4.3 GEOLOGIC ISSUES

Would the proposal result in or expose people to potential impacts involving:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Surface fault rupture?	☐	☐	☐	X
b) Seismic groundshaking?	☐	☐	☐	X
c) Seismic ground failure, including liquefaction?	☐	☐	☐	X
d) Seiche, tsunami, or volcanic hazards?	☐	☐	☐	X
e) Landslides and slope instability?	☐	☐	☐	X
f) Erosion, changes in topography, or unstable soil conditions from excavation, grading, or fill?	☐	☐	X	☐
g) Subsidence of the land?	☐	☐	☐	X
h) Expansive soils?	☐	☐	☐	X
i) Unique geologic or physical features?	☐	☐	☐	X

SETTING

REGIONAL SETTING

All of the SDG&E facilities proposed to be sold are located on the western coast of California in the Peninsula Ranges Physiographic Province, an area of moderate to high seismic activity. Major northwest-trending fault zones, including the San Andreas fault, Whittier-Elsinore fault, San Jacinto fault, Newport-Inglewood fault, Offshore Zone of Deformation, and Coronado Banks fault parallel the coastline of Southern California (Jennings, 1988). The San Miguel fault and Casa Blanca fault are active faults in Baja California. The Rose Canyon fault, portions of which are considered active, occurs within 20 miles of most of the facilities. All of the facilities are located within 50 miles of at least one major fault zone and are subject to moderate-to-high seismic activity (see Figure 4.3.1, Regional Fault Map, and Figure 4.3.2, Local Fault Map). The La Nacion fault, Point Loma fault, and Spanish Bight fault (Kennedy, 1975; Kennedy, 1977; Kuper and Gastil, 1977; Treiman, 1984; and Treiman, 1991) are among the potentially active faults in the region that occur near some of the sites. None of the power plants or combustion turbine sites are situated within State of California Alquist-Priolo Special Studies Zones, which are areas designated by the state adjacent to active faults with the greatest risk of damage from seismic activity.

INSERT FIGURE 4.3.1
REGIONAL FAULT MAP

INSERT FIGURE 4.3.2
LOCAL FAULT MAP

The San Andreas fault, Whittier-Elsinore fault, San Jacinto fault, Newport-Inglewood fault, Offshore Zone of Deformation, Coronado Bank fault, and San Miguel fault are major active faults in the region that have produced earthquakes during historic times, and as a consequence, may be expected to generate earthquakes in the future. These faults have a very high probability of generating future earthquakes (Wesnousky, 1986; Petersen, 1996) of potential significance to the SDG&E power plants and combustion turbines (CTs). Although located several hundred miles south of the South Bay Power Plant (and therefore not shown in Figure 4.3.1 or Figure 4.3.2), the Casa Blanca fault has historically been a source of major earthquakes causing low- to moderate-level ground accelerations in the project area.

LOCAL SETTING

Encina Power Plant

The Encina Power Plant is located primarily on a relatively level marine terrace at an elevation ranging from 20 to 40 feet. The power plant site fronts on the Pacific Ocean to the west and on Agua Hedionda Lagoon to the north. Elevations in the vicinity of Agua Hedionda Lagoon and beach range from 0 to 20 feet. The power plant is situated on Pleistocene-aged marine terrace deposits consisting of interstratified sand and silt. Facilities or property located along the margin of Agua Hedionda Lagoon are underlain by Holocene-aged alluvium consisting of interstratified silt, sand and clay (including estuarine deposits), Holocene-aged beach deposits consisting of sand and cobbles, Pleistocene-aged marine terrace deposits, and Eocene-aged Santiago Formation (Tan and Kennedy, 1996).

The marine terminal (buoys) for off-loading of fuel oil at the Encina Power Plant is located approximately 3,000 feet offshore to the west and is connected to the plant via a buried fuel pipeline. Geologic units consist of Holocene-aged beach deposits, Pleistocene-aged marine terrace deposits, and Eocene-aged Santiago Formation in the offshore area (Welday and Williams, 1975; Green and Kennedy, 1987).

South Bay Power Plant

The South Bay Power Plant is situated on tidal flats along the southeastern margin of San Diego Bay. The power plant site is relatively level and is at an elevation ranging between approximately 0 to 20 feet above mean sea level (MSL). The undeveloped areas of the site adjacent to the bay occur at an approximate elevation of 0 to 5 feet above MSL. For construction of the power plant, the tidal flats were built up with artificial fill, approximately 5 to 15 feet or more in depth, consisting of hydraulic fill and other manmade fill materials (Benton Engineering, 1992, 1994; Woodward-Clyde, 1985, 1988; San Diego Unified Port District, 1972; Kennedy, 1977). Below the manmade fill soils, the geologic formations consist of a thick sequence of unconsolidated Holocene-aged bay deposits (bay mud) made up of interstratified silt, sand, and clay. The bay deposits are, in turn, underlain by Late Pleistocene-aged marine terrace deposits, equivalent to the Bay Point Formation (Kennedy, 1977). Deposits of the Pliocene-aged San Diego Formation underlie these materials at depth.

Naval Station CT

The Naval Station CT site at 32nd Street is located on artificially filled land and Holocene-aged bay deposits. The fill is composed of hydraulic fill obtained by dredging of San Diego Bay and/or other fill materials (San Diego Unified Port District, 1972). The fill is underlain by unconsolidated Holocene-aged bay deposits consisting of interstratified sand, silt, and clay (Kennedy and Peterson, 1975).

Division Substation CT

The Division Substation CT site is located on artificially filled land and Holocene-aged bay deposits. The fill is composed of hydraulic fill obtained by dredging of San Diego Bay and/or other fill materials. The fill is underlain by unconsolidated Holocene-aged bay deposits consisting of interstratified sand, silt, and clay. The bay deposits are underlain, in turn, by Late Pleistocene-aged marine terrace deposits equivalent to the Bay Point Formation consisting predominantly of sand and lesser amounts of gravel, silt, or clay (Kennedy and Peterson, 1975).

Naval Training Center CT

The Naval Training Center CT site is located next to the boat channel on artificially filled land. The fill is composed of hydraulic fill obtained by dredging of San Diego Bay. Approximately 10 to 20 feet of hydraulic fill composed of silty fine sand has been identified at the site (Fluor Daniel GTI, 1998a). The fill is underlain by unconsolidated Holocene-aged deltaic deposits or bay deposits consisting of sand, silt, and clay. The bay deposits are underlain, in turn, by Late Pleistocene-aged marine terrace deposits equivalent to the Bay Point Formation consisting predominantly of sand and lesser amounts of gravel, silt, or clay (Kennedy and Peterson, 1975). A buried U.S. Navy landfill exists to the south, beyond the limits of the site.

North Island Naval Air Station CTs

The North Island Naval Air Station CTs site is located on the northerly side of North Island on artificially filled land. The Spanish Bight, an embayment between the City of Coronado and North Island, existed in the vicinity of the site prior to 1944. Hydraulic fill materials from the dredging of San Diego Bay and other artificial fill materials were used for infilling the Spanish Bight (San Diego Unified Port District, 1972). Approximately 10 to 20 feet of hydraulic fill composed of silty fine sand has been identified at the site (Fluor Daniel GTI, 1998a). The fill is underlain by unconsolidated Holocene bay deposits consisting of sand, silt, and clay or is underlain directly by the Late Pleistocene-aged marine terrace deposits equivalent to the Bay Point Formation (Kennedy and Peterson, 1975; Fluor Daniel GTI, 1998a), consisting predominantly of sand and lesser amounts of gravel, silt, or clay.

Kearny Construction and Operation Center CTs

The site of the Kearny Construction and Operation Center CTs is located on a level mesa top that is underlain by Pleistocene-aged marine terrace deposits. These marine terrace deposits are equivalent to the Lindavista Formation (Kennedy and Peterson, 1975), which consists of sand, gravel, and clay. The Lindavista Formation contains expansive clayey soils in this area.

Miramar Yard CTs

The site of the Miramar Yard CTs is located on a level mesa top that is underlain by Pleistocene-aged marine terrace deposits. These marine terrace deposits are equivalent to the Lindavista Formation, which consists of sand, gravel, and clay (Kennedy and Peterson, 1975). The Lindavista Formation contains expansive clayey soils in this area.

El Cajon Substation CT

The El Cajon Substation CT site is located in a broad valley underlain by relatively deep deposits of unconsolidated Holocene-aged alluvium (Tan, 1992) and colluvium (i.e., slopewash). These materials are referred to as unconsolidated slopewash composed of silty sand approximately 10 feet in depth (Fluor Daniel GTI, 1998a). The alluvium and colluvium are underlain at depth by Eocene-aged sedimentary rocks of the Friars Formation composed of interstratified clay and sand and/or by Cretaceous-aged granitic rock of the Southern California Batholith.

24th Street Terminal Refueling Facility

The 24th Street Terminal Refueling Facility, a marine terminal previously used for off-loading and storage of fuel oil, is connected to the South Bay Power Plant via a four-mile-long fuel oil pipeline. The pipeline is located largely within the SDG&E transmission alignment that approximately parallels the railroad tracks west of Interstate 5.

The 24th Street Terminal Refueling Facility is located on artificially filled land and bay deposits along the eastern margin of San Diego Bay. The western edge of the marine terminal is founded on piers. The terminal site is relatively level and is at an elevation of approximately 0 to 10 feet above MSL. A thick sequence of unconsolidated Holocene-aged bay deposits consisting of interstratified silt, sand and clay, which is underlain in turn by Late Pleistocene marine terrace deposits (equivalent to the Bay Point Formation), are present on the site (Kennedy, 1977). Deposits of the Pliocene-aged San Diego Formation underlie these materials at depth. Much of the 24th Street Terminal Refueling Facility is situated on artificial fill composed of hydraulic fill and other fill materials (San Diego Unified Port District, 1972; Kennedy, 1977).

The fuel pipeline crosses terrain underlain by Holocene-aged river alluvium, Holocene-aged bay deposits, and Pleistocene-aged marine terrace deposits. Deposits of the Pliocene-aged San Diego Formation underlie these materials at depth.

CHECKLIST ISSUES

The following checklist issues are based on the understanding that no new large structures or other significant construction is projected to occur as a result of the proposed divestiture. However, some relatively minor improvements to separate divested property from retained property (e.g., switchyards, transmission towers, transmission lines, etc.) are planned. Such minor improvements may involve the construction of access roads to, and fencing around, those SDG&E facilities not included in the divestiture. No significant grading is expected.

a) FAULT RUPTURE

In major earthquakes, fault displacement can cause rupture along the surface trace of the fault, leading to severe damage to any structures or other improvements located on the fault trace. Surface fault rupture generally occurs along an active fault trace, but displacement along faults with a much older displacement history also occurs. No aspect of the project would alter the seismic hazards at the facilities. The approximate locations of regionally major faults in Southern California are shown in Figure 4.3.1, Regional Fault Map. Figure 4.3.2, Local Fault Map, indicates the approximate location of faults in the southwesterly portion of San Diego County and San Diego Bay. None of the power plants or CT sites are located within mapped State of California Alquist-Priolo Special Studies Zones. Potential additional employees at the facilities would not be exposed to fault rupture because none of the facilities are in the immediate vicinity of known faults.

Encina Power Plant

The Encina Power Plant site is not located in the immediate vicinity of any known earthquake faults. The nearest known fault is the active Offshore Zone of Deformation, located offshore approximately 2.5 miles to the west. Therefore, no impacts related to surface fault rupture are anticipated to occur at the Encina Power Plant site.

South Bay Power Plant

The South Bay Power Plant site is not located in the immediate vicinity of any known earthquake faults. The nearest known fault is an unnamed potential fault located approximately 0.5 miles to the east in downtown Chula Vista. The potentially active La Nacion fault and the active Rose Canyon fault are located approximately three miles to the east and nine miles to the north, respectively. Therefore, no impacts related to surface fault rupture are anticipated at the South Bay Power Plant site.

Naval Station CT

The Naval Station CT site at 32nd Street is not located in the immediate vicinity of any known earthquake fault. The nearest known active fault is located approximately 3.5 miles to the northwest. Therefore, no impacts related to surface fault rupture are anticipated at the Naval Station CT site.

Division Substation CT

The Division Substation CT site is not located in the immediate vicinity of any known earthquake fault. The nearest known active fault is the Rose Canyon fault located approximately 3.5 miles to the northwest. Therefore, no impacts related to surface fault rupture are anticipated at the Division Substation CT site.

Naval Training Center CT

The Naval Training Center CT site is not located in the immediate vicinity of any known earthquake faults. The nearest known potentially active fault and active fault are the Point Loma fault and Rose Canyon fault located approximately 1.1 miles to the east and 1.3 miles to the northeast, respectively. Therefore, no impacts related to surface fault rupture are anticipated at the Naval Training Center CT site.

North Island Naval Air Station CTs

The North Island Naval Air Station CTs site is not located in the immediate vicinity of any known active earthquake fault. The nearest known active fault is the Rose Canyon fault located approximately 1.7 miles to the northeast.

The buried trace of the Spanish Bight fault has been mapped through or in close proximity to the North Island Naval Air Station CTs (see Figure 4.3.2). The location and recency of activity of the Spanish Bight fault are based on interpreted offsets of Late Pleistocene marine deposits (equivalent to the Bay Point Formation) from offshore seismic reflection profiling (Kennedy and Welday, 1980; Treiman, 1984, 1991). The Spanish Bight fault, as well as the nearby Coronado and Silver Strand faults, are considered splays of the Rose Canyon fault. North of the site, portions of the Rose Canyon fault are considered active and are mapped as State of California Alquist-Priolo Special Studies Zones. The Spanish Bight fault is not recognized as an active fault and is tentatively considered potentially active. It should be noted that because the Spanish Bight was infilled with thick fill materials, the exact location of the Spanish Bight fault on land and its recency of activity are not well defined. Based on the proximity of the North Island Naval Air Station CTs to the Spanish Bight fault, the potential for ground surface rupture at the site cannot be precluded. However, the project would not contribute to increasing the potential for ground surface rupture at the site.

Kearny Construction and Operation Center CTs

The Kearny Construction and Operation Center CTs site is not located in the immediate vicinity of any known earthquake faults. The nearest known active fault is located approximately 4.9 miles to the west. Therefore, no impacts related to surface fault rupture are anticipated at the Kearny Construction and Operation Center CTs site.

Miramar Yard CTs

The Miramar Yard CTs site is not located in the immediate vicinity of any known earthquake faults. The nearest known active fault is located approximately 4.5 miles to the west. Therefore, no impacts related to surface fault rupture are anticipated at the Miramar Yard CTs site.

El Cajon Substation CT

The El Cajon Substation CT site is not located in the immediate vicinity of any known earthquake faults. The nearest known active fault is located approximately 13 miles to the east.

Therefore, no impacts related to surface fault rupture are anticipated at the El Cajon Substation CT site.

24th Street Terminal Refueling Facility

The 24th Street Terminal Refueling Facility and fuel pipeline are not located in the immediate vicinity of any known earthquake faults. The nearest known fault is an unnamed potential fault located approximately 1.5 miles to the southeast in downtown Chula Vista. The potentially active La Nacion fault and the active Rose Canyon fault are located approximately three miles to the east and six miles to the north, respectively. Therefore, no impacts related to surface fault rupture are anticipated at the 24th Street Terminal Refueling Facility.

Conclusion

Although some of the sites are located on or in close proximity to suspected potentially active faults, none of the sites are located on known active faults or within mapped State of California Alquist-Priolo Special Studies Zones. The physical changes caused by the project would not alter the existing risk of rupture at any of the sites. Therefore, the proposed project would not contribute to increasing the potential for ground surface rupture at the SDG&E facilities involved in the divestiture nor to increasing the potential exposure of people to fault rupture at the sites.

b) SEISMIC GROUNDSHAKING

The project sites occur in an area of moderate-to-high seismic activity, as is most of southern California. Figure 4.3.1, Regional Fault Map, shows the approximate locations of the sites relative to several known active and potentially active faults in the Southern California region. The approximate distances and the maximum credible earthquakes (MCE) associated with some of the faults in the region are indicated in Table 4.3.1. The MCE is equivalent to the Upper Bound Earthquake for the faults as defined by the Division of Mines and Geology (Peterson, 1996). For an MCE of 7.0 on the Offshore Zone of Deformation or on the Rose Canyon fault, all of the project sites would lie within an area of strong groundshaking. However, since most of Southern California is subject to seismic activity, it would be speculative to assume that potential additional employees from the project would be exposed to higher degrees of seismic groundshaking.

Conclusion

The project sites are located within an area subject to strong groundshaking. However, the project would not contribute to increasing the potential for groundshaking at the SDG&E sites proposed for divestiture, nor would any access roads and fences that may be constructed as a result of this project cause groundshaking impacts.

TABLE 4.3.1
ACTIVE AND POTENTIALLY ACTIVE FAULTS NEAR SDG&E POWER PLANTS AND COMBUSTION TURBINES

Facility	Fault	Trend	Closest Segment (miles)	Recency of Movement	MCE[a]	MPE[b]
Encina Power Plant	Offshore Zone of Deformation	NNW	2.5	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	24.0	Historic	7.5	7.2
South Bay Power Plant	Rose Canyon	NNW	9.0	Holocene	7.0	6.5
	La Nacion[c]	NNW	3.0	Late Pleistocene	6.8	NA
	Coronado Bank	NNW	12.0	Holocene	7.0	6.2
	Whittier-Elsinore	NNW	44.0	Historic	7.5	7.2
Naval Station CT	Rose Canyon	NNW	3.5	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	42.0	Historic	7.5	7.2
Division Substation CT	Rose Canyon	NNW	3.5	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	42.0	Historic	7.5	7.2
Naval Training Center CT	Rose Canyon	NNW	1.3	Holocene	7.0	6.5
	Point Loma[c]	NW	1.1	Late Pleistocene	5.5	NA
	Whittier-Elsinore	NNW	43.0	Historic	7.5	7.2
North Island Naval Air Station CTs	Rose Canyon	NNW	1.7	Holocene	7.0	6.5
	Spanish Bight[c]	NE	0.0	Late Pleistocene	6.5	NA
	Point Loma[c]	NNW	1.9	Late Pleistocene	6.5	NA
	Whittier-Elsinore	NNW	44.5	Historic	7.5	7.2
Kearny Construction and Operation Center CTs	Rose Canyon	NNW	4.9	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	34.0	Historic	7.5	7.2
Miramar Yard CTs	Rose Canyon	NNW	4.5	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	34.0	Historic	7.5	7.2
El Cajon Substation CT	Rose Canyon	NNW	13.0	Holocene	7.0	6.5
	Whittier-Elsinore	NNW	30.0	Historic	7.5	7.2
24th Street Terminal Refueling Facility	Rose Canyon	NNW	6.0	Holocene	7.0	6.5
	La Nacion[c]	NNW	3.0	Late Pleistocene	6.8	NA
	Coronado Bank	NNW	12.0	Holocene	7.0	6.2
	Whittier-Elsinore	NNW	44.0	Historic	7.5	7.2

[a] MCE = Maximum Credible Earthquake Magnitude; an estimate of the largest earthquake judged by geologic studies capable of occurring on a fault or segment of a fault.

[b] MPE = Maximum Probable Earthquake Magnitude; an estimate of the largest earthquake judged by geologic studies capable of occurring on a fault during a design period.

[c] Potentially active fault (known movement during Pleistocene, but not during Holocene). Potentially active faults are only presented maximum credible earthquakes. They are not presented for maximum probable earthquakes.

SOURCES: Wesnousky, S.G., 1986, Earthquakes, Quaternary Faults and Seismic hazards in California, in Journal of Geophysical Research, Vol. 91, No. B12; Greensfelder, R.W., 1974, Maximum Credible Rock Accelerations from Earthquakes in California, California Division of Mines and Geology, Map Sheet 23; Ploessel, M.R. and Slosson, J.E., 1974, Repeatable High Ground Accelerations from Earthquakes, Important Design Criteria, Division of Mines and Geology: California Geology, September 1974; and References.

c) SEISMIC GROUND FAILURE

Earthquakes may cause secondary ground failures. Seismically induced ground failures are caused by a loss of strength and failure of the underlying soils after repeated cycles of shaking. Examples of seismically induced ground failure include liquefaction, lateral spreading, ground-lurching, and subsidence. Liquefaction (the rapid transformation of a soil to a fluid-like state) typically occurs in loose, saturated, granular soils such as sands and in non-plastic silts. Earthquake groundshaking induces a rapid rise in excess pore pressure, and the soil loses its strength and capacity to support structures. It may spread laterally, settle, form fissures (i.e., open voids or fractures in the ground) or form sand boils (i.e., upwellings of sand at the surface). Lateral spreading is the horizontal movement of loose, unconfined sedimentary and fill deposits during seismic activity. Ground-lurching is the horizontal movement of soil, sediments, or fill located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Subsidence is the vertical downward movement of the ground surface and can be associated with seismic activity.

Each of the project sites is located in an area of moderate seismic activity in relatively close proximity to several major active faults. Many of the sites are situated on the margin of San Diego Bay and underlain by unconsolidated Holocene-aged bay deposits consisting of saturated, relatively loose sand and silt, and by artificial fill (i.e., hydraulic fill and other manmade fill materials).

Because of the nature of the underlying soil conditions and the site terrain at all of the sites (except the Kearny and Miramar Yard CTs), seismically induced ground failure (e.g., liquefaction, lateral spreading, ground-lurching, etc.) is considered a significant potential hazard at the sites. Proposed improvements that may be constructed as a part of the parcelization of the site (e.g., fences or minor graded access roads) could be impacted as a result of seismically induced ground failure. However, the proposed access road and fences are not critical to the operation of the facility, and any impacts would not be considered significant. Due to the relatively dense nature of the underlying soils and the pressure of a regionally deep static water table at the Kearny and Miramar Yard CT sites, these sites are not subject to seismically induced ground failure. As with seismic groundshaking, it would be speculative to assume that potential additional employees would be subject to higher degrees of seismic ground failure, since most of Southern California is subject to seismic activity.

Conclusion

Many of the SDG&E facilities are located within areas subject to seismically induced ground failure. However, the proposed project would not increase the potential for seismically induced ground failure at the SDG&E facilities.

d) SEICHE, TSUNAMI, AND VOLCANIC HAZARDS

Seiches are long-period oscillatory waves in enclosed or partially enclosed water bodies (e.g., harbors, bays, lakes, etc.) generated by atmospheric pressure differences, wind, and seismic tremors.

Tsunamis are long-period seismic sea waves (long relative to water depth) generated by sudden movements of ocean bottom during submarine earthquakes, landslides, or volcanic activity. The two source regions in the Pacific Ocean primarily responsible for tsunamis that could damage California are the Aleutian Trench and the Peru-Chile Trench. Southern California, south of Point Conception, is considered much less susceptible to severe tsunamis than areas to the north, owing to the orientations of the coastal area of San Diego County. The maximum water level rise or fall (wave height amplitude) caused by tsunamis or seiches recorded at tide gages in La Jolla, San Diego, and Los Angeles between 1946 and 1998 were 3.3 feet, 4.6 feet, and 5.0 feet, respectively (Lander, 1993; U.S. Army Corps of Engineers, 1986 and 1989).

Volcanic hazards include the eruption of volcanoes, burial by lava flows or ejected pyroclastic debris, emanations of toxic gases or thermal springs, volcanic tremors or earthquakes, and deformation by tectonic uplift. No known Holocene-aged volcanoes are located within San Diego County. The nearest known major volcanoes of potential significance to the SDG&E facilities included in the divestiture are Cerro Prieto and Volcan Prieto. These volcanoes are located 100 miles or more to the southeast on the Gulf of California in Mexico and had significant volcanic activity during the Pleistocene and Pliocene.

Due to the proximity of the bay or ocean, some of the plant sites may be subject to tsunami and seiche hazards. Since tsunami hazards exist along all of the Pacific coast and seiche hazards exist around enclosed water bodies in the western states, it is speculative that potential additional employees would be subject to a higher degree of hazard from the project. Volcanic hazards would not be expected at any of the sites. The potential improvements (e.g., fences or access roads) at some of the sites may be subjected to tsunami or seiche hazards; however, these facilities would not be critical to the operation of the plants.

Conclusion

A few of the sites are located near large water bodies subject to tsunamis and seiches of relatively low magnitude. However, the proposed project would not contribute to increasing the potential for tsunamis or seiches at the SDG&E facilities. The potential impact due to volcanic hazards on all of the sites is considered negligible.

e) LANDSLIDES AND MUDFLOWS

Encina Power Plant

The Encina Power Plant site is not located in the vicinity of any known landslides or mudflows. Based on a geotechnical report (Woodward-Clyde, 1994), an area of over-steepened slopes resulted in a previous slope failure along the edges of the Lower Lagoon at the site. The slope failure was subsequently repaired using stabilization measures. Although major slopes are present at the site, no other areas of slope instability were reported at the Encina Power Plant site.

South Bay Power Plant

The South Bay Power Plant site is not located in the vicinity of any known landslides or mudflows. The site varies from nearly level to sloping ground. Major slopes are present in the easterly portion of the site, and low slopes are present along the shoreline facing San Diego Bay and elsewhere on the site. While some potential for instability may be present on the site, no reports or other evidence of slope instability were found. Therefore, the level of hazard from future instability is considered relatively low to moderate.

Naval Station CT

The Naval Station CT site at 32nd Street is nearly level and is not located in the vicinity of any known landslides or mudflows. Therefore, the potential for slope instability is considered low.

Division Substation CT

The Division Substation CT site is nearly level and is not located in the vicinity of any known landslides or mudflows. Therefore, the potential for slope instability is considered low.

Naval Training Center CT

The Naval Training Center CT site is nearly level, except for a slope located along the northwest side of the site adjacent to the boat channel. No landslides or mudflows are known to have occurred in the vicinity of the site. While the potential for future instability in the slope along the boat channel cannot be precluded, the potential impact on the project is considered low because of the relatively low slope height and distance of the slope from the project facilities.

North Island Naval Air Station CTs

The North Island Naval Air Station CTs site is nearly level and is not located in the vicinity of any known landslides. Therefore, the potential for slope instability is considered low.

Kearny Construction and Operation Center CTs

The Kearny Construction and Operation Center CTs site is nearly level and is not located in the vicinity of any known landslides. Therefore, the potential for slope instability is considered low.

Miramar Yard CTs

The Miramar Yard CTs site is nearly level and is not located in the vicinity of any known landslides. Therefore, the potential for slope instability is considered low.

El Cajon Substation CT

The El Cajon Substation CT site is nearly level and is not located in the vicinity of any known landslides. Therefore, the potential for slope instability is considered low.

24th Street Terminal Refueling Facility

The 24th Street Terminal Refueling Facility site is not located in the vicinity of any known landslides or mudflows. A low slope is present along the westerly side of the terminal, which fronts on San Diego Bay. While the potential for future instability in the slope along the waterfront cannot be precluded, the potential impact on the project is considered low because of the relatively low slope height.

Conclusion

None of the project sites are located on known ancient landslides or mudflows. A slope failure was documented at the Encina Power Plant site in a slope adjacent to Agua Hedionda Lagoon. Several of the sites are located in geologic materials and terrain that may have a potential for slope instability. Despite these conditions, the sale and continued use of the SDG&E facilities would not increase the potential for slope instability, landslides, or mudflows.

f) EROSION, CHANGES IN TOPOGRAPHY, AND UNSTABLE SOIL CONDITIONS

Many of the sites are located in areas of weakly cemented, unconsolidated soils that may be subject to erosion. Unstable soil conditions related to the presence of potentially compressible soils also appear to exist at the sites. Such conditions could cause settlement of new facilities. Construction of potential new facilities (e.g., fences or minor graded access roads) or soil remediation activities could cause soil erosion. However, the flat topography of most of the sites and the use of standard construction methods that minimize erosion potential would result in only minor soil erosion potential.

Conclusion

The proposed project would not contribute to increasing the potential for changes in topography or unstable soil conditions at the SDG&E facilities. While construction of proposed facilities (e.g., access roads and fences) may cause minor erosion impacts, these impacts would be less than significant.

g) SUBSIDENCE OF THE LAND

Ground subsidence is a geologic hazard typically associated with an increase in effective stresses in unconsolidated sedimentary materials over a region caused by heavy withdrawal of groundwater or petroleum by pumping, by decomposition or degassification of peat or other organic-rich soils, or by tectonic movements. Ground fissures and open voids at the ground surface are commonly associated with areas of ground subsidence. No data that document regional ground subsidence or ground fissures in the vicinity of any of the SDG&E facilities included in the divestiture are known to exist. However, based on a field reconnaissance of the sites, the potential for ground subsidence at the sites appears to be relatively low.

Conclusion

None of the sites are located in areas of known ground subsidence. The proposed project would not increase the potential for ground subsidence at the SDG&E facilities.

h) EXPANSIVE SOILS

Expansive soils occur throughout areas of San Diego County that are underlain by fine-grained soils such as plastic silts and clays. The phenomenon occurs when water infiltrates into the soil matrix, causing an expansion (swelling) of the fine-grained soils. Deterioration of structures and pavements can result when they are not designed to withstand the soil pressures exerted by expansive soils.

Based on a review of data and experience in the region, expansive soils are anticipated to exist on many, if not all, of the SDG&E sites included in the project.

Conclusion

The proposed project, involving the sale and continued use of electricity generating facilities, would not increase the potential for expansive soil impacts at the SDG&E facilities.

i) UNIQUE GEOLOGIC OR PHYSICAL FEATURES

No unique geologic or physical features, such as unique rock outcroppings or geologic landmarks, are known to exist at the SDG&E facilities. Therefore, the project would cause no impacts.

Conclusion

The proposed project would not affect any unique geologic or physical features at the SDG&E facilities.

REFERENCES — Geologic Issues

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