SECTION 6.0

Alternatives

This section discusses alternatives to the Contra Costa Generating Station (CCGS) as proposed in this Application for Certification (AFC). These include the "no project" alternative, power plant site alternatives, linear facility route alternatives, technology alternatives, water supply alternatives, and wastewater disposal alternatives. These alternatives are discussed in relation to the environmental, public policy, and business considerations involved in developing the project. The main objective of the CCGS is to produce environmentally responsible, cost effective, operationally flexible, and efficient electrical power in the San Francisco Bay Area.

The Energy Facilities Siting Regulations (Title 20, California Code of Regulations [CCR], Appendix B) guidelines titled *Information Requirements for an Application* require:

> A discussion of the range of reasonable alternatives to the project, including the no project alternative…which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and an evaluation of the comparative merits of the alternatives.

The regulations also require:

> A discussion of the applicant's site selection criteria, any alternative sites considered for the project and the reasons why the applicant chose the proposed site.

6.1 Project Objectives

The key objective of the CCGS is to provide approximately 624 megawatts (MW) of environmentally responsible, cost-effective, operationally flexible, and efficient power capacity to the San Francisco Bay Area. The project will displace older and inefficient generation in the Bay Area and has been designed to be able to start up and ramp up very quickly to backstop intermittent, renewable generation sources. As more renewable resources are brought on line as a result of electric utilities meeting California's Renewable Portfolio Standard (RPS), projects such as CCGS that are strategically located within the load centers and are specifically designed to ramp up quickly will be critical in supporting local electrical reliability and grid stability.

The CCGS would provide needed electric generation capacity with improved efficiency and operational flexibility to help meet northern California's long-term electricity needs. Pacific Gas and Electric Company (PG&E) has identified a near-term need for new power facilities that can be online by or before 2015 and that can support easily dispatchable and flexible system operation. PG&E has issued a Request for Offers (RFO) to obtain these energy resources from qualified bidders. The CCGS is participating in this RFO. The CCGS's project objectives are consistent with and address this need as follows:

- Provide the most efficient, reliable, and predictable power supply available by using combined-cycle, natural gas-fired combustion turbine technology capable of supporting the growing power needs of the Bay Area
- Use state-of-the-art technology to provide operational flexibility and rapid-start and dispatch capability
- Site the project within the area of electrical demand and near existing infrastructure, thus minimizing the project's linears
- Site the project on a brownfield site

In addition to technology alternatives described in this section, project objectives for site selection included minimizing or eliminating the length of any project linears, including gas and water supply lines, discharge lines, and transmission interconnections. These objectives minimize potential offsite environmental impacts and the cost of construction.

In responding to and addressing the need for environmentally responsible, cost-effective, operationally flexible, and efficient power capacity in the Bay Area, the project includes the following project objectives related to site selection:

- Site control readily available, brownfield site preferred
- Adjacent to or near a 115-kilovolt (kV) or 230-kV high-voltage electrical transmission lines
- Adjacent to or near high-pressure natural gas transmission lines
- Industrial land use designation with consistent zoning
- Large enough to accommodate the site including construction laydown
- Located near centers of demand for maximum efficiency and system benefit
- Potential environmental impacts can be mitigated and minimized

The proposed CCGS site meets all of the project siting objectives.

The CCGS will provide power to the grid to help meet the need for electricity and to help replace dirtier, less-efficient fossil fuel generation resources retired because of age or cost of producing power. The CCGS will enhance the reliability of the state's electrical system by providing power generation near the centers of electrical demand. Additionally, as demonstrated by the analyses contained in this AFC, the project would not result in any significant environmental impacts. Therefore, as will be detailed in the following sections, there are no alternatives that would be preferred over the project as proposed.

6.2 The "No Project" Alternative

The "no project" alternative would forego all of the benefits associated with the CCGS project. In addition, the "no project" alternative would likely result in more energy production from the existing older and less efficient power plants in the region. In addition to the ongoing environmental impact of using the less efficient and less environmentally

benign generation, there would likely be some negative economic consequences for the region's commercial and residential ratepayers and for the regional economy.

In summary, the "no project" alternative would not serve the growing needs of the Bay Area and California's businesses and residents for economical, reliable, and environmentally sound generation resources. Moreover, the "no project" alternative would not satisfactorily meet the project objectives specified above and thus was rejected in favor of the proposed project.

6.3 Power Plant Site Alternatives

For comparison purposes, and to meet the requirements of the California Environmental Quality Act (CEQA) and Title 20, alternative sites were chosen that could feasibly attain most of the project's basic objectives. The alternative sites are shown in Figure 6.3-1. The key siting criteria in considering these alternatives and the proposed CCGS site are provided in Section 6.1.

6.3.1 Proposed Project Site

The proposed site is located near the southeast corner of Wilbur Avenue and Bridgehead Road, south of the former DuPont facility in Oakley, California. The property is currently farmed for wine grapes and is approximately 22 acres. The property is zoned as Heavy Industrial, although it is included within the DuPont Specific Plan as a redevelopment area. For this reason, it appears in the current City Zoning map as P-1RA, Redevelopment. On the April 8, 2008 City Redevelopment planning map, the project site is shown as being proposed for a Utility Energy zoning. The site is also designated in the Oakley 2020 General Plan for Utility Energy land use.[1]

The site would require an approximately 2.4-mile-long electrical transmission line to connect to the PG&E Contra Costa Substation. The site is located within 100 feet of PG&E's existing 69-kV transmission corridor. The CCGS will tie into the adjacent PG&E Antioch natural gas terminal located on the northern border of the site. Water would be provided from an existing pipeline currently used to supply the DuPont facility. The nearest residence is located approximately 2,600 feet southwest of this site. The site is owned by DuPont and is controlled by Contra Costa Generating Station, LLC, through an option to purchase.

The site meets all of the project's objectives and would have no significant, unmitigated, environmental impacts. The CCGS site:

- Is located adjacent to a PG&E natural gas supply transfer station
- Is located approximately 100 feet from PG&E's two existing 69-kV corridors
- Has an adjacent parcel for construction laydown areas
- Is located near the centers of demand for maximum efficiency and system benefit
- Minimizes construction impacts on existing residences and businesses
- Has feasible mitigation of potential environmental impacts

[1] The City of Oakley, when first incorporated in 1999, adopted the Contra Costa County zoning map and zoning ordinance pending reconsideration by the City of Oakley. The City of Oakley published its General Plan, with planned land use designations in 2002 and has begun rezoning certain portions of the city as redevelopment areas under specific plans.

6.3.2 Alternative 1: 18th Street Site

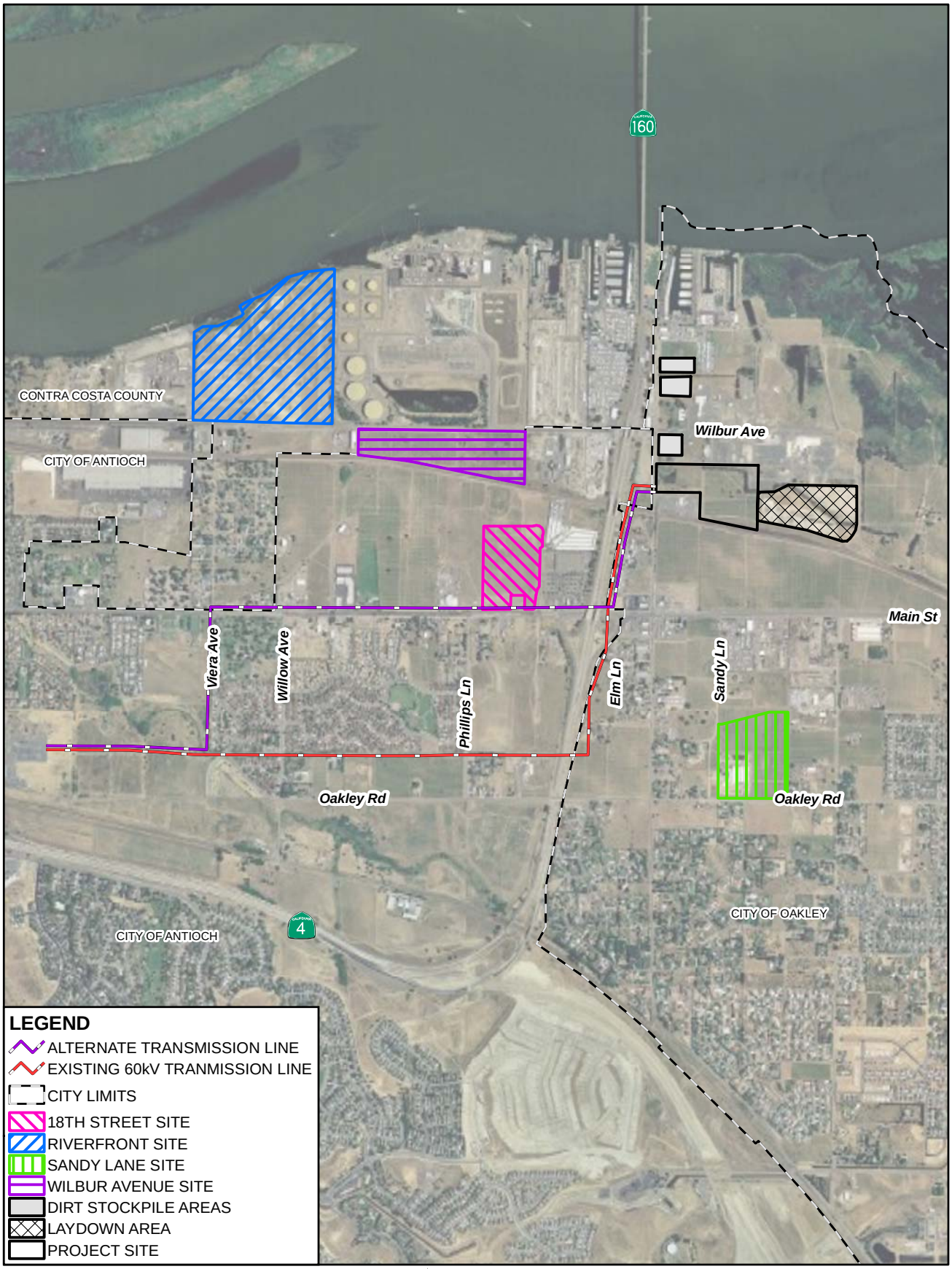
This alternative is approximately 0.6 mile southwest of the CCGS, south of PG&E's Gateway Generating Station between the Burlington Northern Santa Fe (BNSF) railroad tracks and East 18th Street in Antioch. This property is undeveloped and is approximately 26 acres. The property is zoned as Planned Business Center and Planned Development District and is located within the City of Antioch. A power plant in this location would be an inconsistent use with the zoning and would require a zoning and general plan amendment. The site would require an approximately 1.5-mile-long electrical transmission line to connect to PG&E Contra Costa Substation and a 0.8-mile-long natural gas line to tie into the existing PG&E Antioch Terminal to the northeast. The nearest residence is located approximately 120 feet south of this site. It is unknown whether site control would be feasible at this location.

6.3.3 Alternative 2: Wilbur Avenue Site

This alternative is located approximately 0.5 mile west of the CCGS, south of PG&E's Gateway Generating Station between Wilbur Avenue and the BNSF railroad. This property is partially farmed and is approximately 29 acres. The property is zoned as Heavy Industrial and is in unincorporated Contra Costa County. A power plant would be consistent with this zoning. Several PG&E transmission line corridors traverse the western portion of this property, limiting the amount of space available for construction of a plant. The site would require an approximately 1.4-mile-long electrical transmission line to connect to the PG&E Contra Costa Substation and an approximately 0.6-mile-long natural gas line to tie into the existing PG&E Antioch Terminal to the east. The nearest residence is located approximately 1,200 feet west of this site. It is unknown whether site control would be feasible at this location.

6.3.4 Alternative 3: Riverfront Site

This alternative is approximately 1.1 mile west of the CCGS, located on the north side of Wilbur Avenue immediately adjacent to Riverfront's Contra Costa Power Plant, and bordered on the north by the San Joaquin River. The property is adjacent to oil storage tanks from the Mirant Contra Costa Power Plant. This property is undeveloped and is approximately 80 acres. The property is zoned as Heavy Industrial and is in unincorporated Contra Costa County. A power plant would be consistent with this zoning. The site would require an approximately 1.4-mile long transmission line to connect to the PG&E Contra Costa Substation and a 1.2-mile-long natural gas line to tie into the PG&E Antioch Terminal to the east. The nearest residence is located approximately 500 feet south of this site. The owners of the site were contacted numerous times and were unwilling to sell or lease the site; as such, site control would not be feasible at this location.



This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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FIGURE 6.3-1
ALTERNATIVE LOCATIONS
CONTRA COSTA GENERATING STATION
OAKLEY, CALIFORNIA

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6.3.5 Alternative 4: Sandy Lane Site

This alternative is approximately 0.6 mile south of the CCGS and is bordered by Oakley Road to the south and Sandy Lane to the west. This property is farmed and is approximately 30 acres. The property is zoned as P-1RA, or Redevelopment, and is in the City of Oakley. The site would require an approximately 2-mile-long electrical transmission line to connect to the PG&E Contra Costa Substation and 0.8-mile-long natural gas line to tie into the PG&E Antioch Terminal to the north. The nearest sensitive receptor is located approximately 120 feet south of this site. It is unknown whether site control would be feasible at this location.

6.4 Comparative Evaluation of Alternative Sites

In the discussion that follows, the sites are compared in terms of each of the 16 topic areas required in the AFC, as well as in terms of project development constraints. The most useful topics for comparison are as follows:

- **Project Development Constraints—**Are there site characteristics that would prohibit or seriously constrain development, such as significant contamination problems, or lack of fuel, transmission capacity, or water?
- **Land Use Compatibility—**Is the parcel zoned appropriately for industrial use and compatible with local land use policies?
- **Routing and Length of Linear Facilities—**Can linear facilities be routed to the site along existing transmission lines, pipelines, and roads? Will linear facilities be significantly shorter for a given site?
- **Visual Resources—**Are there significant differences between the sites in their potential for impact on valuable or protected viewsheds?
- **Biological Resources—**Would there be significant impacts on wetlands or threatened or endangered species such that mitigation of these effects would be unduly expensive or constrain the supply of available mitigation resources?
- **Contamination—**Is there significant contamination onsite, such that cleanup expense would be high or such that cleanup would cause significant schedule delay?
- **Noise—**Is the site sufficiently near a sensitive receptor area such that it would be difficult to mitigate potential noise impacts to below the level of significance?
- **Use of Previously Disturbed Areas—**Has the site been previously disturbed? Does the site minimize the need for clearing vegetation and otherwise present low potential for impact on biological and cultural resources?
- **Other Environmental Categories—**Are there significant differences between the sites in their potential for impact in other environmental categories?

There is no precise mathematical weighting system established for considering potential impacts in alternatives analyses. Some of the criteria used to compare the alternatives are more or less important to consider than others. For example, an impact that could affect

public health and safety or could result in significant environmental impacts is obviously of greater concern than a purely aesthetic issue associated with an advisory design guideline. It is important in comparing alternatives to focus on the key siting advantages and the potential adverse environmental effects of a particular site. Comparing each of the environmental disciplines and giving each discipline equal weight would provide a misleading analysis because effects in one area are not necessarily equivalent in importance to effects in another area.

For example, although the sites may differ in terms of available local road and street capacities and the current levels of traffic congestion, the number of workers during the operational phase of the project is low and would be unlikely to have a significant effect on local traffic. The sites may differ widely in the amount of traffic congestion they would cause during construction, but this is a temporary impact and should not be a strong consideration in site selection, as long as measures to mitigate this impact are feasible. The sites would not differ significantly in terms of geological hazards, though proximity to a major fault would call for more rigorous and expensive seismic engineering. Hazardous materials handling and worker health and safety issues would be the same or nearly the same for most sites. Though the risk of a release of hazardous materials during transport might be seen as more or less likely depending on location (roadway hazards, in particular), the record of safe transport and handling of such materials is clear. Further, the sites considered here are all in or near urban areas that are served by good transportation networks and are close to the sources of supply.

Project effects on paleontological and cultural resources are not often consequential in comparing alternatives. Once an initial screening for effects on highly significant sites is completed, the probabilities of encountering hidden paleontological or cultural resources during construction are difficult to calculate or compare.

6.4.1 Project Development Constraints

As indicated in the introductory descriptions of each of the alternative sites, the basic needs of power plant siting for land, access to electrical transmission, gas supply, and water are met at the CCGS site.

The 18th Street site would require offsite linears to connect to gas, transmission, and water. The transmission interconnection would be approximately the same length as for the CCGS; however, this site would require a longer gas and water supply pipeline.

The Wilbur Avenue site would require offsite linears to connect to gas, transmission, and water. The transmission interconnection would be approximately the same length as for the CCGS; however, it would require a longer gas and water supply pipeline. Additionally, the site is traversed by several PG&E transmission lines, which essentially render almost 50 percent of the site unusable.

The Riverfront site would require offsite linears to connect to gas, transmission, and water. The transmission interconnection would be approximately the same length as for the CCGS; however, this site would require a longer gas and water supply pipeline. Additionally, the site is located near abandoned oil storage tanks at Mirant's Contra Costa Power Plant and it is uncertain what the costs and schedule impacts might be for dealing with any required cleanup or mitigation resulting from the tanks' proximity.

The Sandy Lane site would require offsite linears to connect to gas, transmission, and water. The transmission interconnection would be longer than that for the CCGS, and the site would also require a longer gas and water supply pipeline than that for the CCGS. The electrical transmission line would be shorter than the one for CCGS. Orchard Park School (kindergarten through eighth grade) is located approximately 700 feet east of this site. For this reason (the site is less than 1,000 feet from a school), under Air Resources Board rules, the application for an Authority to Construct air permit (in this case, under the California Energy Commission's [CEC] jurisdiction) would require a more rigorous permitting process.

6.4.2 Air Quality

The quantity of emissions from project operation would be the same at any of the sites. Each of the sites has similar contributions to airsheds and, therefore, would be subject to similar review, emission reduction crediting, and permitting requirements, except for the Sandy Lane site, which is less than 1,000 feet from a school. Each site is on relatively flat terrain that will help to promote dispersion of emissions. The differences between the sites in terms of their distances from the nearest residences should not make a significant difference in air quality impacts at these residences. Mitigation would bring any potential impacts to a level below significance for any of the alternatives.

6.4.3 Biological Resources

The CCGS site has some biological resources or habitat value. The entire site consists of a vineyard that has been actively farmed for several years and may provide some limited habitat. In addition, a 0.62 acre wetland area, constructed in 1996 as mitigation for offsite impacts related to the Lauritzen Yacht Harbor, is adjacent to the west end of the CCGS site. Both the Wilbur Avenue and Sandy Lane sites are actively farmed, and there appears to be limited habitat at the sites. Because these two sites are similar in context to the CCGS site and are located near areas with known threatened and endangered species, the biological resources permitting and mitigation requirements are likely to be similar to those for CCGS.

The Riverfront site is located in a heavily industrial area and, although the parcel is undeveloped, the northern boundary of the site is the San Joaquin River. Because of the proximity of the river, which is known to contain threatened and endangered species, mitigation and permitting (state and federal) for biological resources may be required to develop the Riverfront site.

The 18th Street site is undeveloped and currently not in agricultural production. The surrounding uses include the PG&E Gateway Generating Station, as well as an automobile salvage yard and some actively farmed fields. Because of the proximity of the farmed fields and because the site is undeveloped, it is possible for the site to have some limited biological resources.

6.4.4 Cultural Resources

There are no known significant cultural resources at the CCGS site. Resources of the 18th Street, Wilbur Avenue, Riverfront, and Sandy Lane sites are unknown. Each of the sites has approximately the same general cultural resource sensitivity except for the Riverfront site, which has high sensitivity because of its location on the San Joaquin River.

6.4.5 Geological Resources and Hazards

There would be no significant difference among the sites in terms of geological resources and hazards. There are no geological resources located on or near any of the sites.

6.4.6 Hazardous Materials Handling

There would be no significant difference among the site locations in terms of hazardous materials handling. The uses of hazardous materials would be the same for any of the sites. Though there might be differences in the distances that trucks carrying hazardous materials would travel to deliver the materials, these differences would be minor and would not necessarily be consequential, given the effective mitigation measures available and the excellent safety record for transport of these materials.

6.4.7 Land Use and Agriculture

The proposed CCGS site is currently zoned H-I, Heavy Industrial.[2]. Although power plants are not specifically mentioned in the Contra Costa County zoning ordinance, it appears the H-I zone was intended to allow most heavy manufacturing uses. The site is located in a redevelopment zone with a General Plan land use designation of Utility Energy. According to the City of Oakley's zoning ordinance, "The Utility Energy designation allows for power plant uses involved in the clean production of electricity utilizing the best available combustion turbine technology."

The 18th Street site is zoned PBC and C-3 (Planned Business Center and Planned Development District, respectively). A power plant is not an approved use for these zones, and would require a zoning and general plan amendment. The Wilbur Avenue and Riverfront sites are both designated H-I, Heavy Industrial, which allows for the use of power plants. The Sandy Lane site is also zoned H-I (Contra Costa County zoning) and is included in the proposed River Oaks Crossing Specific Plan. If the Specific Plan is finalized, the site will be zoned P-1RA. A power plant may not be an allowable use for this area, as the intent is to create a commercially zoned area.

The proposed CCGS site is designated by the California Department of Conservation as Farmland of Statewide Importance; however, it is in a designated urban growth boundary. The 18th Street site is designated as Farmland of Statewide Importance (~30%) and Other (~70%) and is similarly in a designated urban growth infill area. The Wilbur Avenue site is designated as Unique Farmland (~50%) and Farmland of Local Importance (~50%) and is also in a designated urban growth area. The Riverfront and Sandy Lane sites are both designated as Urban and Built Up. Neither the CCGS site nor the four alternative sites have a Williamson Act contract.

6.4.8 Noise

Developments at each site would be able to meet the appropriate city and county noise standards. Table 6.4-1 identifies the nearest residence to each site. As the table shows, the CCGS site is approximately 900 from the nearest residence, a trailer park. The 18th Street,

[2] As stated above, this specific zoning was established before the City of Oakley incorporated in 1999. Although the City of Oakley has not formally rezoned the property, it has designated the area for specific planning under redevelopment. Redevelopment planning maps (April 2008) show the CCGS site designated for Utility Energy land use.

Riverfront, and Sandy Lane sites are all within 500 feet of the nearest residence. These locations may make compliance with local noise ordinances and CEQA standards for noise impacts difficult or prohibitively expensive to achieve.

TABLE 6.4-1
Nearest Residences to Alternative Sites

Site Name	Distance to Nearest Residence
CCGS site	900 feet southwest
18th Street site	120 feet south
Wilbur Avenue site	1,200 feet west
Riverfront site	500 feet south
Sandy Lane site	Residences located on north, east, and west borders (less than 100 feet)

6.4.9 Paleontology

There would be no significant difference between the sites in terms of potential effects on paleontological resources. The probability of encountering significant fossils is approximately the same at each site.

6.4.10 Public Health

The project would not be likely to cause significant adverse long-term health impacts (either cancer or non-cancer) from exposure to toxic emissions, regardless of the site chosen.

6.4.11 Socioeconomics

All four sites are located in Contra Costa County. The number of workers, construction costs, payroll, and property tax revenues would be nearly the same for the project at each of the sites. Most of the workers would come from the Contra Costa County area, depending on the site. Most workers would commute daily or weekly to the plant site. Some may move temporarily to the local area during construction, causing site-specific impacts on schools, utilities, and emergency services. These impacts would be temporary. Disproportionate impacts on minority and low-income populations would be unlikely because minority populations are not concentrated in an area or areas that are also high potential impact areas. The project is not likely to cause significant adverse public health impacts on areas that are disproportionately minority or low income.

6.4.12 Soils

Use of the proposed CCGS, Wilbur Avenue, and Sandy Lane sites would involve the conversion of agricultural land to industrial uses. The CCGS site, Wilbur Avenue, and Sandy Lane sites are currently farmed. The 18th Street site has not been farmed for several years. The Riverfront site is undeveloped but does not appear to have been farmed. Differences in soil erosion would be inconsequential with the use of best management practices during construction and operation.

6.4.13 Traffic and Transportation

The number of employees working at a given time during project operation (approximately 22) will not significantly impact local traffic conditions at any of the sites. The peak number of employees during construction (729) will have much more impact. The impact will be temporary and can be mitigated by transportation management planning. Therefore, the effect of construction-phase traffic should not figure as a major consideration in evaluating or comparing the sites.

6.4.14 Visual Resources

None of the sites are located in an area with protected viewshed or in a designated viewshed corridor. From the proposed CCGS site, the project would be visible to local residents because of the open and agricultural nature of the area surrounding the site to the south and east. The DuPont facility, existing screening trees on the DuPont property, and State Route (SR) 160 (elevated berm) would provide some screening from viewers located to the north and west of the proposed CCGS site; however, several structures at the plant would extend above the current structures and the mature trees at the DuPont facility. Although the CCGS would be a large structure, there are few residential, recreational, or other sensitive viewers nearby.

The 18th Street, Wilbur Avenue, and Riverfront sites are located in a relatively industrialized area; however, two power plants (Gateway Generating Station and Riverfront's Contra Costa Power Plant) are located nearby, within 0.25 mile to 0.5 mile of each of the sites. The addition of another power plant to the area would increase the appearance of an industrial area for all viewers. Additionally, residences to the south of all three plants would have an unobstructed view of each of these locations.

The Sandy Lane site is situated in an agricultural pocket, with residential uses on all four sides. There is a small industrial facility in the southwest corner that may provide limited screening for residents to the southwest, but most structures at the plant would be easily visible from all directions.

6.4.15 Water Resources

The proposed CCGS will use an air cooled condenser (ACC), reducing the need for a large cooling water supply. Water for fire protection, potable water uses (e.g., drinking water, safety showers), and some processes (e.g., reverse osmosis permeate, evaporative cooler blowdown) will be supplied by the Diablo Water District. The potable water to be provided to the CCGS for use as process water was previously allocated for industrial use at the DuPont facility.

Each of the alternative sites is large enough for an ACC to be in use, so a large process water supply would not be necessary for operation of the plant. Similar to CCGS, each alternative site would require a similar amount of water for fire protection, potable water uses, and some processes. Because both the Wilbur Avenue and Riverfront sites are located near the Riverfront Contra Costa Power Plant, each of these sites would be able to tap into the potable water line from the City of Antioch that is in place for the Contra Costa Power Plant. The connection would be less than approximately 500 feet. The 18th Street site, because of its proximity to the Gateway Generating Station, would be able to tap into the potable water

line from the City of Antioch that is in place for the Gateway Generating Station. Similar to the earlier discussion for the Wilbur Avenue and Riverfront sites, the connection is presumed to be less than approximately 500 feet. The Sandy Lane site also would be able to tap into a water line located along Oakley Road or, if that is unavailable, would require an approximately 0.9-mile-long connection to tie into the DuPont water system.

6.4.16 Waste Management

The management of wastes would not differ between the proposed project site and three of the four alternatives. The 18th Street, Wilbur Avenue, and Sandy Lane sites are vacant; no demolition would be necessary. Waste generated at the three sites during operations would be similar.

The Riverfront site may have some concrete foundations onsite. Also, contamination from the nearby Riverfront Contra Costa Power Plant oil storage tanks may have migrated along the northwest boundary onto this site. Waste generated at this site during construction is anticipated to be greater than at the proposed CCGS site.

6.4.17 Summary and Comparison

Based on the site selection criteria as described in Section 6.3, it is clear that power plant siting is feasible at all three sites. Following is a summary of site selection factors:

- **Site control feasible—**Site control has been achieved at the CCGS site. It is unknown whether the 18th Street, Wilbur Avenue, or Sandy Lane sites are available for lease or purchase. Site control at the Riverfront site is not feasible.
- **Located on a brownfield site –** The CCGS site is located within the former DuPont manufacturing complex on property that has been actively farmed and was not used for industrial processes. The Riverfront site is located on a brownfield site. The Wilbur Avenue and Sandy Lane sites are actively farmed and would require a conversion from a greenfield site to an industrial site. The 18th Street site, although not actively farmed, is undeveloped and would involve the conversion of a greenfield site to an industrial site.
- **Location near electrical transmission facilities—**The CCGS site will require a 2.4-mile transmission line to be constructed to connect the site to the PG&E Contra Costa Substation. The transmission line will be located within an existing 69-kV transmission line corridor, and will replace the old steel lattices with a newer monopole design. All four alternatives would ultimately tie into to the PG&E Contra Costa Substation. The 18th Street site would require an approximately 1.5-mile transmission line to be constructed partially within the same 69-kV corridor as planned for the CCGS. The Wilbur Avenue and Riverfront sites would require an approximately 1.4-mile-long transmission corridor to be located within a transmission corridor in place for the Riverfront Contra Costa Power Plant. The Sandy Lane site would require an approximately 2-mile-long corridor and would partially follow the transmission route for the CCGS.
- **Location near ample natural gas supply—**Each of the sites is near a sufficient source of fuel gas and would tie into the PG&E Antioch Terminal. The CCGS is adjacent to the Antioch Terminal. The 18th Street site would require an approximately 0.8-mile gas line

to tie into the Antioch Terminal. The Wilbur Avenue site would require an approximately 0.6-mile gas line, and the Riverfront site would require a 1.25-mile gas line route to connect with the Antioch Terminal. The Sandy Lane site's gas pipeline would be 0.8 miles long.

- **Land zoned for industrial use—**The CCGS, Wilbur Avenue, and Riverfront sites are all zoned appropriately for the siting of a power plant. The CCGS is currently zoned Heavy Industrial; however, it is in the pending DuPont Specific Plan and its General Plan land use designation is Utility Energy. The 18th Street site is zoned for Planned Business Center/Planned Development District and would require a zoning and General Plan amendment. The Sandy Lane site is zoned for redevelopment under the proposed River Oaks Crossing Specific Plan. If the Specific Plan is finalized, the site will be zoned P-1RA. A power plant may not be an allowable use for this area, as the intent is to create a commercially zoned area.
- **Parcel or adjoining parcels of sufficient size for the site and construction laydown—** The CCGS and Riverfront sites are adequately sized to allow for both the project site and laydown. Because of the transmission lines running across the western portion of the site, the Wilbur Avenue site is limited in space and would not be adequate in size for the plant. Additionally, construction laydown would need to be located to the south of the site, across the BNSF railroad. Construction workers would need to traverse the railroad to access the site. The 18th Street site is sufficient in size for the plant; however, the laydown area would require the use of additional land to the north or west that is currently under agricultural development. The Sandy Lane site has adequate acreage for the plant site but, as with the 18th Street site, would require additional construction laydown areas to the east, on currently farmed fields.
- **Location near the centers of electrical demand—**Each of the sites is in Contra Costa County and near the cities of Antioch and Oakley, where electrical demand is high.
- **Minimizes impacts on local residents and businesses –** The CCGS, Riverfront, and Wilbur Avenue sites are located in industrial areas, and the addition of a power plant is consistent with the general character of the areas. Noise and visual impacts at these sites would be similar to what is already in place. These three sites are located farther from residential subdivisions than the other sites and would cause limited impacts on residents and businesses in the area. The 18th Street site is located close to a nearby residential suburb and would also convert vacant undeveloped land into an industrial facility. Noise from this site would have an impact on local residents in the area. The Sandy Lane site is also located near several residential subdivisions, would require the conversion of farmland to an industrial facility, and would change the existing nature of the area.
- **Mitigation of potential impacts is feasible—**Mitigation of potentially significant environmental impacts appears feasible at the CCGS and Wilbur Avenue sites. Because of the zoning of the 18th Street and Sandy Lane sites, it is unknown whether mitigation will be feasible. Because of the Riverfront site's location near the San Joaquin River and the old oil storage tanks to the east, it is unknown whether mitigation will be feasible.

When taking into account the comparative analysis provided above, the CCGS site best meets the project objectives as compared to the 18th Street, Wilbur Avenue, Riverfront, and Sandy Lane sites. The CCGS site has a known adjacent supply of natural gas and potable water. Transmission corridors are similar for the three sites, all requiring a tie-in to the PG&E Contra Costa Substation.

The CCGS, Wilbur Avenue, and Riverfront sites are zoned appropriately for power plant uses and would be located in industrial areas near existing industrial facilities. The 18th Street site is zoned Planned Business Center and Planned Development District, and the Sandy Lane site is zoned Redevelopment; both of these sites would require a Zoning and General Plan amendment to allow for construction of a power plant. The proposed CCGS, Sandy Lane, and Wilbur Avenue sites are similar in terms of biological resource impacts because they are located in areas that are currently farmed. The Riverfront site may also have impacted biological resources because of the proximity of the San Joaquin River along its northern boundary.

The Riverfront site may have contamination along the eastern boundary from past activities at the Riverfront Contra Costa Power Plant. The CCGS site has been cleared by the California Department of Toxic Substances Control for redevelopment.

Additionally, it is unknown whether the 18th Street, Wilbur Avenue, Riverfront, and Sandy Lane sites are available for long-term lease or purchase.

The CCGS site best meets the project objectives without resulting in any adverse environmental impacts as compared to the 18th Street, Wilbur Avenue, Riverfront, and Sandy Lane sites. As a result, the 18th Street, Wilbur Avenue, Riverfront and Sandy Lane sites were rejected in favor of the CCGS site. Table 6.4-2 provides a summary of the environmental and project development constraints for all five sites.

6.5 Alternative Project Design Features

This section addresses alternatives to some of the CCGS design features, such as the locations of the natural gas supply pipeline, electrical transmission line, and water supply pipeline.

6.5.1 Alternative Natural Gas Supply Pipeline Routes

The facility will connect to PG&E's existing high-pressure natural gas pipeline at the Antioch Terminal, which is located along the western boundary of the project site. Because of the short distance and direct route, no other alternatives were analyzed.

6.5.2 Electrical Transmission System Alternatives

The preferred transmission alternative is to connect with the PG&E Contra Costa Substation within an existing 2.4-mile-long transmission corridor. The existing 69-kV steel lattice towers will be replaced by monopole towers carrying a 230-kV transmission line from the project to the substation. The 69-kV transmission line will be co-located on the monopole structures or replaced by the 230-kV line.

TABLE 6.4-2
Environmental and Project Development Constraints of the CCGS and Alternative Sites

Site or Alternative	CCGS Site	18th Street Site	Wilbur Avenue Site	Riverfront Site	Sandy Lane Site
Site control	Yes	No	No	No	No
Brownfield site	Adjacent	No	No	Yes	No
Land Use and zoning	Zoned as HI – Heavy Industrial, power plants are an allowable use and designated in the General Plan for Utility Energy	Zoned as PBC/C-3, Planned Business Center and Planned Development District; power plants are not an allowable use, and a zoning and General Plan amendment would be needed	Zoned as HI – Heavy Industrial, power plants are an allowable use	Zoned as HI – Heavy Industrial, power plants are an allowable use	Zoned as P-1RA, Redevelopment; power plants may not be an allowable use.
California Department of Conservation Designation	100% Farmland of Statewide Importance	30% Farmland of Statewide Importance 70% Other	50% Unique Farmland 50% Farmland of Local Importance	Urban and Built Up	Urban and Built Up
Williamson Act Contract	No	No	No	No	No
Sensitive noise receptors nearby	Nearest residence ~900 ft southwest	Nearest residence ~120 feet south	Nearest residence ~1,200 feet west	Nearest residence ~480 feet south	Nearest residence ~120 feet south
Visual resources	DuPont facility and screening trees located to the north and east of the proposed site blocking views for viewers to north and east; SR 160 blocks views from the west; few residences in surrounding area	Industrial facilities (including two power plants) located north and northeast, providing limited screening for viewers to the north; no screening to the south, west, or southeast; Several residential areas to the southwest and west	Industrial facilities (including two power plants) located north and northeast, providing limited screening for viewers to the north; no screening to the south, west, or southeast; several residential areas to the southwest and west	Industrial facilities (including two power plants) located north and northeast, providing limited screening for viewers to the north; no screening to the south, west, or southeast; several residential areas to the southwest and west	Residential areas located to the north, south, east, and west, including a school 700 feet to the east; an industrial facility is present immediately southwest, which may block some views

TABLE 6.4-2
Environmental and Project Development Constraints of the CCGS and Alternative Sites

Site or Alternative	CCGS Site	18th Street Site	Wilbur Avenue Site	Riverfront Site	Sandy Lane Site
Biological resources	Land is actively farmed with vineyards; a 0.62-acre protected wetland is located on the eastern boundary; may provide limited habitat for wildlife and ground-nesting birds	Site is undeveloped and surrounded by actively farmed fields; may provide limited habitat for wildlife and ground-nesting birds	Western portion of site is actively farmed; eastern portion is undeveloped and next to large industrial facilities to the north and east; may provide limited habitat for wildlife and ground-nesting birds	Site is undeveloped and next to large industrial facilities to the east; northern portion of site borders the San Joaquin River; may provide limited habitat for wildlife and ground-nesting birds	Site is actively farmed; may provide limited habitat for wildlife and ground-nesting birds
Cultural resources	No	Unknown	Unknown	Unknown	Unknown
Significant unmitigated impacts or costly mitigation?	No	Site would need to be rezoned and general plan amended; close to residential subdivisions with no industrial facilities to screen view; located near two other power plants, increases industrial nature of area	Several transmission lines over western portion of the site, rendering half of the site unusable	Site borders San Joaquin River to the north, and old oil storage tanks to the east; contamination from oil storage tanks may extend onto this site	School located 700 feet from the site, which may lead to permitting obstacles; residential receptors located to the north, south, east, and west; a small industrial facility to the southwest may block view slightly, but noise and visual impacts will be greater at this site

One transmission line route alternative was analyzed for this project, as shown in Figure 6.3-1. The transmission line would exit the southwest corner of the plant and would cross Bridgehead Road before turning south to follow the easement adjacent to SR 160 for approximately 2,600 feet to East 18th Street/Main Street. At East 18th Street, the transmission line would head west for approximately 1 mile to the transmission line corridor that is in place for the Riverfront Contra Costa Power Plant. At that point, the line would follow the transmission line corridor and turn south for approximately 1,300 feet before turning west to connect with the PG&E Contra Costa Substation. The entire distance would be approximately 2.3 miles.

The alternative transmission line was not selected for the following reasons:

- East 18th Street is heavily developed with residential and some businesses, and easements for a transmission line corridor would be difficult to obtain.
- Construction of the alternate route would require more traffic disruption than the proposed route, as approximately 1 mile runs along a heavily traveled route.
- The alternative route is longer than the proposed route.
- The alternative route does not follow an existing transmission corridor for the length of the entire route.
- The alternative route would be co-located within an existing transmission line corridor (the Riverfront Contra Costa Power Plant transmission corridor), and it is unknown if there is space available for an additional transmission line in this corridor.

6.5.3 Water Supply Alternatives

The facility will connect to an existing 24-inch potable water supply line that serviced the former DuPont facilities. Because of the short distance and direct route, no other alternatives were analyzed. It is possible that recycled water will be available in the future from the Ironhouse Sanitation District (ISD) and that this water can displace some of the potable water uses at CCGS.

6.6 Technology Alternatives

The configuration of the CCGS was selected from a wide array of technology alternatives. These include generation technology alternatives, fuel technology alternatives, combustion turbine alternatives, and nitrogen oxide (NO_x) control alternatives.

6.6.1 Generation Technology Alternatives

Selection of the power generation technology focused on those technologies that can utilize the natural gas readily available from the existing transmission system. Following is a discussion of the suitability of such technologies for application to the CCGS that were each rejected for failing to meet project objectives for the reasons described below.

6.6.1.1 Conventional Boiler and Steam Turbine

This technology burns fuel in the furnace of a conventional boiler to create steam. The steam is used to drive a steam turbine generator, and the steam is then condensed and returned to the boiler. This is an outdated technology that can achieve thermal efficiencies up to approximately 36 percent when utilizing natural gas, although efficiencies are somewhat higher when utilizing oil or coal. Because of this low efficiency and large space requirement, the conventional boiler and steam turbine technology was eliminated from consideration.

6.6.1.2 Simple-Cycle Combustion Turbine

Aero-derivative turbine-generator units are able to achieve thermal efficiencies up to approximately 38 percent. A simple-cycle combustion turbine has a quick startup capability and lower capital cost than that of a combined-cycle, and is very appropriate for peaking applications. Because of its relatively low efficiency, conventional simple-cycle technology tends to emit more air pollutants per kilowatt hour (kWh). Because of this relatively low efficiency, simple-cycle combustion turbine technology was eliminated from consideration.

6.6.1.3 Kalina Combined-Cycle

This technology is similar to the conventional combined-cycle, except a mixture of ammonia and water is used in place of pure water in the steam cycle. The Kalina cycle could potentially increase combined-cycle thermal efficiencies by several percentage points. This technology is still in the development phase and has not been commercially demonstrated; therefore, it was eliminated from consideration.

6.6.1.4 Internal Combustion Engines

Internal combustion engine designs are also available for small peaking power plant configurations. These are based on the design for large marine diesel engines, fitted to burn natural gas. Advantages of internal combustion engines are that they use very little water for cooling because they use a closed-loop coolant system with radiators and fans; provide quick-start capability (online at full power in 10 minutes); and are responsive to load-following needs because they are deployed in small units (for example, 10 to 14 engines in one power plant) that can be started up and shut down at will. Disadvantages of this design include somewhat higher emissions than comparable combustion turbine technology. Additionally, internal combustion engine installations are generally deployed at less than 150 MW and so would not meet the project objective to generate 624 MW of power.

6.6.2 Power Plant Cooling Alternatives

Wet cooling technology was evaluated as an alternative to the use of ACC system for cooling. With a wet-cooled plant, fresh water is pumped through a condenser, where it is exposed to pipes carrying steam from a steam turbine. The steam condenses to water and is recycled through the HRSG. Heated water cycling through the condenser is then pumped to a cooling tower, where large fans draw air through the heated water droplets, cooling the water, which is cycled back to the condenser, with evaporative losses of approximately 5 percent.

Wet cooling using fresh or potable water is discouraged by state water and CEC policy. Wet cooling using recycled water is acceptable under state policy, but the choice of this cooling

method depends on the availability of a supply of tertiary treated recycled water. Such recycled water is not currently available at the project location. The Applicant has met with ISD to determine whether ISD could provide recycled water to the CCGS. ISD is in the process of constructing a Title 22 recycled water treatment plant and so it is likely that recycled water will be available to the CCGS in the future.

Another drawback of wet cooling is that it takes large amounts of water to cool a large, combined-cycle power plant; approximately 16 times as much as a dry-cooled design, as is proposed for the CCGS. Therefore, even though the dry-cooling design is more expensive and is less efficient in power generation than a wet-cooled design, CCGS has been designed as a dry-cooled plant using an air-cooled condenser. No other technologies are currently available that are capable of adequately cooling the CCGS.

As discussed in Section 5.15, Water Resources, the CCGS will use a small amount of potable water for inlet chilling because there is not sufficient recycled water available to accommodate using recycled water for this purpose. The CCGS is committed to receiving recycled water for inlet chilling when it becomes available.

6.6.3 Fuel Technology Alternatives

Technologies based on fuels other than natural gas were eliminated from consideration because they do not meet the project objective of utilizing natural gas available from the existing transmission system. Additional factors rendering alternative fuel technologies unsuitable for the proposed project are as follows:

- No geothermal or hydroelectric resources exist in Contra Costa County.
- Biomass fuels such as wood waste are not locally available in sufficient quantities to make them a practical alternative fuel, and CCGS site space is limited.
- Wind technologies are not flexible and dispatchable resources because they must respond to available wind; CCGS space is limited and these technologies require large expanses of land. A wind power installation also would not be compatible with urban/suburban land uses in this location.
- Utility-scale solar technologies need to be sited in an area with high solar radiation[3] and require very large amounts of land (up to 10 acres per MW). Contra Costa County is not a viable location for concentrating solar technologies or utility-scale photovoltaic power plants because it is lacking in the large and open expanses of land necessary and is not a strong solar energy resource area. These resources are also available only during the daytime and may be reduced or unavailable on cloudy days.
- The availability of the natural gas resource provided by PG&E and the environmental and operational advantages of natural gas technologies make natural gas the logical choice for the proposed project.

[3] Measured in terms of kWh per square meter of land. See the National Renewable Energy Laboratory for additional information about solar energy and maps of solar resource distribution (http://www.nrel.gov/solar/). The project area solar radiation is rated at approximately 5 to 5.25 kWh per square meter. Utility-scale solar energy plants are not currently being proposed for areas with solar radiation at levels this low.

6.6.4 NO_x Control Alternatives

To minimize NO_x emissions from the CCGS, the combustion turbine generators (CTGs) will be equipped with dry low NO_x combustors and selective catalytic reduction (SCR) using aqueous ammonia as the reducing agent. The following combustion turbine NO_x control alternatives were considered:

- Steam injection (capable of 25 to 42 parts per million [ppm] NO_x)
- Water injection (capable of 25 to 42 ppm NO_x)
- Dry low NO_x combustors (capable of 15 to 25 ppm NO_x)

Dry low NO_x combustors were selected because these allow for lower acceptable NO_x emissions while being able to achieve an output turndown rate of 30 percent. This turndown is necessary to meet variable load demand.

Two post-combustion NO_x control alternatives were considered:

- SCR
- SCONOx™

SCR is a proven technology and is used frequently in combined-cycle applications. Ammonia is injected into the exhaust gas upstream of a catalyst. The ammonia reacts with NO_x in the presence of the catalyst to form nitrogen and water.

$SCONO_x$™ consists of an oxidation catalyst, which oxidizes carbon monoxide to carbon dioxide and nitric oxide to nitrogen dioxide. The nitrogen dioxide is adsorbed onto the catalyst, and the catalyst is periodically regenerated.

The level of emission control effectiveness between the $SCONO_x$ and SCR technologies is approximately the same. However, the $SCONO_x$ technology does not use ammonia to reduce air emissions. The CEC recently summarized in the U.S. Environmental Protection Agency's opinion (CEC, 2007) "that $SCONO_x$ is no more effective for reducing air quality impacts than selective catalytic reduction…, and it also found $SCONO_x$ to be significantly more expensive and arguably less reliable, particularly for larger facilities." Therefore, $SCONO_x$ was not considered for the CCGS project.

The following reducing agent alternatives were considered for use with the SCR system:

- Anhydrous ammonia
- Aqueous ammonia
- Urea

Anhydrous ammonia is used in many combined-cycle facilities for NO_x control, but is more hazardous than diluted forms of ammonia. Aqueous ammonia (an ammonia-water solution) is proposed for the CCGS because of its safety characteristics. Urea has not been commercially demonstrated for long-term use with SCR and was eliminated from consideration.

6.6.5 Waste Discharge Alternatives

The CCGS will discharge any process wastewaters to the ISD's sanitary sewer system through an existing onsite connection. Stormwater will be processed through an oil/water

separator as necessary and then discharged into a bioswale drainage system that meets the Contra Costa County C.3 design requirements for drainage design and that discharges downgradient of the power plant site (see Section 5.15, Water Resources).

The alternative discharge method for process wastewater would be to construct a zero liquid discharge (ZLD) system in which concentrators and crystallizers are used to evaporate process wastewater and to remove the residual salts and other contaminants such that little or no water is discharged, and residual salt is trucked as a "salt cake" byproduct to a landfill. The CEC, as stated in the 2003 Integrated Energy Policy Report (IEPR), has encouraged power plant developers to incorporate ZLD facilities into their power plant designs as a way of reducing discharges and maintaining the quality of state waters. The 2003 IEPR states:

> Additionally, as a way to reduce the use of fresh water and to avoid discharges in keeping with the Board's policy, the Energy Commission will require zero-liquid discharge technologies unless such technologies are shown to be "environmentally undesirable" or "economically unsound."

The use of a ZLD design was considered for the CCGS and was eliminated from consideration for the following reasons:

- It is not necessary to use a ZLD to control wastewater discharge in a plant using dry cooling, because discharge volumes using dry cooling are relatively small, approximately one-sixteenth those of a wet-cooled plant.
- ZLD systems are technologically complex and expensive to construct, operate, and maintain, adding to the project's capital cost and reducing its return on investment.
- ZLD systems have been found to be relatively unreliable, often resulting in plant outages that affect operating ability, the availability of power, and grid reliability.

To summarize, using ZLD for a dry-cooled plant of this nature would not support the CCGS project objectives of providing easily dispatchable, reliable, and economically viable power to the northern California grid. The cost of a ZLD in terms of initial construction costs, operations and maintenance costs, and lost production costs would be out of proportion to any environmental benefits of the eliminated volume of wastewater. The use of a ZLD would be economically unfeasible and would offer little or no environmental benefit.

6.7 References

California Energy Commission (CEC). 2007. Final Staff Assessment for the Colusa Generating Station Power Plant. November.