSAR) or updated FSAR (SCE, 2003). SCE expects that all steam generator replacement project activities could be conducted without requiring an amendment of the license from the NRC. For all work related to the steam generator replacement project, including creating the containment opening, the materials, strength, seismic design, radiation shielding, and protection from earthquakes would be addressed in the license amendment process under 10 CFR 50.59 (SCE, 2004a).

These regulations require that nuclear power plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunamis, and seiches without the loss their safety functions and capabilities. The Reactor Site Criteria (10 CFR 100, including Appendix A) describe the nature of the investigations required to obtain the geologic and seismic data necessary to determine site suitability and provide reasonable assurance that a nuclear power plant can be constructed and operated at a proposed site without undue risk to the health and safety of the public. More specifically, these criteria describe procedures for determining the quantitative vibratory ground motion design basis at a site due to earthquakes, as well as provide information needed to determine whether and to what extent a nuclear power plant needs to be designed to withstand the effects of surface faulting. Other geologic and seismic factors required to be taken into account in the siting and design of nuclear power plants are also identified.

With respect to frequency of faulting, the NRC uses a more conservative approach than that of State-level Alquist-Priolo regulations (see below). The NRC classifies a "capable" fault as a fault that has exhibited one or more of the following characteristics:

- Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years;
- Macro-seismicity as determined instrumentally with records of sufficient precision to demonstrate a direct relationship with the fault; or
- A structural relationship to a capable fault, according to the two characteristics listed above, such that movement on one could be reasonably expected to be accompanied by movement on the other.

In response to these requirements, earthquake potential of the significant seismic sources in the region has previously been characterized in the 2003 update to the FSAR, which included an assessment of potential seismic sources, earthquake probability, and estimated levels of deterministic and probabilistic ground motions for the site.

State Statutes

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 (formerly the Special Studies Zoning Act) regulates development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. While the Act does not specifically regulate power plant projects, it does help define areas where fault rupture is most likely to occur. The Act groups faults into categories of active, potentially active, and inactive. Historic and Holocene age faults are considered active, Late Quaternary and Quaternary age faults are considered potentially active, and pre-Quaternary age faults are considered inactive. These classifications are qualified by the conditions that a fault must be shown to be sufficiently "active" and "well defined" by detailed site-specific geologic explorations in order to determine whether building setbacks should be established. There are no Alquist-Priolo faults in the vicinity of the proposed transport routes or near the SONGS facility.

California Coastal Act

The California Coastal Act guides the management of coastal resources through the establishment of a coastal zone management program. Expansion of existing power plants in the Coastal Zone is governed by California Coastal Act policy and regulations (Section 30001.2 of Coastal Act). ~~Chapter 11 of the Coastal Act discusses Hazards in the coastal environment, including coastal bluff erosion.~~ Section 30603 requires that after certification of the Local Coastal Program, the Coastal Commission retains appeal authority for any development within 300 feet of the top of the seaward face of any coastal bluff. ~~Policy 2 in Chapter 11 states that new development shall ensure structural stability while not creating or contributing to erosion or geologic instability. This policy is cross referenced to Section 23.07.086 of the Coastal Zone Land Use Ordinance (CZLUO).~~

~~Policy 6 in Chapter 11 of the Coastal Act discusses coastal bluff setbacks for new development or expansion of existing uses. The policy requires that the sites be designed and set back adequately to assure stability and structural integrity and to withstand bluff erosion and wave action for a period of 75 years without construction of shoreline protection structures which would require substantial alterations to the natural landforms along bluffs and cliffs. This policy may affect siting of the proposed OSG Onsite Storage Alternative.~~ One of the possible locations for the OSG Storage Facility is in the vicinity of Unit 1, which is located less than 300 feet from the coastline and coastal bluffs. ~~Policy 6 is cross referenced with Section 23.04.118 of the CZLUO.~~

~~Policy 7 in Chapter 11 of the Coastal Act specifies that coastal bluffs and cliffs greater than 10 feet in vertical relief are to be included in the Geologic Study Area (GSA) combining designation. The requirements of Policy 7 are cross referenced to Section 23.07.080 and its subsections of the CZLUO which require a geologic report on the hazards of the area unless the County Engineer determines previous reports are adequate to characterize the project area.~~

Local Ordinances and Policies

The General Plan Safety Elements for San Diego County contain guidelines and recommendations for the avoidance of geologic hazards (San Diego County, 1991).

Figure D.5-2. Aerial Infrared Photograph Showing Existing Landslides along San Onofre Bluffs
CLICK HERE TO VIEW

This page intentionally blank.

D.5.3 Environmental Impacts and Mitigation Measures for the Proposed Project

The literature review and field check of the geologic conditions in the project area revealed that slope stability issues along certain portions of the potential transport routes and seismic ground shaking hazards are most likely to adversely affect the Proposed Project. These issues are addressed in the following discussion of impacts.

D.5.3.1 Definition and Use of Significance Criteria

These criteria address geologic and soil conditions and paleontological resources with respect to the impacts the project may have on the local setting, and the impact specific geologic hazards and conditions may have upon the project. The criteria are established based on CEQA statutes, guidelines and appendices; thresholds of significance developed by local agencies; government codes and ordinances; and requirements stipulated by California Alquist-Priolo statutes.

Impacts of the project on the geologic environment would be considered significant if:

- Unique geologic features or geologic features of unusual scientific value (including significant fossils) for study or interpretation would be disturbed or otherwise adversely affected.
- Known mineral and/or energy resources would be rendered inaccessible.
- Agricultural soils would be converted to non-agricultural uses.
- Geologic processes, such as landslides or erosion, could be triggered or accelerated by construction or disturbance of landforms.
- Substantial alteration of topography would be required or could occur beyond that which would result from natural erosion and deposition.

Impacts of geologic hazards on the project would also be considered significant if the following conditions existed:

- High potential for earthquake-induced ground shaking to cause liquefaction, settlement, lateral spreading and/or surface cracking in the vicinity of proposed work areas or along the transportation routes.
- Potential for tsunamis or seiche to cause damage to temporary facilities or to equipment during transportation or construction of facilities.

The information in the setting, Section D.5.1 above, demonstrates that the Proposed Project would not impact agricultural or erodible soils, mineral resources, or paleontological resources.

Applicant-Proposed Measures

SCE has proposed to include the following measures as part of the Proposed Project in order to manage impacts on soils during placement of temporary structures at SONGS (SCE, 2004b):

- **Geo-1:** Erosion control measures will be implemented and no structures will be placed on expansive soils without mitigation.

D.5.3.2 Replacement Steam Generator Transport

Transport of the RSGs on the proposed Beach and Road Route would involve heavy loads that the Applicant would manage in a way to minimize surface disruption. The Project Description identifies steps the Applicant would take to protect surfaces and minimize disturbance of loose sediments, such as beach sand, by placing heavy duty matting and traveling at low speeds. Replacement steam generator offloading and transport activities would have a transient effect on the landscape and as such would not impact geological, soils, or paleontological resources. However, the route would cross over areas of potentially unstable earth materials.

Impact G-1: Extremely heavy loads could mobilize unstable ground along Old Highway 101 and the San Onofre Bluff area of transport route

The extremely heavy transport loads and equipment would add an unusual load to the road along the Old Highway 101 portion (Segment I) of the transport route. Portions of this route closely approach the landslide-prone San Onofre Bluff area. It is possible that steam generator transport could trigger a landslide along this already unstable section of coast. The locations most likely to be at risk are those areas that most closely approach the bluffs. Additionally, some areas of Old Highway 101 are underlain by poorly consolidated fill which has caused causing structural damage to the road over time. The transport of extremely heavy loads over these sections of roadway could potentially cause significant damage, include large ground cracks and settlement of the road. This would be a potentially significant impact, but with implementation of Mitigation Measure G-1a, the impact would be reduced to a less than significant level (Class II).

Mitigation Measure for Impact G-1, Extremely heavy loads could mobilize unstable ground along Old Highway 101 and the San Onofre Bluff area of transport route

G-1a **Prevent overloading of unstable ground along transport route.** ~~Existing~~ Any existing geotechnical reports for these areas shall be obtained and reviewed by SCE~~/~~ and CPUC not less than one year prior to the scheduled transport of the RSGs. SCE~~/~~ and CPUC shall determine if the existing reports provide sufficient information to establish that the geologic formations under and adjacent to the portions of the transport route near the San Onofre Bluffs are sufficiently stable to withstand the extremely heavy loads. If no existing reports are available and/or new investigations are deemed necessary, ~~they~~ new investigations shall be completed not less than ten months prior to transport of the RSGs.

Either the existing geological reports or new studies shall meet the following performance criteria not less than six months before the scheduled start of transport activities:

- Report clearly identifies any and all unstable portions of the transport route.
- SCE or its consultant shall develop plans for any necessary road improvements, which shall be reviewed by the CPUC or its consultant to ensure that proposed improvements would both (1) ensure ground stability of all roads to be used during transport and (2) remain within the footprint of the proposed route so as to ensure that there would be no additional environmental impacts.

Any and all necessary road improvements shall be completed at least 60 days prior to the scheduled start of transport activities. The CPUC or its environmental monitor shall ensure construction activities remain within the defined road footprint. In addition, the CPUC or its consultant shall survey the transport route after the completion of construction (prior to the start of transport activities) to ensure that completed improvements successfully stabilized appropriate portions of all roads to be used during transport.

Impact G-2: Temporary effects of earthquake shaking could endanger worker safety

In the unlikely, but not impossible, event of a major earthquake occurring in the region during the Proposed Project, the effects of ground shaking could endanger workers. This is especially a concern during offloading and transport activities, when large loads would be lifted and handled by cranes and tractor movers. Seismic ground shaking could create sudden breaks in road surfaces, trigger landslides, cause equipment in the offloading and staging areas to topple, and possibly destabilize the transport tractors or the load. Ground shaking could result in liquefaction of loose, saturated beach deposits along the beach segment of the transport route that could destabilize the transport tractors or the load. Workers could be injured or killed if they are in the path of falling or toppling equipment, but implementation of Mitigation Measure G-2a would reduce this impact to a less than significant level (Class II).

Mitigation Measure for Impact G-2, Temporary effects of earthquake shaking could endanger worker safety

G-2a **Protect workers from temporary effects of earthquake shaking.** The Applicant shall produce a safety plan that specifically includes measures that will be taken to ensure worker safety during earthquake-caused ground shaking. This plan shall be submitted to CPUC and MCBCP for review at least 60 days prior to the scheduled commencement of RSG offloading or staging activities, whichever occurs earlier. Elements of the plan should include, but not be limited to the following: (a) a protocol for workers to follow in the event an earthquake occurs; (b) protocols for set-up and management of equipment during the offloading, transport, staging, preparation, and installation phases that address the potential effects of ground shaking; and (c) training for workers so they will know what to do in the event of an earthquake.

Impact G-3: Temporary effects of earthquake-induced tsunami could endanger worker safety

In the unlikely event of an earthquake-induced tsunami during offloading at the MCBCP Del Mar Boat Basin or transport of the RSG along the Beach, seawater runup/surge could reach and flood the work areas. Workers could be injured or killed if the tsunami destabilizes equipment or if the runup washes workers away. The possibility for damage/injury would represent a potentially significant impact that would be mitigated to a less than significant level with Mitigation Measure G-3a (Class II).

Mitigation Measure for Impact G-3, Temporary effects of earthquake-induced tsunami could endanger worker safety

G-3a **Protect workers from temporary effects of tsunami.** The Applicant shall ensure that work crews receive tsunami-warning notifications from the Pacific Tsunami Warning Center (operated by NOAA). The safety plan required under Mitigation Measure G-2a shall include a protocol for workers to follow in the event of a tsunami.

D.5.3.3 Staging and Preparation

Staging and preparation would involve development of temporary facilities to support project activities. Temporary facilities would be located on previously developed or disturbed areas within the SONGS OCA and the Mesa east of I-5. Seismic shaking in the event of an earthquake on one of the nearby faults is the primary potential impact of geology on this part of the project. There would be no impact to geological, soils, or paleontological resources from this portion of the project.

As described for offloading and transport (Impact G-2), ground shaking during a major earthquake could endanger workers during staging and preparation. Seismic ground shaking could create breaks in the developed SONGS area, trigger landslides, and cause equipment in the staging area to topple. Because workers could be injured or killed if they are in the path of falling or toppling equipment, implementation of Mitigation Measure G-2a would be necessary to reduce this impact to a less than significant level (Class II).

D.5.3.4 Original Steam Generator Removal, Staging, and Disposal

Prepare for and Create Containment Opening

Removing the OSGs would require creating a temporary opening in the containment structure. SCE is conducting structural engineering studies to determine the effects of the opening on the load-carrying capability of the containment structure (SCE, 2004a). Depending on the results of the studies, SCE may be required by the NRC to modify the structure or the crane structure within the containment. SCE expects the containment to maintain acceptable integrity with the construction opening in place.

The facility modification review process under NRC regulation (10 CFR 50.59) would address the activity of creating the containment opening and ensure that the restored containment structure would be adequately protected from earthquake hazards. Although the plan for maintaining structural integrity would be developed during the engineering phase of the project, the safety of the containment structure with the opening in place and the restored containment building would be inspected, monitored, and assessed by the NRC during and after restoration (NRC, 2000). The work plan for creating the containment opening and restoring the structure would be reviewed by the NRC with the objectives of: verifying that design changes and engineering evaluations are performed in accordance with NRC license requirements, other standards, and industry criteria; ensuring that nuclear and radiological safety are maintained; and verifying satisfactory implementation of the post-installation test program. Because NRC regulations (10 CFR 50.59 and 10 CFR 100) require maintaining adequate safeguards to ensure seismic safety of the containment structure and NRC oversight would ensure compliance with the applicable standards, seismic hazards would not be expected to compromise the integrity of the modified containment structure. Additional discussion of safety issues related to this activity is provided in Section D.12, System and Transportation Safety.

Original Steam Generator Disposal

The OSGs would be moved from the reactors to a temporary enclosure facility where they would be dismantled, encapsulated, and prepared for transport to an offsite licensed LLRW disposal facility. Disposal of the OSGs would involve brief use of specialized transporters between SONGS 2 & 3 and the rail loading location adjacent to the OCA. Disposal would also involve shipping the LLRW in specialized containers to an off-site location by rail or on regional highways. There would be only transient impacts from the possibility of seismic ground shaking during the work of steam generator removal, staging, and transportation to the disposal site. As identified for other phases of work, an earthquake during this phase could jeopardize worker safety (Impact G-2). Protecting workers from potentially toppling equipment, as in Mitigation Measures G-2a, would reduce Impact G-2 to a less than significant level (Class II). There would be no impacts to geological, soils, or paleontological resources with this phase of the project.

D.5.3.5 Steam Generator Installation and Return to Service

There would be only transient impacts from the possibility of seismic ground shaking during the work of steam generator installation. As identified for other phases of work, an earthquake during this phase could jeopardize worker safety (Impact G-2). Protecting workers from potentially toppling equipment, as in Mitigation Measures G-2a, would reduce Impact G-2 to a less than significant level (Class II). There would be no impacts to geological, soils, or paleontological resources with this phase of the project.

D.5.4 Environmental Impacts and Mitigation Measures for the Alternatives

D.5.4.1 Transportation Route Alternatives

I-5/Old Highway 101 Route Alternative

The I-5/Old Highway 101 Route Alternative would cause Old Highway 101 to be subjected to extremely heavy loads during transport of the RSGs, as with the Proposed Project (Impact G-1). Implementation of Mitigation Measure G-1a would ensure that potentially unstable transport route along Old Highway 101 (Segment I) near the San Onofre Bluffs is not overloaded, which would reduce Impact G-1 to a less than significant level (Class II).

As with the Proposed Project, seismic ground shaking could create sudden breaks in road surfaces, trigger landslides, cause equipment in the offloading and staging areas to topple, and possibly destabilize the transport tractors or the load and could jeopardize worker safety (Impact G-2), which would warrant implementation of Mitigation Measure G-2a (Class II). Also, as with the Proposed Project, offloading activities at the MCBCP Del Mar Boat Basin could potentially be affected by a tsunami, jeopardizing worker safety (Impact G-3), which would warrant implementation of Mitigation Measure G-3a (Class II). There would be no impacts to geological, soils, or paleontological resources with this phase of the project.

MCBCP Inland Route Alternative

The MCBCP Inland Route Alternative would avoid transport along the potentially unstable San Onofre Bluffs, which would avoid Impact G-1, previously identified for the Proposed Project and I-5/Old Highway 101 Route Alternative. This means Mitigation Measure G-1a would not be necessary with the MCBCP Inland Route.

As with the Proposed Project, seismic ground shaking could create sudden breaks in road surfaces, trigger landslides, cause equipment in the offloading and staging areas to topple, and possibly destabilize the transport tractors or the load (Impact G-2), warranting implementation of Mitigation Measure G-2a (Class II); and offloading activities at the MCBCP Del Mar Boat Basin could potentially be affected by a tsunami (Impact G-3), warranting implementation of Mitigation Measure G-3a (Class II). There would be no impacts to geological, soils, or paleontological resources with this phase of the project.

D.5.4.2 OSG Disposal Alternative

OSG Onsite Storage Alternative

Onsite storage of the OSGs would require operation of a long-term storage facility that could be exposed to geologic hazards, and the construction could accelerate soil erosion. Under this alternative, the OSGs would be moved from the containment buildings to a temporary containment facility where they would be

dismantled, encapsulated, and prepared for transport by tractor-trailer to a new onsite OSG Storage Facility. The OSGs would remain on site for either the remainder of SONGS operating life or until an alternate licensed disposal site became available. If an earthquake were to occur during the transport of heavy loads being moved to the OSG Storage Facility, worker safety could be jeopardized by earthquake-induced ground shaking (Impact G-2). Protecting workers from potentially falling or toppling equipment, as required by Mitigation Measure G-2a, would reduce Impact G-2 to a less than significant level (Class II).

Impact G-4: OSG Storage Facility construction activities could accelerate soil erosion

As a result of grading and excavation activities during construction periods, soils at the OSG Storage Facility project site would be exposed to wind and water erosion. Implementing Mitigation Measure G-4a would reduce this impact to a less than significant level (Class II).

G-4a **Prevent accelerated erosion during OSG Storage Facility construction.** SCE or its construction contractor shall implement erosion control measures as part of Best Management Practices that may include the placement of sandbags around basins; use of proper grading techniques; appropriate sloping, shoring, and bracing of the construction site; and covering or stabilizing topsoil stockpiles. Construction industry standard storm water Best Management Practices can be found in the *State of California Storm Water Best Management Practice Handbook*, Construction Activity. An erosion control plan incorporating appropriate Best Management Practices shall be reviewed and approved by the ~~CPUC~~ San Diego Regional Water Quality Control Board (RWQCB) at least 60 days prior to final approval of the OSG Storage Facility design.

Impact G-5: Unsuitable soil conditions could compromise integrity of the OSG Storage Facility

Unsuitable soil conditions consisting of expansive and corrosive soils at each possible location for the OSG Storage Facility could cause damage to the foundation and appurtenant underground structures. Implementation of Mitigation Measure G-5a would ensure that the OSG Storage Facility would not be damaged by expansive or corrosive soils, which would reduce this impact to a less than significant level (Class II).

G-5a **Prepare site-specific geotechnical investigation for OSG Storage Facility.** SCE shall perform a site-specific design-level geotechnical investigation to fully characterize the presence and extent of expansive and corrosive soils. Based on the collected data, appropriate design measures identified by the NRC shall be incorporated into the structural design of the OSG Storage Facility to prevent damage from the presence of expansive or corrosive soils. Design options could include: removal of unsuitable subgrade soils and replacement with engineered fill; installation of cathodic protection systems to protect buried metal utilities; use of coated or nonmetallic (i.e., concrete or PVC) pipes not susceptible to corrosion; construction of foundations using sulfate-resistant concrete; and placement of moisture barriers above and around expansive subgrade soils to help prevent variations in soil moisture content. Geotechnical recommendations should also include site preparation, settlement, bearing capacity, and seismic design parameters. The results of this investigation shall be reviewed ~~and approved~~ by ~~SCE and~~ the CPUC at least 60 days prior to commencing staging and preparation activities.

Impact G-6: Ground shaking could compromise integrity of the OSG Storage Facility

Severe ground shaking could compromise the integrity of the OSG Storage Facility if the materials and design of the structure are not based on all relevant earthquake data, including recent data on earthquake activity near the SONGS site. Estimated PGAs at the SONGS site are approximately 30%g for "soft

rock" or soil type Sc conditions. Mitigation has been identified that would minimize damage to the OSG Storage Facility from severe ground shaking, and with Mitigation Measure G-6a, the storage facility would be designed to reduce this impact to a less than significant level (Class II).

G-6a **Prepare an updated Safety Analysis Report to accommodate the OSG Storage Facility.** SCE shall prepare an update to the SONGS 2 & 3 Safety Analysis Report that accommodates the OSG Storage Facility and submit the report to the CPUC and NRC. The report shall describe the compliance approach with the applicable requirements of NRC regulations 10 CFR 50.59, 72.103, and 72.128. This shall include a geological, seismological, and engineering evaluation that reflects current seismic conditions and their specific effect on the selected OSG Storage Facility location. The Design Earthquake for the proposed OSG Storage Facility site shall be developed by SCE, ~~adjusted~~ as necessary, and SCE shall confirm that the updated information has been submitted to the NRC for consideration in the OSG Storage Facility design plan~~incorporated into the structural design of the facility~~.

D.5.5 Environmental Impacts of the No Project Alternative

The No Project Alternative would probably cause the power plant to shut down prematurely. This would decrease the potential for infrastructure damage or worker injury due to earthquakes or landslides. However, the ~~The~~ No Project Alternative would probably result in the construction of replacement power plants and replacement transmission lines or the expansion of existing power plants elsewhere in southern California. New power plants based on either fossil fuels or renewable energy sources may have local geological impacts or be impacted by geological hazards. Facility siting requirements, normally addressed through CEQA compliance, would likely ensure that the replacement facilities are designed and built to minimize geological impacts or exposure to geological hazards.

D.5.6 Mitigation Monitoring, Compliance, and Reporting Table

Measures G-2a and G-3a would reduce potential environmental impacts resulting from the project-related use of facilities located at MCBCP to a less than significant level. Implementation of these mitigation measures on the Base, however, would require prior approval by the Base Commanding General and would be subject to review under the federal National Environmental Policy Act (NEPA).

Table D.5-~~2~~ 3 shows the mitigation monitoring, compliance, and reporting program for Geology, Soils, and Paleontology.

Table D.5-~~2~~3. Mitigation Monitoring Program – Geology, Soils, and Paleontology

IMPACT G-1	**Extremely heavy loads could mobilize unstable ground along Old Highway 101 and the San Onofre Bluff area of transport route (Class II)**
MITIGATION MEASURE	**G-1a: Prevent overloading of unstable ground along transport route.** ~~Existing~~ Any existing geotechnical reports for these areas shall be obtained and reviewed by SCE~~/~~ and CPUC not less than one year prior to the scheduled transport of the RSGs. SCE~~/~~ and CPUC shall determine if the existing reports provide sufficient information to establish that the geologic formations under and adjacent to the portions of the transport route near the San Onofre Bluffs are sufficiently stable to withstand the extremely heavy loads. If no existing reports are available and/or new investigations are deemed necessary, ~~they~~ new investigations shall be completed not less than ten months prior to transport of the RSGs. Either the existing geological reports or new studies shall meet the following performance criteria not less than six months before the scheduled start of transport activities: • Report clearly identifies any and all unstable portions of the transport route. • SCE or its consultant shall develop plans for any necessary road improvements, which shall be reviewed by the CPUC or its consultant to ensure that proposed improvements would both (1) ensure ground stability of all roads to be used during transport and (2) remain within the footprint of the proposed route so as to ensure that there would be no additional environmental impacts. Any and all necessary road improvements shall be completed at least 60 days prior to the scheduled start of transport activities. The CPUC or its environmental monitor shall ensure construction activities remain within the defined road footprint. In addition, the CPUC or its consultant shall survey the transport route after the completion of construction (prior to the start of transport activities) to ensure that completed improvements successfully stabilized appropriate portions of all roads to be used during transport.
Location	Old Highway 101 segment of transport routes and segment of routes adjacent to San Onofre Bluffs
Monitoring / Reporting Action	Letter report providing summary of geotechnical reports reviewed; New reports if necessary; CPUC to review and approve any road improvements; CPUC to verify stability of road(s) after completion of all reports and construction but before transport
Effectiveness Criteria	Route not damaged during project; area capable of supporting heavy loads; no additional environmental impacts from stabilization of transport route
Responsible Agency	CPUC, California Department of Parks and Recreation
Timing	Prior to start of project (see text of measure for exact time limits)
IMPACT G-2	**Temporary effects of earthquake shaking could endanger worker safety (Class II)**
MITIGATION MEASURE	**G-2a: Protect workers from temporary effects of earthquake shaking.** The applicant shall produce a safety plan that specifically includes measures that will be taken to ensure worker safety during earthquake-caused ground shaking. This plan shall be submitted to CPUC and MCBCP for review at least 60 days prior to the scheduled commencement of RSG offloading

Table D.5-~~2~~3. Mitigation Monitoring Program – Geology, Soils, and Paleontology

	or staging activities, whichever occurs earlier. Elements of the plan should include, but not be limited to the following: (a) a protocol for workers to follow in the event an earthquake occurs; (b) protocols for set-up and management of equipment during the offloading, transport, staging, preparation, and installation phases that address the potential effects of ground shaking; and (c) training for workers so they will know what to do in the event of an earthquake.
Location	Entire transport route
Monitoring / Reporting Action	Provide copy of Safety Plan to CPUC and MCBCP
Effectiveness Criteria	No workers injured by effects of seismic shaking during project
Responsible Agency	CPUC, MCBCP, local planning agencies
Timing	Prior to offloading and transport of RSGs
IMPACT G-3	**Temporary effects of earthquake-induced tsunami could endanger worker safety (Class II)**
MITIGATION MEASURE	**G-3a: Protect workers from temporary effects of tsunami.** The applicant shall ensure that work crews receive tsunami-warning notifications from the Pacific Tsunami Warning Center (operated by NOAA). The safety plan required under Mitigation Measure G-2a shall include a protocol for workers to follow in the event of a tsunami.
Location	Camp Pendleton Del Mar Boat Basin and beach segment of proposed route
Monitoring / Reporting Action	Provide copy of Safety Plan to CPUC and MCBCP
Effectiveness Criteria	No workers injured by effects of tsunami during project
Responsible Agency	CPUC, MCBCP, local planning agencies
Timing	Prior to offloading and transport of the RSGs
IMPACT G-4	**OSG Storage Facility construction activities could accelerate soil erosion (Class II)**
MITIGATION MEASURE	**G-4a: Prevent accelerated erosion during OSG Storage Facility construction.** SCE or its construction contractor shall implement erosion control measures as part of Best Management Practices that may include the placement of sandbags around basins; use of proper grading techniques; appropriate sloping, shoring, and bracing of the construction site; and covering or stabilizing topsoil stockpiles. Construction industry standard storm water Best Management Practices can be found in the *State of California Storm Water Best Management Practice Handbook*, Construction Activity. An erosion control plan incorporating appropriate Best Management Practices shall be reviewed and approved by the ~~CPUC~~ San Diego Regional Water Quality Control Board (RWQCB) at least 60 days prior to commencing staging and preparation activities.
Location	Location of OSG Storage Facility Alternative
Monitoring / Reporting Action	Provide copy of erosion control plan to CPUC
Effectiveness Criteria	Erosion of soils at construction site is limited and controlled
Responsible Agency	CPUC, San Diego RWQCB, NRC
Timing	Prior to commencing staging and preparation activities
IMPACT G-5	**Unsuitable soil conditions could compromise integrity of the OSG Storage Facility (Class II)**
MITIGATION MEASURE	**G-5a: Prepare site-specific geotechnical investigation for OSG Storage Facility.** SCE shall perform a site-specific design-level geotechnical investigation to fully characterize the presence and extent of expansive and corrosive soils. Based on the collected data, appropriate design measures identified by the NRC shall be incorporated into the structural design of the OSG Storage Facility to prevent damage from the presence of expansive or corrosive soils. Design options could include: removal of unsuitable subgrade soils and replacement

Table D.5-~~2~~3. Mitigation Monitoring Program – Geology, Soils, and Paleontology

	with engineered fill; installation of cathodic protection systems to protect buried metal utilities; use of coated or nonmetallic (i.e., concrete or PVC) pipes not susceptible to corrosion; construction of foundations using sulfate-resistant concrete; and placement of moisture barriers above and around expansive subgrade soils to help prevent variations in soil moisture content. Geotechnical recommendations should also include site preparation, settlement, bearing capacity, and seismic design parameters. The results of this investigation shall be reviewed ~~and approved~~ by ~~SCE and~~ the CPUC at least 60 days prior to commencing staging and preparation activities.
Location	Location of OSG Storage Facility Alternative
Monitoring / Reporting Action	Provide copy of Geotechnical Investigation Report to CPUC
Effectiveness Criteria	OSG Storage Facility not damaged by unsuitable soils
Responsible Agency	CPUC, NRC
Timing	Prior to commencing staging and preparation activities
IMPACT G-6	**Ground shaking could compromise integrity of the OSG Storage Facility (Class II)**
MITIGATION MEASURE	**G-6a: Prepare an updated Safety Analysis Report to accommodate the OSG Storage Facility.** SCE shall prepare an update to the SONGS 2 & 3 Safety Analysis Report that accommodates the OSG Storage Facility and submit the report to the CPUC and NRC. The report shall describe the compliance approach with the applicable requirements of NRC regulations 10 CFR 50.59, 72.103, and 72.128. This shall include a geological, seismological, and engineering evaluation that reflects current seismic conditions and their specific effect on the selected OSG Storage Facility location. The Design Earthquake for the proposed OSG Storage Facility site shall be developed by SCE, ~~adjusted~~ as necessary, and SCE shall confirm that the updated information has been submitted to the NRC for consideration in the OSG Storage Facility design plan~~incorporated into the structural design of the facility~~.
Location	Location of OSG Storage Facility Alternative
Monitoring / Reporting Action	Provide copy of Safety Analysis Report update to CPUC and NRC
Effectiveness Criteria	OSG Storage Facility not damaged during ground shaking
Responsible Agency	CPUC, NRC
Timing	Prior to commencing staging and preparation activities

D.5.7 References

California Coastal Commission (CCC), 2000, Staff Report for SCE, SDGE, City of Anaheim, and City of Riverside Proposed Construction of San Onofre Nuclear Generating Stations (SONGS) Units 2 and 3 Temporary Spent Nuclear Fuel Storage Facility, CDP Application No. E-00-014.

California Division of Mines and Geology, 1996, Probabilistic Seismic Hazard Assessment for the State of California, DMG Open-File Report 96-08.

California Geological Survey, 2002, Revised Probabilistic Seismic Hazard Assessment California Fault Parameters.

California Geological Survey, 2005, Probabilistic Seismic Hazards Mapping (PSHM) Ground Motion web site, http://www.consrv.ca.gov/cgs/rghm/psha/index.htm.

CDMG (California Division of Mines and Geology). 1999. Authors: Larose, K., L. Youngs, S. Kohler-Antablin, and K. Garden. 1999. Mines and Mineral Producers active in California (1997-1998). California Department of Mines and Geology (now the California Geological Survey) Special Publication 103.

Kennedy, M. P. 2001. Geologic Map of the Las Pulgas Canyon 7.5' Quadrangle, San Diego County, California: A Digital Database Version 1.0. CGS Preliminary Geologic Map.

Moyle, W. R., Jr. 1973. Geologic Map of Eastern Part of Camp Pendleton, Southern California. USGS Open File Map, Sheet 2 of 2.

Norris, R. M. and R. W. Webb. 1976. Geology of California. Publisher: John Wiley & Sons, Inc.

NRC (Nuclear Regulatory Commission). 2000. NRC Inspection Manual. Inspection Procedure 50001, Steam Generator Replacement Inspection. Issued September 6, 2000.

SCE (Southern California Edison). 1998 Update. San Onofre 2 & 3 FSAR. Section 2.4.6, Probable Maximum Tsunami Flooding.

SCE (Southern California Edison). June 2003 Update. San Onofre 2 & 3 FSAR. Section 2.5, Geology, Seismology, and Geotechnical Engineering.

_____. 2004a. Proponent's Environmental Assessment (PEA) Proponent's Environmental Assessment for Replacement of the SONGS 2 & 3 Steam Generators, including Exhibit SCE-3. Submitted to California Public Utilities Commission. February 27.

_____. 2004b. Attachment #123 to Response to April 15, 2004, Deficiency Notice. June 7.

San Diego County Department of Planning and Land Management. General Plan Seismic Safety Element. 1991.

SCS (Soil Conservation Service). Author: Bowman, Roy H. 1973. Soil Survey of San Diego Area California. United States Department of Agriculture, Soil Conservation Service in cooperation with University of California Agricultural Experiment Station.

Tan, S. S. 1999a. Geologic Map of the San Clemente 7.5' Quadrangle, Orange and San Diego Counties, California: A Digital Database Version 1.0. CGS Preliminary Geologic Map.

_____. 1999b. Geologic Map of the San Onofre Bluff 7.5' Quadrangle, San Diego County, California: A Digital Database Version 1.0. CGS Preliminary Geologic Map.