Chapter 10 Table of Contents

Section	Title	Page
10.1	Unavoidable Adverse Environmental Impacts	10.1-1
10.1.1	Unavoidable Adverse Environmental Impacts of VCS Construction	10.1-1
10.1.2	Unavoidable Adverse Environmental Impacts of VCS Operations	10.1-3
10.2	Irreversible and Irretrievable Commitments of Resources	10.2-1
10.2.1	Reversible Commitments of Environmental Resources	10.2-1
10.2.1.1	Land Use Commitments	10.2-1
10.2.1.2	Hydrology and Water Use Commitments	10.2-2
10.2.1.3	Ecological Commitments (Terrestrial and Aquatic)	10.2-2
10.2.1.4	Socioeconomics	10.2-3
10.2.1.5	Radiological Releases	10.2-3
10.2.1.6	Air Emissions and Meteorological Changes	10.2-3
10.2.2	Retrievable Commitments of Material Resources	10.2-4
10.2.3	References	10.2-5
10.3	Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment	10.3-1
10.3.1	Construction of VCS and Short-Term Uses	10.3-1
10.3.2	Operation of VCS and Long-Term Productivity	10.3-2
10.3.3	Summary of Relationship Between Short-Term Uses and Long-Term Productivity	10.3-3
10.4	Benefit-Cost Balance	10.4-1
10.4.1	Benefits	10.4-1
10.4.1.1	Need for Power	10.4-1
10.4.1.2	Fuel Diversity	10.4-1
10.4.1.3	Avoided Emissions	10.4-2
10.4.1.4	Advantages of Nuclear Power	10.4-2
10.4.1.5	Tax Payments	10.4-3
10.4.1.6	Local Economy	10.4-3
10.4.1.7	Other Benefits	10.4-3
10.4.1.8	Benefit Summary	10.4-4
10.4.2	Costs	10.4-4
10.4.2.1	Internal Costs — Proposed Action	10.4-4
10.4.2.2	Internal Costs — Generation Alternatives	10.4-7
10.4.2.3	External Costs	10.4-8
10.4.2.4	Alternative Sites	10.4-9
10.4.3	Summary	10.4-10
10.4.4	References	10.4-11

Chapter 10 List of Tables

Number	Title
Table 10.1-1	VCS Construction-Related Unavoidable Adverse Environmental Impacts
Table 10.1-2	VCS Operations-Related Unavoidable Adverse Environmental Impacts
Table 10.4-1	Estimated Avoided Air Pollutant Emissions
Table 10.4-2	Benefit Summary
Table 10.4-3	Benefits of the Proposed Project
Table 10.4-4	Nuclear Plant Monetary Costs
Table 10.4-5	Coal-fired Plant Monetary Costs
Table 10.4-6	Gas-fired Plant Monetary Costs
Table 10.4-7	Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

10.1 Unavoidable Adverse Environmental Impacts

This section summarizes those unavoidable adverse impacts that could potentially result from construction and operation of VCS Units 1 and 2. Unavoidable adverse impacts are predicted adverse environmental impacts that cannot be avoided and for which there are no practical means of mitigation. This section considers unavoidable adverse impacts from VCS construction and operation and associated new transmission lines constructed and operated both in new areas and areas adjacent to existing transmission corridors. This summary also identifies reasonable and practical mitigation actions proposed to reduce the impacts. Information provided in Sections 4.6 and 5.10 was used to prepare this section.

The following categories have been assessed for unavoidable adverse impacts resulting from VCS construction and operations:

- Land use
- Hydrology and water use
- Ecology (terrestrial and aquatic)
- Socioeconomics
- Radiology
- Meteorology and atmospheric releases
- Environmental justice

10.1.1 Unavoidable Adverse Environmental Impacts of VCS Construction

The potential adverse environmental impacts from the construction of VCS are described in detail in Chapter 4. Table 4.6-1 summarizes those impacts and identifies the measures and controls that may be implemented to reduce or eliminate them. Construction-related unavoidable adverse environmental impacts (CU) are summarized in Table 10.1-1 and include the following:

Land Use

CU1. Disturbance of approximately 8386 acres composed primarily of rangeland by conversion to industrial land use, with a permanent loss of approximately 7630 acres of terrestrial habitat.

CU2. Disturbance of approximately 2211 (not including corridor to Cholla substation) acres for constructing new transmission line corridors.

CU3. Affected mineral rights and associated oil and gas leases would not be accessible during construction.

CU4. Trees and vegetation would be cleared during construction.

Hydrology and Water Use

CU5. Withdrawal of water from the Guadalupe River for approximately 2 years to fill the cooling basin.

CU6. Localized drawdown in the underlying aquifer because of consumption of groundwater for construction activities.

CU7. Temporary increase in suspended solids concentration and turbidity in nearby surface waters.

CU8. Temporary sediment loading on downgradient wetlands and water bodies.

CU9. Discharge of treated sanitary wastewater could affect water quality of the Guadalupe River within a mixing zone until construction is completed.

Ecology

CU10. Permanent loss of approximately 7630 acres of habitat and wetlands.

CU11. Temporary loss of some aquatic habitat during shoreline dredging.

CU12. Displacement of birds and small mammals because of noise, with the displacement being permanent for some species.

CU13. Aquatic habitats within the footprint of the cooling basin would be destroyed or degraded by earth-moving activities, then inundated when the basin is filled.

Socioeconomic

CU14. Loss of construction jobs, population, wage income, indirect jobs and income, and sales tax revenue resulting from out-migrating workforce within the region of influence.

CU15. Potential decline in residential property tax base resulting from out-migrating workforce.

CU16. Visual impacts for up to several miles from construction at the site.

CU17. Increase in traffic on local roads and Victoria County Barge Canal until construction activities cease.

CU18. Increased use of recreational facilities within a 50-mile region until construction is completed.

CU19. Exposure of construction workers to temporary elevated noise and vibration levels from construction activities.

CU20. Exposure of construction workers to temporary fugitive dust and fine particulate matter emissions from construction activities and equipment.

CU21. Exposure of surrounding population to temporary and localized noise, fugitive dust, and exhaust emissions.

CU22. Increase demand on community services and infrastructure within the region of influence from in-migration of construction workers.

Radiological

No unavoidable adverse impacts were identified.

Meteorology and Atmospheric Releases

No unavoidable adverse impacts were identified.

Environmental Justice

There would be no unusual resource dependencies by low-income or minority groups, and therefore no disproportionate unavoidable adverse impacts.

10.1.2 **Unavoidable Adverse Environmental Impacts of VCS Operations**

The potential environmental impacts from VCS operation are described in detail in Chapter 5. Table 5.10-1 summarizes those impacts and identifies measures and controls that may be implemented to reduce or eliminate them. The operations-related unavoidable adverse environmental impacts (OU) are summarized in Table 10.1-2 and include the following:

Land Use

OU1. Approximately 7630 acres of land would not be available until the completion of decommissioning.

OU2. Approximately 2211 acres of land dedicated to new transmission line corridors (Cholla corridor not included) would not be available.

OU3. Affected mineral rights and associated oil and gas leases would not be accessible until the completion of decommissioning.

Hydrology and Water Use

OU4. Potential hydrologic impacts from the groundwater withdrawal from the Evangeline Aquifer until VCS ceases to operate.

OU5. Water withdrawal from the Guadalupe River via the Guadalupe-Blanco River Authority Calhoun Canal to replace water lost to evaporation, drift, seepage, and blowdown until VCS ceases to operate.

OU6. Seepage of the cooling basis would increase infiltration to the underlying Chicot Aquifer, potentially altering the natural shallow groundwater flow direction and gradient near the cooling basin, until the completion of decommissioning.

OU7. Discharges from VCS operations would affect the water quality of the Guadalupe River within a mixing zone until VCS ceases to operate.

OU8. Potential water quality impacts to streams or rivers in or near the transmission corridors resulting from the use of EPA-approved herbicides.

<u>Ecology</u>

OU9. Discharges from VCS operations would have physical, chemical, and thermal impacts to the aquatic resources in the Guadalupe River in a mixing zone until VCS ceases to operate.

OU10. Impingement of a small number of juvenile and adult fish in the raw water makeup system intake until VCS ceases to operate.

OU11. Entrainment of fish eggs and larvae in the raw water makeup system intake until VCS ceases to operate.

OU12. Small adverse impacts to wildlife from noise, minor shadowing, small increase in precipitation, and salt deposition from the plant service water system cooling towers until VCS ceases to operate.

OU13. Small adverse impacts to vegetation and wildlife habitat from transmission system operation and maintenance.

OU14. Avian mortality resulting from collision with transmission lines.

<u>Socioeconomic</u>

OU15. Visual impacts to local landscape from reactor buildings, support facilities, plant service water system cooling towers and associated plumes, transmission lines, and offsite facilities until the completion of decommissioning.

OU16. Electrical shock hazards, electromagnetic field exposure, and noise resulting from operation of the transmission lines.

OU17. Potential for television and radio interference from transmission lines.

OU18. Increased use of recreational facilities in the 50-mile region.

OU19. Increase demand on community services and infrastructure within the region of influence from in-migration of operations workers.

OU20. Increase in traffic on local roads at shift changes until the completion of decommissioning.

Radiological

OU21. Dose to operations workers and the public from operations of VCS until VCS ceases to operate.

OU22. Discharges of radioactive liquids and gases to the environment until VCS ceases to operate.

OU23. Generation of radioactive waste from the fuel cycle until VCS ceases to operate.

OU24. Dose to transportation workers and the public resulting from nuclear fuel transport.

OU25. Dose to workers from decommissioning of VCS.

Meteorology and Atmospheric Releases

OU26. Air emissions from auxiliary systems operated on an intermittent basis.

Environmental Justice

There would be no unusual resource dependencies by low-income or minority groups, and therefore no disproportionate unavoidable adverse impacts.

Table 10.1-1 (Sheet 1 of 4)
VCS Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
Land Use	Permanently disturbing approximately 7630 acres of an 8386 acre land disturbance.	CMC7	CU1
	Temporary disturbance of approximately 756 acres.	CMC2	CU1
	Clearing and grubbing of trees and vegetation.	CMC1	CU4
	Excavating, backfilling, and stockpiling soils onsite.	CMC4	None
	Potential for erosion and sedimentation resulting from stockpiling of soils onsite.	CMC3	None
	Construction of new buildings, support facilities, and impervious surfaces such as site roads.	CMC5	None
	Developing the site may impact federal- and/or state-listed threatened or endangered species. The white-tailed hawk, bald eagle, and wood stork have been observed on or near the site.	CMC6	None
	Constructing new transmission line corridor in area consisting primarily of pasture and cultivated crops.	CMC3, CMC10, CMC26	CU2, CU8, CU11
	Upgrading the existing barge unloading facility at the Port of Victoria Turning Basin on the west bank of the Victoria Barge Canal.	CMC8	CU8, CU11
	Construct a heavy haul road from the barge unloading facility to the site.	CMC11, CMC12	CU8, CU11
	Constructing a rail spur less than one-quarter mile long offsite to connect to the nearest main rail line.	CMC7	CU7
	Potential temporary impacts from ground disturbing activities during installation of underground raw water makeup (RWMU) system intake and blowdown pipelines in offsite areas.	CMC3, CMC13, CMC14	CU7
	Potential temporary impacts during ground disturbing activities within the Coastal Management Zone. The RWMU system intake structure and the portion of the intake pipeline extending from the intake to Highway 185 south of the town of Bloomington would be located in the Coastal Management Zone.	CMC3, CMC14, CMC16	CU7, CU11
	73 historic properties that are eligible for listing on the National Register of Historic Places were identified within the visual effects areas of potential effect.	CMC17	CU16
	29 of the 73 historic properties are contributing elements to the rural historic landscape.	CMC17	CU16
	Constructing new transmission line corridor that potentially could result in some direct physical disturbance to archaeological properties.	CMC17	None
	Not allowing the current land use of affected mineral rights and associated oil and gas leases to continue.	CMC36	CU3
Hydrology and Water Use	Cooling basin would be filled by water withdrawn from the Guadalupe River over an approximate 2-year period.	CMC35	CU5

Table 10.1-1 (Sheet 2 of 4)
VCS Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Installation of groundwater wells and use of groundwater for construction could cause drawdown in the underlying aquifer.	CMC22	CU6
	Storm water runoff from construction areas, including transmission line construction, could adversely affect surface waters.	CMC7, CMC19	CU7
	Shoreline construction and dredging for the blowdown line, heavy haul road, and heavy haul road bridge abutments would introduce sediment to the Guadalupe River.	CMC19, CMC20, CMC25	CU7, CU8
	Shoreline construction and dredging for the RWMU system intake pipeline could introduce sediment to the Calhoun Canal.	CMC3, CMC11	CU7, CU8
	Pipeline water body crossing could adversely affect surface water.	CMC14	CU7
	Discharge of treated sanitary wastewater could affect water quality of receiving water bodies.	CMC19	CU9
Ecology (Terrestrial and Aquatic)	Construction activities would result in the permanent loss of approximately 7630 acres of habitat but would not reduce the regional diversity of plants or plant communities. The loss of rangeland habitat would result in displacement of large and/or mobile terrestrial wildlife and the mortality of the smaller, less mobile species. The loss of these animals would not affect or otherwise threaten the status of regional populations of these species.	CMC1, CMC2, CMC3, CMC6, CMC15	CU10, CU11, CU12, CU13
	Displacement of birds and small mammals from noise, with the displacement being permanent for some species and temporary for others.	CMC23	CU12
	Constructing new transmission line corridors in counties that support endangered and/or threatened species.	CMC10, CMC26	None
	Potential sedimentation in water bodies and wetlands resulting from earth-distributing activities and shoreline construction could temporarily eliminate some benthic macroinvertebrate habitat and temporarily degrade some fish spawning habitat.	CMC2, CMC3, CMC19	CU7, CU11
	Accidental spills could adversely affect groundwater, surface waters, and aquatic ecosystems.	CMC3, CMC21	None
	Heavy haul road and blowdown pipeline water body crossing could adversely affect surface water, impacting aquatic ecosystems.	CMC2, CMC11,CMC20, CMC24, CMC25	CU8, CU11
	Pump station and RWMU system intake pipeline water body crossing could adversely affect surface water, impacting aquatic ecosystems.	CMC14, CMC25	CU8, CU11
	Transmission line routes could require crossing of water bodies or erection of towers.	CMC3, CMC7, CMC10, CMC26	CU8, CU11
	Aquatic habitats within the footprint of the cooling basin would be destroyed or degraded by earth moving activities, then inundated when the basin and reservoir are filled.	No practical mitigation measures are possible.	CU13
Socioeconomic	Exposure of construction workers to temporary elevated noise and vibration levels from construction activities.	CMC23, CMC27	CU19

Table 10.1-1 (Sheet 3 of 4)
VCS Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Exposure of people living or working in the area and transient populations to temporary elevated noise levels from construction activities.	CMC23, CMC28, CMC33	CU21
	Temporarily exposing construction workers, people living or working adjacent to the construction area, and transient population to fugitive dust and fine particulate matter emissions.	CMC9	CU20, CU21
	Temporarily exposing construction workers, people living or working adjacent to the construction area, and transient populations to exhaust emissions.	CMC9	CU20, CU21
	Delivery of construction materials to the site and workers commuting to the site would pose the risk of vehicle accidents involving injuries and fatalities.	CMC33	None
	Potential for occupational injuries or illnesses resulting from construction activities.	CMC29, CMC30	None
	Moderate, temporary increase in population in the six-county region of influence (ROI) resulting from in-migration of construction and indirect workers and families.	CMC31	None
	Loss of construction jobs, population, wage income, and indirect jobs and income resulting from out-migrating construction workforce as construction is completed.	CMC31	CU14
	Loss of sales tax collections resulting from out-migrating construction workforce as construction is completed.	CMC31	CU14
	Loss of sales tax collections resulting from lack of expenditures for construction-related materials and services as construction is completed.	CMC31	CU14
	Decline in the residential property tax base resulting from the departure of worker families from the ROI as construction is completed.	CMC31	CU15
	Increased traffic as a result of construction on the roads in the vicinity.	CMC32, CMC33	CU17
	Increase in traffic resulting from the VCS workers should the need to evacuate arise.	CMC32	CU17
	Increased traffic on the Victoria Barge Canal resulting from barge deliveries of construction materials.	CMC34	CU17
	Potentially, construction noises and vibrations would adversely affect hunting on nearby properties by startling the prey, driving them to a new location, thus altering the use of the land. Temporary construction activities for the haul road segment crossing nearby properties could affect recreational hunting.	CMC23, CMC28, CMC33	None
	Greater use of recreational facilities within the ROI and at recreational facilities outside of the ROI, but within a 50-mile radius.	CMC31	CU18
	Construction of transmission lines could temporarily affect recreational use of the properties adjacent to the right-of-way.	CMC10, CMC31	None
	Potential shortage in housing resulting from the in-migrating population.	CMC31	None

Table 10.1-1 (Sheet 4 of 4)
VCS Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Potential rise in prices for existing and newly constructed housing and rental rates resulting from project-related housing demand.	CMC31	None
	Additional water demand resulting from in-migrating workers would slightly reduce the excess capacity in public water supply of the two water planning regions in the ROI.	CMC31	CU22
	Additional wastewater requiring treatment resulting from in-migrating workers' water usage would reduce excess treatment capacity across the ROI by a small amount.	CMC31	CU22
	Increase in the residents-per-police officer and residents-per-firefighter ratios in the ROI.	CMC31	CU22
	Increased student enrollment in Independent School Districts in the ROI that is within the cumulative capacity of the ROI's schools.	CMC31	CU22
Radiological	Potentially exposing Unit 2 construction workers to radiation after Unit 1 becomes operational. Estimated dose would be within public dose criteria of 10 CFR 20, 10 CFR 50, and 40 CFR 190.	No mitigation measures are required.	None
Meteorology and Atmospheric Releases	No adverse impacts were identified.	No mitigation measures required.	None
Environmental Justice	No adverse impacts to low-income or minority groups were identified.	No mitigation measures required.	None

a. Construction-related mitigation measures and controls (CMC) were taken from Table 4.6-1.
b. Construction-related unavoidable adverse Impacts (CU) are listed in Subsection 10.1.1.

Table 10.1-2 (Sheet 1 of 5)
VCS Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
Land Use	Approximately 7630 acres of land would be dedicated to the plant use.	No practical measures of mitigation.	OU1
	Approximately 2211 acres of land (not including the Cholla line corridor) would be dedicated to the new transmission line corridor.	No practical measures of mitigation	OU2
	Impacts of salt deposition and shadowing from the plant service water system (PSWS) cooling tower operation.	No mitigation would be required.	None
	Not allowing affected mineral rights and associated oil and gas leases to continue.	OMC1	OU3
	Potential impacts to historic resources resulting from VCS operation and the transmission lines. Visual impacts to offsite historic facilities from the ability to see the structures and PSWS cooling tower plumes of VCS.	OMC2	OU15
	Commitment of small amounts of land for waste burial during decommissioning.	No mitigation would be required.	None
	Impacts from land disposal of nonradioactive solid wastes.	No mitigation would be required.	None
	Operation of the units will result in generation of mixed waste, which is regulated as both radioactive waste and hazardous waste.	OMC11	None
	Impacts to land use from fuel cycle. Total annual land requirements for fuel cycle support would be about 430 acres, 50 acres of which would be permanently committed.	No mitigation would be required.	None
Hydrology and Water Use	Potential localized hydrologic impacts from the withdrawal of groundwater from the Evangeline Aquifer.	OMC3	OU4
	Water withdrawal from the Guadalupe River via the Guadalupe-Blanco River Authority Calhoun Canal to replace water lost to evaporation, drift, seepage, and blowdown.	OMC4	OU5
	Seepage from the operation of the cooling basin would increase infiltration to the underlying Chicot Aquifer, which could alter the natural shallow groundwater flow direction and gradient near the cooling basin.	No practical measures of mitigation.	OU6
	Potential impacts to water quality of the Guadalupe River from discharges from the VCS cooling basin.	OMC5	OU7
	Potential impacts to water quality of surface water because of increased volume of storm water resulting from new impervious surfaces.	OMC10	OU7
	Potential water quality impacts to surface water and groundwater from spills of chemicals or petroleum products.	OMC6	OU7
	Potential water quality impacts to streams or rivers in or near the transmission corridors resulting from the use of EPA-approved herbicides.	OMC7	OU8

Table 10.1-2 (Sheet 2 of 5)
VCS Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Potential impacts to water resources from fuel cycle. Total annual water use for the fuel cycle would be 4.37 x 10^{10} gallons.	No mitigation would be required.	None
Ecological (Terrestrial and Aquatic)	Impacts (thermal, chemical, and physical) to the Guadalupe River and its aquatic life resulting from blowdown from the VCS cooling basin.	OMC5	OU9
	Impingement of a small number of juvenile and adult fish at the raw water makeup (RWMU) system intake.	OMC8	OU10
	Fish eggs and larvae entrainment at the RWMU system intake.	OMC8	OU11
	Potential impacts to vegetation and terrestrial wildlife in the area resulting from atmospheric effects from operations of the PSWS cooling towers. Operation of the PSWS cooling towers could lead to minor shadowing, very small increase in precipitation, no noticeable increases in ground-level humidity in the immediate vicinity, and salt deposition that is a fraction of the level needed to have visible effects on vegetation.	No mitigation would be required.	OU12
	Potential impacts to wildlife from noise from the PSWS cooling towers. Noise from the PSWS cooling towers would be less than the level the NRC considers of small significance.	No mitigation would be required.	OU12
	Potential impacts to vegetation and wildlife habitat from transmission system operation, which include corridor maintenance and transmission line use relative to terrestrial ecosystems.	OMC7	OU13
	Avian mortality resulting from collision with transmission lines.	OMC12	OU14
	Potential water quality impacts and subsequent impacts to aquatic populations from maintenance of transmission lines that lie at or near water bodies and wetlands.	OMC13	OU13
Socioeconomic	Operations-related population increase of the six-county region of influence of less than 2%.	OMC16	None
	Limited development would result in minimal changes in the area's basic land use pattern resulting from the operations-related population.	No practical mitigation measures are possible.	None
	Noise impacts resulting from the operation of plant systems including the PSWS cooling towers. Noise levels would be below 65 dBA.	No mitigation would be required.	None
	Visual impacts to landscape from reactor buildings, PSWS cooling towers and associated plumes, and offsite facilities.	No practical mitigation measures are possible.	OU15
	The increased traffic resulting from these commuters would increase the risk of vehicle accidents involving injuries and fatalities. Additional injuries were estimated to be less than 14 annually.	OMC17	OU20
	Increased traffic on area roadways resulting from operations and outage workers commuting to VCS.	OMC17	OU20

Table 10.1-2 (Sheet 3 of 5)
VCS Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Impact to worker health resulting from occupational injuries and illnesses. Total recordable cases of occupational injuries and illnesses estimated per year for the onsite worker population of VCS is less than three cases based on historical incident rates at Exelon facilities.	OMC19	None
	Impacts to members of the public resulting from the operation and maintenance of the transmission system may occur as visual impacts, electric shock hazards, electromagnetic field exposure, noise impacts, or radio and television interference.	OMC14	OU16, OU17
	Potential health impact to members of the public from contact with human disease-causing thermophilic microorganisms in the cooling basin and at the Guadalupe River from the blowdown.	OMC9	None
	Physical structures and infrastructure of VCS onsite and offsite (e.g., intake structure) as well as operational activities would produce visual and physical impacts for recreational facilities in the vicinity.	OMC18	OU15
	Potential impact to housing market affecting prices and rents.	No practical mitigation measures are possible.	OU19
	Greater use of recreational facilities within the ROI and at recreational facilities outside of the ROI, but within a 50-mile radius.	No practical mitigation measures are possible.	OU18
	Impacts to local wastewater treatment systems could occur because the population would increase from the in-migration of operations-related workers and their families.	OMC16	OU19
	Additional water demand resulting from operations-related population would slightly reduce the excess capacity in public water supply of the two water planning regions in the ROI.	OMC16	OU19
	Potential impact to medical services in Victoria County resulting from medical service needs of operations-related population, but within capacity.	No practical mitigation measures are possible.	OU19
	Impact to schools resulting from operations workforce increasing the student population.	No practical mitigation measures are possible.	OU19
	Potential impact to police and fire department services in the ROI resulting from small increases in the ratio of persons to police and firefighters over preconstruction levels. The ratio would be less than that during the construction period, which could lead to the dismissal of officers and firefighters hired to provide services at that time of higher population.	No practical mitigation measures are possible.	OU19
Radiological	Potential health impacts to workers from radiation exposure of an annual maximum dose of 60 person-rem per unit.	No practical mitigation measures are possible.	OU21
	Potential health impacts to fuel cycle workers caused by radiation exposure. The estimated occupational dose (to all fuel cycle workers cumulatively) is approximately 2300 person-rem per year.	No practical mitigation measures are possible.	OU23

Table 10.1-2 (Sheet 4 of 5)
VCS Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Potential health impacts to transportation workers and members of the public caused by radiation exposure resulting from the loading, unloading, and transport of radioactive materials associated with the fuel cycle. The estimated collective dose to workers and the public from transportation associated with the fuel cycle is 9.6 person-rem per year. For comparative purposes, the estimated collective dose from natural background radiation to the population within 50 miles of VCS is 75,000 person-rem per year.	No practical mitigation measures are possible.	OU24
	Potential health impacts to members of the public from exposure to radiological releases. Modeling using the design and operational parameters of VCS results in estimated doses to the public that are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190.	No practical mitigation measures are possible.	OU21
	Potential health impacts to members of the public from radioactive effluents from the fuel cycle. The estimated whole-body population dose commitment to the U.S. population would be approximately 1500 person-rem per year.	No practical mitigation measures are possible.	OU21
	Potential environmental impacts from disposal of radioactive wastes generated as a result of the fuel cycle.	No practical mitigation measures are possible.	OU23
	Potential health impacts to members of the public and workers caused by exposure to radiation emitted during incident-free transportation of radiological materials during operation and decommissioning. Shipments would be less than the one per day condition of 10 CFR 51.52.	OMC15	OU21
	Potential impact to worker health resulting from occupational exposures. Experience with decommissioned power plants has shown that the occupational exposures during the decommissioning period are comparable to those associated with refueling and plant maintenance when a plant is operational.	No practical mitigation measures are possible.	OU25
	Radiological impacts from the transport of materials removed during decommissioning to their disposal sites. The expected impact from this transportation activity would not be significantly different from normal operations.	No practical mitigation measures are possible.	OU24
Atmospheric and Meteorological	Noise, salt deposition, minor shadowing, and a very small increase in precipitation from the PSWS cooling tower operation. Noise levels 400 feet from the PSWS cooling towers are estimated to be less than 65 dBA, a level characterized by the NRC in NUREG-1555 as of small significance. Salt deposition of less than the amount necessary to result in damage to vegetation.	No practical means of mitigation.	OU12
	Potential visual impacts from PSWS cooling tower plumes. Operation of the PSWS cooling towers would result in plumes that could occur in each direction of the compass and would spread out, reducing the time that the plume would be visible from any particular location.	No mitigation would be required.	OU15
	Potential impacts to air quality from limited, short-term operation of auxiliary systems.	No practical means of mitigation.	OU26

Table 10.1-2 (Sheet 5 of 5)
VCS Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impacts	Mitigation Measures and Controls[a]	Unavoidable Adverse Impacts[b]
	Potential impacts to air and water quality from fuel cycle. Gaseous effluents would be less than 0.13% of all 2005 US SO_2 emissions and less than 0.027% of all 2005 US NO_x emissions. Milling process chemical effluents are not released in quantities sufficient to have significant impacts on the environment.	No practical means of mitigation.	OU22
Environmental Justice	No disproportionately high and adverse impacts to low-income and minority populations.	No mitigation would be required.	None

a. Operations-related mitigation measures and controls (OMC) were taken from Table 5.10-1.
b. Operations-related unavoidable adverse impacts (OU) are listed in Subsection 10.1.2.

10.2 Irreversible and Irretrievable Commitments of Resources

This section identifies and describes the predicted irreversible and irretrievable commitment of resources that would be involved with the construction and operation of VCS Units 1 and 2. The term "irreversible commitment of resources" applies to environmental resources that could not be altered at some later time by practical means to restore the resource's present state before construction of VCS. "Irretrievable commitment of resources" applies to material resources that, when used by construction or operation of VCS, cannot by practical means be recycled or restored for other use. This section will summarize the predicted irreversible and irretrievable commitments of resources which will be input in the final benefit-cost balancing of the project.

10.2.1 Reversible Commitments of Environmental Resources

In the construction and operation of any electric generating station, few environmental resources are irreversibly committed to the facility beyond its operational life. The irreversible commitments of resources resulting from the construction and operation of VCS are in the areas of land use, hydrology and water use, terrestrial and aquatic ecological resources, socioeconomics, radiological releases, and atmospheric releases and meteorological changes. The resource commitments are discussed in the following subsections.

10.2.1.1 Land Use Commitments

The new units and their supporting facilities would be located on the approximately 11,500-acre VCS site in Victoria County, Texas (Figure 2.1-1). The land is currently classified as rangeland, forest land and wetland (Table 2.2-1). Construction would occur on land that has not been previously disturbed. Most of the dedicated acreage is rangeland. Approximately 7630 acres of the 8386 acres disturbed during the pre-construction and construction periods would be permanently dedicated to the new units, their supporting facilities, the cooling basin, and the adjacent Guadalupe-Blanco River Authority (GBRA) storage water reservoir.

Once VCS ceases operations and the plant is decommissioned in accordance with NRC requirements, the land that was dedicated to the new units and their supporting facilities could be used for future industrial or nonindustrial use. The blowdown pipeline from the cooling basin to the Guadalupe River could be removed, restoring this offsite land for uses that were previously precluded by the pipeline easement. The blowdown discharge structure at the Guadalupe River could also be removed and the area restored. However, the GBRA water storage and structures and facilities that convey water to and from it may still be used to support non-VCS-related uses. Offsite water conveyance facilities and structures (e.g., the pump station on Calhoun Canal and water pipeline to the VCS site) are only partially dedicated to supporting VCS operations. These facilities and structures would continue to be dedicated to water conveyance to serve the GBRA storage water reservoir.

Other offsite facilities and structures would support VCS construction or operation. The existing barge facility on the Victoria Barge Canal that would be improved to facilitate construction and operation of

VCS would continue to support regional transportation needs through the operational life of the plant and after decommissioning. The heavy haul road could remain in place as part of the regional transportation infrastructure or be removed after the decommissioning of VCS. The rail spur connecting VCS to the Union Pacific rail line could remain for future use once VCS is decommissioned or be removed.

Finally, the land committed to the disposal of radioactive and nonradioactive wastes generated as a result of construction and operation of VCS would be governed by the applicable regulations and permits and could not be used for other purposes. The land used for disposal, while not available for other uses, is not considered irreversible since it could be reclaimed for future use.

10.2.1.2 **Hydrology and Water Use Commitments**

As discussed in Chapter 3, the VCS closed-cycle cooling system would require makeup water to the cooling basin to replace water lost to evaporation, seepage, and blowdown. The source of this makeup water would be the Guadalupe River via the GBRA Calhoun Canal. The portion of the water pumped to the cooling basin that would be lost to evaporation, or some seepage would be made unavailable as a river resource; however, the portion of the water pumped to the cooling basin and subsequently released as blowdown and some seepage would be returned to the river.

Other plant systems would use groundwater from onsite wells. Once the groundwater is extracted from the aquifer, it is consumed or discharged to the cooling basin making it unavailable as a future groundwater resource. Water resources consumed during normal operation of VCS would not be readily available as a future resource, but should not affect the overall availability of water resources for the area. The water stored in the cooling basin could be returned to the river once VCS is decommissioned or could be used for other purposes.

10.2.1.3 **Ecological Commitments (Terrestrial and Aquatic)**

There would be impacts to vegetation and temporary relocation of terrestrial wildlife due to construction and operation of VCS. A suitable habitat for most of the species affected is available adjacent to the VCS site and in the region.

Approximately 756 acres disturbed during construction for temporary construction facilities and activities would be restored and could be available as a habitat upon completion of construction. The cooling basin and GBRA water storage reservoir could become a habitat for water birds and serve as an aquatic habitat. The decommissioning of VCS would result in restoration of the area, with the exception of the GBRA water storage and conveyance facilities.

Construction of the cooling basin and GBRA storage water reservoir would require alteration of the landscape. All aquatic habitats within the approximately 7110-acre footprint of the cooling basin and GBRA storage water reservoir would be eliminated or degraded by earth-moving activities. The cooling basin and GBRA storage water reservoir would support aquatic life; however, due to the high summer water temperatures possible in portions of the basins, they would be expected to primarily support thermally tolerant aquatic communities. In addition, aquatic resources such as benthic organisms, fish, and shellfish would be lost as a result of impingement and entrainment at the GBRA Calhoun Canal intake structure during filling of the basin and reservoir and operation of VCS. However, as discussed in Section 5.3, impingement and entrainment would not endanger regional populations, due to the common nature of the potentially affected species in southeastern Texas. Additionally, no aquatic species of concern (i.e., listed as state or federally threatened or endangered) and no critical habitats have been identified on the VCS site, in the Guadalupe River near the site, or within the GBRA canal system. The decommissioning of VCS could eventually result in restoration of the area, with the exception of the GBRA water storage and conveyance facilities.

10.2.1.4 **Socioeconomics**

The effect of the construction and operation of the new units would be to increase employment and to provide positive input to the local community in the form of taxes.

The social and economic impacts resulting from VCS plant construction and operation are SMALL because the large existing inventory of vacant housing in the ROI is sufficient for the in-migrating workforce, the current capacity of existing public services would not be burdened by the in-migrating workforce, and the projected maximum student enrollment associated with VCS represents about one-third of the ROI’s excess capacity. The additional law enforcement and fire protection personnel and equipment needed to support the in-migrating workers during VCS plant operation and future non-VCS-related population growth in the ROI would most likely continue to be used. Therefore, there would be no irreversible commitment of resources from a socioeconomic standpoint once the decommissioning of the new units is complete.

10.2.1.5 **Radiological Releases**

The new units would operate under the limitations imposed by NRC with respect to radioactive releases. Decommissioning would also be performed according to the requirements of NRC, which would ultimately be expected to result in the unrestricted use of the site. Therefore, the operation of the new units would not result in irreversible environmental changes to the area due to radiological releases.

10.2.1.6 **Air Emissions and Meteorological Changes**

There would be no major releases of pollutants to the atmosphere from operation of the new units, because use of equipment utilizing diesel fuel that would generate such pollutants is intermittent and limited (e.g., for testing, startup and shutdown, or actuation during a loss of offsite power). Upon decommissioning of the new units, these potential impacts would cease. Therefore, the operation of ancillary equipment associated with the new units would result in negligible irreversible air emissions.

The operation of the large cooling basin has the potential to impact the local meteorology. However, these impacts are expected to be limited to the immediate vicinity of the basin. Therefore, operation of the cooling basin associated with the new units would not result in irreversible long-term meteorological changes to the area.

10.2.2 Retrievable Commitments of Material Resources

Construction of VCS requires large quantities of building materials that would be considered irretrievable commitments of resources unless they are recycled when the plant is decommissioned. Construction materials used for VCS would be similar to those for any major, multi-year construction project. Unlike the earlier generation of nuclear plants, asbestos and other materials considered hazardous would not be used in accordance with safety regulations and practices. The following is a list of the major construction materials that would be required and the estimated quantities needed for construction of the two ESBWR units at the site:

- 710,000 cubic yards of concrete
- 142,000 tons of rebar for the reactor buildings
- 12,600,000 lineal feet of cable
- 491,000 lineal feet of piping greater than 2.5 inches in diameter

The amounts would not be atypical of other types of power plants such as hydroelectric and coal-fired plants, or of many large industrial facilities (e.g., manufacturing plants) that are constructed throughout the United States. Use of construction materials in the quantities associated with those expected for a nuclear power plant, while irretrievable unless they are recycled at decommissioning, would have a SMALL impact with respect to the availability of such resources.

During operations, the main resource irretrievably committed would be the uranium used in the fuel cycle. VCS would require about 3376 metric tons of uranium over an assumed 40-year operating life of the 2-unit plant. Uranium is a metal nearly as common as tin or zinc, and it is a constituent of most rocks and of the sea (WNA Mar 2007). The known uranium resources and the current and projected demand for uranium is assessed biennially in a joint effort by the Organisation for Economic Co-Operation and Development Nuclear Energy Agency and the International Atomic Energy Agency and the results published in what is known as the “Red Book” (OECDNEA/IAEA 2008). The Red Book forecasts the world’s identified uranium resources of 5,468,800 metric tons would be sufficient for about 100 years of reactor supply at the 2006 usage rate of 66,500 metric tons. These projections do not consider uranium savings that could be achieved by specifying lower tails assays or using MOX fuel, or by the deployment of advanced reactor and fuel cycle technologies. Large stocks of uranium, previously dedicated to military applications, have become available for commercial applications. Highly enriched uranium and natural uranium held in various forms by the military sector could meet the demand for natural uranium for commercial applications for several years. The current production of uranium is less than demand due to secondary sources such as the conversion of weapons materials. Market forces will spur increased exploration and development of production capacity as the material currently available from the military sector is used. Known uranium resources will increase as the price increases and there should be sufficient long-term availability of reasonably priced uranium to supply both existing and future reactors. The World Nuclear Association (WNA) also studies supply and demand of uranium, applying market value considerations to its forecast. The WNA concludes that a 70-year supply of uranium is available based on the 2006 usage rate of 66,500 metric tons and the world's measured uranium resources (the amount known to be economically recoverable from ore bodies) of 4,700,000 metric tons (WNA Mar 2007). The VCS uranium consumption over the operating life of the plant represents less than 0.1% of the world uranium resources. Therefore, the uranium that would be used by VCS to generate power, while irretrievable, would have a SMALL impact with respect to the long-term availability of uranium worldwide.

10.2.3 **References**

WNA Mar 2007. World Nuclear Association, *Supply of Uranium*, March 2007, available at http://www.world-nuclear.org/info/inf75.html, accessed November 6, 2007.

10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

This Environmental Report focuses on the analysis and resulting conclusions associated with the environmental and socioeconomic impacts arising from activities during construction and operation of VCS Units 1 and 2. For the purpose of this section, “short-term” represents the period from start of construction to the end of station life, including prompt decommissioning. "Long-term” represents the period extending beyond the end of station life, including the period up to and beyond that required for decommissioning. This section includes an evaluation of the extent to which the short-term uses preclude any options for future use of the VCS site.

10.3.1 **Construction of VCS and Short-Term Uses**

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of construction of VCS and the measures proposed to reduce those impacts. There are adverse environmental impacts that would remain after all practical measures to avoid or mitigate the impacts have been taken. However, none of these impacts represent a long-term effect that would preclude any options for future use of the VCS site.

VCS would be located on an approximately 11,500-acre site in Victoria County, Texas. Approximately 7630 acres of the 8386 acres, disturbed during the preconstruction and construction periods, would be dedicated to the new electricity generation units, their supporting facilities, the cooling basin, and the adjacent Guadalupe-Blanco River Authority (GBRA) water storage reservoir. Activities currently associated with this site are cattle grazing and a limited amount of oil and gas production. During construction and operation of VCS, the land would not be available for these uses; however, these activities represent only a small portion of such activities in the region. Upon completion of construction, the remaining areas would be restored and available for use. Decommissioning of VCS would likely result in release of the area for unrestricted use. However, at that time, the GBRA water storage and structures and facilities that convey water to and from it may still be used to support non-VCS-related uses.

Some construction activities will increase the ambient noise levels in the vicinity of the VCS site. However, upon completion of these activities, the ambient levels will be reduced to the levels associated with the operation of VCS and will be further reduced after plant decommissioning is completed. The workforce will be protected by adherence to the OSHA requirements for noise levels. There will be no effects on the long-term productivity of the VCS site as a result of these noise-related impacts.

Construction-related traffic has the potential to cause congestion in the immediate area of the VCS site and potentially cause deterioration to some of the roads. Potential mitigation measures including upgrades to intersections, staggering work shifts, and public notification of traffic congestion should reduce construction-related traffic congestion.

Construction of the VCS would be beneficial to the local area through the generation of new construction-related jobs, local spending by the construction workforce, and payment of taxes to the area. The adverse socioeconomic impacts that occur as a result of increased population and construction activities will cease once construction is complete and the workforce leaves the area. Benefits from increased tax revenues would persist into the foreseeable future.

The construction of the VCS will not affect short-term uses of the environment.

10.3.2 **Operation of VCS and Long-Term Productivity**

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of operation of VCS and the measures proposed to reduce those impacts. There are adverse environmental impacts that would remain after all practical measures to avoid or mitigate the impacts have been taken. However, none of these impacts represent a long-term effect that would preclude any options for future use of the VCS site.

At the end of station life, the VCS site would be decommissioned using an approved decommissioning method as required by the NRC. The site would be available for future industrial or nonindustrial use, with the exception of the GBRA storage water reservoir and the structures for conveying water to and from the reservoir. The offsite land that would be used for the blowdown discharge pipeline and rail spur would also be available for future industrial or nonindustrial use. Other offsite land used for water conveyance and transportation of construction materials (e.g., a barge facility and a heavy haul road) could continue to be used for water conveyance supporting the GBRA storage water reservoir and local transportation. The maximum long-term impact to productivity would result if the station and its support structures are not dismantled at the end of the period of station operation, and consequently the land occupied by these structures would not be available for other uses.

Operation of VCS would require water resources. The water used in plant operations would be groundwater pumped from onsite wells. The makeup water for the cooling basin would be withdrawn from the Guadalupe River via the GBRA Calhoun Canal. Short-term impacts to water resources as a result of the operation of VCS would be SMALL. Upon decommissioning of the site, use of local water resources for the purposes of supporting VCS would cease. Therefore, the use of water resources supporting operation of VCS would not impact the long-term productivity of the site.

Operation of VCS would require the consumption of nonrenewable resources, as described in Subsection 10.2.2. Consumption of these materials would cease upon decommissioning and does not affect the future productivity of the VCS site.

The operation of fossil fuel-fired combustion equipment (e.g., auxiliary boiler and diesel generators) would result in air emissions during the operation of VCS. Air quality impacts would be small because this equipment would be operated infrequently. Additionally, the predicted salt deposition from operation of the mechanical draft plant service water system cooling towers at locations away from the immediate vicinity of the cooling towers would be less than the NUREG-1555 significance level where visible effects to vegetation may be observed. Once the units cease to operate and are decommissioned, impacts to air would cease. No future issues for the long-term uses of the site would result from the impacts of increased air emissions.

Chemical effluents would be released to the Guadalupe River, in compliance with a Texas Pollutant Discharge Elimination System wastewater discharge permit. As described in Subsection 5.3.2, the releases would not adversely affect the Guadalupe River water quality during the operation of VCS. After decommissioning, releases to surface waters would cease.

Impacts due to radiological emissions would be SMALL because the operation of VCS would be in accordance with NRC regulations, which restrict liquid and gaseous effluent releases. Once VCS ceases to operate and is decommissioned, radiological releases would cease. Activities associated with decommissioning would reduce contamination to levels that meet appropriate NRC release criteria. No future issues associated with the radiological emissions from operation of VCS would affect the long-term uses of the VCS site.

Spent nuclear fuel would be disposed at a repository, such as the candidate repository at Yucca Mountain, Nevada (Subsection 5.7.1.6). However, the spent nuclear fuel may be stored temporarily on the site, such as in the spent fuel pool or an independent spent fuel storage installation. This portion of the site would be unavailable for future use until the spent fuel is transported offsite.

Socioeconomic changes brought about by the operation of VCS, such as additional local infrastructure, would persist after decommissioning. Property taxes paid by Exelon to Victoria County would provide significant revenues that would benefit the county for the foreseeable future, and could support greater county infrastructure and social service improvements. The population of the six-county region of influence (Section 2.5) would increase during the life of the station and would use the services provided as a result of VCS-related tax revenues. Much of Victoria County is in agricultural use and provides little tax revenue to support county infrastructure and services. Therefore, taxes paid to Victoria County would have a long-term positive effect on the productivity of the county.

The operation of VCS will not affect long-term productivity of the environment.

10.3.3 Summary of Relationship Between Short-Term Uses and Long-Term Productivity

The negative impacts of local use of the human environment by the installation, operation, and decommissioning of VCS are summarized in terms of the unavoidable adverse environmental impacts of construction and operation in Section 10.1. The irreversible and irretrievable commitments of environmental resources associated with the project are summarized in Section 10.2. Except for the consumption of nonrenewable resources during the construction and operation of VCS, the land committed for conveyance of water to and from the GBRA storage water reservoir that would be located on the VCS site, and the land committed for waste burial, these impacts may be classified as short-term. Impacts resulting from land-use preemption by station structures can be eliminated by removing these structures or by converting them to other productive uses.

The principal short-term benefit resulting from the construction and operation of VCS is production of electricity and associated enhancement in regional economic productivity. The regional productivity resulting from the additional electricity produced by VCS would be expected to result in a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site.

In conclusion, the negative aspects of VCS construction and operation, as they affect the human environment, are outweighed by the positive long-term enhancement of regional productivity through generation of electricity.

10.4 Benefit-Cost Balance

This section provides the benefit-cost analysis for construction and operation of two ESBWR units at the proposed VCS site. Subsection 10.4.1 describes benefits of constructing and operating new nuclear units at VCS. Subsection 10.4.2 describes costs of constructing and operating the units. Subsection 10.4.3 provides a high-level summary of the benefits and costs addressed in Subsections 10.4.1 and 10.4.2.

10.4.1 Benefits

10.4.1.1 Need for Power

VCS Units 1 and 2 will each generate 1535 MWe net output electricity for a total of 3070 MWe. Assuming a reasonably low capacity factor of 85%, the 2-unit plant's average annual electrical energy generation would be approximately 22,900,000 MW-hours. A reasonably high capacity factor of 93% would result in slightly more than 25,000,000 MW-hours of electricity.

As discussed in Chapter 8, the Electric Reliability Council of Texas (ERCOT), the independent system operator for the electric grid for most of Texas, conducted several studies on the need for power in their service area. ERCOT has concluded that a substantial amount of new generation will be needed to meet the projected demand for 2017 along with maintaining the recommended minimum 12.5% reserve margin. The addition of 22,900,000 to 25,000,000 MW-hours of electricity per year from VCS Units 1 and 2 would help maintain system reliability by increasing the availability of baseload power in the ERCOT region.

10.4.1.2 Fuel Diversity

Fuel diversity is the key to affordable and reliable electricity. A diverse fuel mix protects electric companies and consumers from contingencies such as fuel unavailability, price fluctuations, and changes in regulatory practices (EEI Mar 2003). History teaches that it is risky to develop an over-reliance on any one energy source. Industry experience over the past 30 years has demonstrated that a balanced energy portfolio is the key to providing America with a growing supply of affordable electricity (NRRI Mar 2005).

Nuclear power plants currently generate approximately 20% of the electricity produced in the United States; however, recent electric generating capacity additions and projected future additions are fueled primarily by natural gas. According to the U.S. DOE, an over-reliance on a single fuel source, like natural gas, is a potential vulnerability to the long-term security of our nation's energy supply. Additional new nuclear plants must be built in the next decade to address increasing concerns over air quality and climate change, and to ease the pressures on natural gas supply (USDOE 2008). The ERCOT region fuel mix consists of approximately 45.5% natural gas, 37.4% coal, 13.4% nuclear, 2.9% wind, 0.4% water and 0.4% from other sources (actual energy production values January 2007–December 2007)(ERCOT May 2008).

High prices for natural gas and the intense, recurring periods of price volatility experienced over the last several years are influenced partly by demand for natural gas in the electric generation sector (NEI Jan 2005). Electric sector demand for natural gas is being driven by the large amounts of new gas-fired electric generating capacity built in the United States over the past 15 years (NRRI Mar 2005). Since 1990, nearly 90% of all new electric generating capacity has been fueled with natural gas (EIA Jun 2007). New nuclear plants provide forward price stability that is not available from generating plants fueled with natural gas. The intense volatility in natural gas prices experienced over the last several years is likely to continue and leaves the U.S. economy vulnerable. Although nuclear plants are capital-intensive to build, the operating costs are stable and dampen the volatility elsewhere in the electricity market. (NEI Jan 2005).

Operation of the proposed VCS Units 1 and 2 advances the goal of obtaining a diversified mix of electrical generating sources, while meeting state and national goals of creating new baseload generation that would not use natural gas as a fuel.

10.4.1.3 **Avoided Emissions**

Nuclear power generation results in significant local and national air quality benefits. Power plants that use natural gas and coal for electrical generation produce significant air pollutant emissions (e.g., nitrogen oxides, sulfur dioxide, carbon dioxide, and methyl mercury) that adversely affect human health. Fossil fuel-fired power plants are responsible for 67% of the nation's sulfur dioxide emissions, 23% of nitrogen oxide emissions, and 40% of man-made carbon dioxide emissions. The majority of industry's emissions are from coal-fired plants (USEPA Dec 2007). Nuclear reactors have the added benefit that they do not contribute to smog.

Subsections 9.2.3.1 and 9.2.3.2 analyze coal- and gas-fired alternatives to VCS, respectively. Air emissions from these alternatives and nuclear power are summarized in Table 10.4-1.

Regardless of which reasonable alternative one compares to nuclear power, VCS would represent a substantial benefit in emission reduction, or emission avoidance, assuming that the alternative power source would be constructed if VCS Units 1 and 2 were not.

10.4.1.4 **Advantages of Nuclear Power**

Concerns about greenhouse gases and global climate change make it reasonable to expect that, eventually, the United States may have to strictly curb emissions from fossil-fuel electric generation plants, conceivably to the point of displacing coal- and gas-fired electricity generation. If environmental policies greatly restrict carbon emissions in the future, the cost of building and operating fossil-fired plants could increase by 50% to 100%. Nuclear power is the only technology currently available that is a viable alternative to fossil-fired plants for baseload generation. In view of the time that it takes to gear up the nuclear industry, the prospect of needing nuclear power to displace fossil fuel power is one of the reasons for national concern with maintaining a nuclear energy capability. (Chicago Aug 2004)

10.4.1.5 Tax Payments

As described in Subsection 4.4.2.2.2, during the 7-year construction period, Exelon has projected the annual sales tax payments to be approximately $1.7 million for Units 1 and 2, with $1.3 million due to the city of Victoria and $0.4 million due to Victoria County. These payments could provide a total of $9.0 million to the city of Victoria over the 7-year construction period. Increased tax revenues would also come from property taxes as a result of the construction of VCS Units 1 and 2. Franchise taxes would not be paid during the construction period because there would be no revenues during that time.

As described in Subsection 5.8.2.2.2, Exelon estimates that annual property taxes on VCS Units 1 and 2 would be approximately $24 million. Annual franchise tax payments could range from approximately $7.0 million to $11 million during operations. Most people consider large tax payments a benefit to the taxing entity because they support the development of infrastructure which supports further economic development.

10.4.1.6 Local Economy

VCS Units 1 and 2 would require an operations workforce of about 800 people. The multiplier effect would create additional indirect jobs. In total, it is estimated that 2223 new jobs within about a 50-mile radius of the plant (Subsection 5.8.2.2.1) would be created by the start-up of the new units and would be maintained throughout the life of the plant. Many of these jobs would be in the service sector and could be filled by unemployed local residents, lessening demands on social service agencies in addition to strengthening the economy. The economic multiplier effect of the increased spending by the direct and indirect labor force created as a result of two new units would increase the economic activity in the region. Because the residence distribution and shopping patterns of the incoming workers is not known at this time, Exelon cannot predict where the beneficial impacts might occur within the region of interest counties.

Nuclear plants such as the proposed VCS Units 1 and 2 generate approximately $350 million in total output for the local community and roughly $60 million in total labor income.[1] These figures include direct effects, which reflect expenditures for goods, services, and labor, and secondary effects, which include subsequent spending in the community. The economic multiplier effect is one way of measuring secondary effects and means that every dollar spent by nuclear plants result in the creation of an additional $1.13 in the community. (SSEB Jul 2006)

10.4.1.7 Other Benefits

Section 10.3 describes the relationship between short-term uses and long-term productivity of the human environment. Additional benefits not described in Section 10.3 include:

1. The Southern States Energy Board reference (SSEB Jul 2006) does not provide specific years for the $350 and $60 million figures, nor does it specifically identify the studies done by the Nuclear Energy Institute (NEI) to support this statement. However, the Southern States Energy Board is considered a reliable source of data. Exelon considers that the Southern States Energy Board's interpretation of NEI's data is correct, somewhat current (within the late 1990s to early 2000s), and useful for this analysis, even if the exact years of the data cannot be determined.

- Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers.
- Reduced depletion of finite fossil fuel supplies.

10.4.1.8 Benefit Summary

Table 10.4-2 is a summary of the benefits of the proposed project.

In Subsection 9.3.3, *Alternative Site Review*, Exelon evaluated environmental impacts of construction and operation of the proposed project at four alternative greenfield sites (Matagorda County, Buckeye, Alpha, and Bravo). Table 10.4-3 provides a comparison of the benefits of construction and operation of the project as proposed to those at the four alternative sites.

10.4.2 Costs

10.4.2.1 Internal Costs — Proposed Action

There are numerous studies available that estimate the cost of constructing and operating new nuclear power plants. The following studies were reviewed in detail to estimate VCS internal costs:

- *Nuclear Power's Role in Generating Electricity*, Congressional Budget Office (CBO May 2008).
- *The Economic Future of Nuclear Power*, University of Chicago (Chicago Aug 2004).
- *Before the Florida Public Service Commission Florida Power & Light Company's Petition to Determine Need for Turkey Point Nuclear Units 6 and 7 Electrical Power Plant, Direct Testimony & Exhibits of: Steven D. Scroggs*, Florida Power & Light Company (FPL Oct 2007).
- *Nuclear Power Joint Fact Finding*, The Keystone Center (Keystone Jun 2007).
- *The Future of Nuclear Power; an Interdisciplinary MIT Study*, Massachusetts Institute of Technology (MIT Jul 2003).
- *New Nuclear Power Plant Licensing Demonstration Project ABWR Cost/Schedule/COL Project at TVA's Bellefonte Site*, Tennessee Valley Authority (TVA Aug 2005).

The CBO, Keystone, Chicago, and MIT studies are based on costs for plants recently constructed overseas and use input from the U. S. Energy Information Administration (EIA). The TVA study is a bottom-up estimate based on materials and labor costs, and the FPL study is an adaptation of the TVA study. It is difficult to compare study results due to differing assumptions and analytic approaches. In addition, studies do not always identify inputs that would facilitate explanation of the reason for differing results. Table 10.4-4 provides a summary of the estimated nuclear plant costs from these studies. Commonly used terminology cited in Table 10.4-4 and subsequent tables includes the following:

- Overnight cost — Sometimes called "overnight capital cost," this is a convention for expressing the cost of construction as if the plant could be built overnight. The cost is expressed as an absolute dollar value or a dollar value per unit of net (exclusive onsite use) electrical generation capacity, such as dollars per kilowatt or dollars per megawatt. The cost does not include escalation or interest costs during construction or during time between estimate and assumed start of construction. The data is useful for comparing costs of alternative nuclear technologies and becomes the basis for broader cost estimates. Variables affecting interpretation of published information include whether the basis is recent construction history or materials and labor costs buildup; inclusion of owner's costs (e.g., licensing, land, site preparation, cooling system, switchyard, transmission facilities, project management, and contingencies); economies of scale due to number of units to be built at site; and dollar-year of estimate.

- Construction cost — Sometimes called "all-in cost," this adds to overnight cost escalation and interest during construction and during the time between a cost estimate and the start of construction. It is expressed in the same units as overnight cost and is useful for identifying the total cost of construction and for determining the effects of construction delays. Variables affecting the interpretation of published information include completeness of the overnight cost estimate; assumptions on escalation and interest rates, debt/equity ratio, length of construction period, and contingencies; and dollar-year of estimate.
- Levelized Cost — Sometimes called "levelized annual cost" or "breakeven cost," this is the constant real wholesale price needed to recover financing, construction, and operating costs of the plant. The cost is expressed as cent or dollar value per amount of net electrical generation over time, such as cents per kW-hour. Levelized cost is useful for comparing cost-competitiveness between alternative generation technologies (e.g., nuclear versus coal). Variables affecting interpretation of published information include completeness of intermediary cost estimates (overnight and construction); assumptions about plant capacity factor and levelization period; and dollar-year of estimate.
- The studies report cost estimates for different years, such as $1800 in 2003 dollars. In order to compare estimates from different studies, Exelon escalated all estimates to 2008 dollars. Exelon also added an estimate of owner's costs to the results of the TVA study and subtracted transmission costs from the results of the FPL study.

Overnight Cost

Table 10.4-4 shows overnight cost estimates ranging from $2117 to $4441 per kW in 2008 dollars, with more recent costs generally being in the higher end of the range. The increase is consistent with a sharp rise in construction cost indices since 2003 (Keystone study). For a plant such as VCS, with a capacity of 3070 MWe net (Subsection 8.1.1), this data gives an overnight cost range of approximately $6.5 billion to $13.6 billion. Exelon has concluded that, for the purposes of the Chapter 10 benefit/cost analysis, this range would bracket VCS overnight costs.

There are two limitations to applying these overnight cost figures to VCS. First, it is not clear how completely some of the studies incorporate the cost of land. The EIA has indicated that its cost projection is an average of construction costs incurred in completed advanced reactor builds in Asia. It is reasonable to conclude that construction costs for completed reactors would include owner's costs and that, therefore, EIA projections include owner's costs. Table 10.4-4 makes this assumption. The TVA study does not include owner's costs, where land cost would appear, and the FPL study expressly includes $0 for land cost (FPL would use a site of an existing power plant).

VCS is a greenfield site but Exelon has not publicized the cost of purchasing the VCS site. Exelon considers the purchase price for the VCS site to be confidential information and that including the cost of the purchase is unnecessary for the purposes of Chapter 10. The cost is not irretrievable because the land would be available for resale after decommissioning. Therefore, it could not go into a benefit/cost equation accurately except on both sides of the equation, in which case it is not a differentiator useful to a decision maker. While land requirements for alternative technologies (gas- and coal-fired) are conceptually different, Exelon alternative siting information is available only for the alternative nuclear sites described in Section 9.3. For the purposes of Chapter 10, Exelon is assuming that the technology alternatives would be placed on one of these sites, in which case the land cost is not a differentiator between the technology alternatives.

The second limitation to the Table 10.4-4 overnight cost information is that it does not include the cost of transmission facilities. Exelon notes that, while the NRC has historically considered transmission costs to be internal costs, this is not correct for a merchant plant within ERCOT, such as VCS. As Section 3.7 indicates, the transmission service provider for VCS would be American Electric Power (AEP). AEP estimates the cost of interconnection would be approximately $563 million.

Construction Cost

As Table 10.4-4 shows, only two studies, FPL and Keystone, included estimates of total construction costs, although total construction costs would have been calculated by the three other studies (CBO, Chicago, and MIT) reporting levelized costs. The total construction cost estimates, escalated to 2008 dollars, range from $4374 to $7829 per kWe net. Applying this range to VCS would give a total construction cost estimate range of $13.4 billion to $24 billion. Like overnight costs, Exelon has concluded that these estimates would bracket VCS construction costs, excluding land and transmission costs.

The Texas comptroller has published a report that includes a projection of new nuclear plant costs (TCPA May 2008). The report is based on the Chicago study without additional input, so Exelon did not include it in Table 10.4-4. Published literature indicates that Moody's Investor Services has released to subscribers a report on new nuclear plant costs. The literature states that Moody's estimated the all-in cost between $5000 and $6000 per kilowatt, a range that would be at the high end of the Table 10.4-4 range but not as high as FPL's highest estimate. However, the literature indicates that Moody's does not provide details on how the calculation was done, so it is not possible to evaluate what is included or excluded from the estimate. Because the Moody's report is not freely available to the public, Exelon did not include its results in Table 10.4-4.

Levelized Cost

The CBO, Keystone, Chicago, and MIT studies reported estimates of levelized costs, escalated to 2008 dollars, ranging from 6.4 to 11.5 cents per kWh. Generally, the low end of the range represents older studies and the higher-end estimates assume longer construction times (6 to 7 years) and lower capacity factors (75% to 85%). Exelon has concluded that the VCS levelized cost is within this range but that a mid-range estimate is most appropriate.

10.4.2.2 Internal Costs — Generation Alternatives

As described in Chapter 9, Exelon has concluded that coal- and gas-fired generation are reasonable alternatives to the proposed action. These technologies also figure into most published studies that compare the cost of new nuclear plants to the cost of generation alternatives. For several reasons, comparisons between these alternatives are difficult. Coal- and gas-fired plants cost less to build than nuclear plants, but their operating costs are higher. This means that only comparisons of levelized costs reflect a true assessment of competitiveness. Recent domestic experience in building coal- and gas-fired plants means that there is less need for contingency and risk planning than for new nuclear plants. The volatility of the natural gas market makes predicting gas-fired generation operating costs difficult. However, the most significant complicating factor is the potential impact of federal legislation on greenhouse gas emissions.

There are numerous studies available that estimate the cost of constructing and operating new coal- and gas-fired plants. The following two studies that evaluated the cost of constructing and operating new coal- and gas-fired plants under various greenhouse gas control scenarios were reviewed in detail to estimate VCS internal costs.

- Nuclear Power's Role in Generating Electricity, Congressional Budget Office (CBO May 2008).
- Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity, National Energy Technology Laboratory (NETL Aug 2007).

The studies report cost estimates for different years. In order to compare estimates from different studies, all estimates were escalated to 2008 dollars. Tables 10.4-5 and 10.4-6 provide summaries of the estimated coal- and gas-fired plant costs from these studies. Exelon also added an estimate of owner's costs to the results of the National Energy Technology Laboratory (NETL) study.

Overnight Cost

For the coal-fired alternative, assuming no carbon emission (greenhouse gas) controls, Table 10.4-5 shows overnight cost estimates in 2008 dollars ranging from $1600 to $1952 per kW. When carbon emission control is considered, Table 10.4-5 indicates that overnight costs could be as high as $3558 per kW in 2008 dollars. For a coal-fired plant having a capacity of 3033 MWe net (Subsection 9.2.3.1), this data gives an overnight cost range of approximately $4.9 billion to $10.8 billion.

For the gas-fired alternative, assuming no carbon emission control, Table 10.4-6 shows overnight cost estimates in 2008 dollars ranging from $687 to $731 per kW. When carbon emission control is considered, Table 10.4-6 indicates that overnight costs could be as high as $1453 per kW in 2008 dollars. For a gas-fired plant having a capacity of 3033 MWe net (Subsection 9.2.3.2), this data gives an overnight cost range of approximately $2.1 billion to $4.4 billion.

The overnight cost information in Tables 10.4-5 and 10.4-6 do not include the cost of transmission facilities. For the purpose of comparison, Exelon has assumed that the coal- and gas-fired alternatives would be located at the VCS site. As discussed in Subsection 10.4.2.1, VCS would be connected to the grid by 345kV lines at an estimated cost of approximately $563 million.

Levelized Cost

As shown in Table 10.4-5, the CBO and NETL studies reported estimates of levelized costs for coal-fired generation, escalated to 2008 dollars, ranging from 5.9 to 7.3 cents per kWh, assuming no carbon control. When carbon control is considered, the estimates of levelized costs increase to a range of 8.5 to 13.7 cents per kWh.

As shown in Table 10.4-6, the CBO and NETL studies reported estimates of levelized costs for gas-fired generation, escalated to 2008 dollars, ranging from 6.1 to 7.3 cents per kWh, assuming no carbon control. When carbon control is considered, the estimates of levelized costs increase to a range of 7.1 to 10.6 cents per kWh.

10.4.2.3 External Costs

10.4.2.3.1 Land Use

Loss of habitat is one of the costs of constructing VCS. The station is slated to occupy about 7630 acres of the 11,532-acre site. Most of the land occupied by facility structures and the cooling basin is rangeland. A detailed description of land-use impacts is provided in Section 4.1.

Eight new transmission lines are required for VCS. Transmission corridors are discussed in Section 2.2, 4.1, 5.1, and 9.4. Construction of new transmission line corridors would disturb an estimated 2211 acres (not counting the newly considered Cholla line) in an area consisting primarily of pasture and cultivated crops. Operation of transmission lines has minimal to no effects on land use. Transmission line easements restrict placement of permanent structures in the easement or plantings that may interfere with line maintenance. Otherwise, no restrictions are placed on land use.

10.4.2.3.2 Hydrological and Water Use

The consumptive water use from the Guadalupe River for the VCS facilities would range from approximately 43,200 gpm under normal use conditions to 64,500 gpm under maximum use conditions. (Table 3.3-2) A portion of the cooling water is lost to evaporation, and therefore, represents a permanent consumptive loss. However, this loss represents a small fraction of the available surface water that is contained within the Lower Guadalupe River Basin.

10.4.2.3.3 Terrestrial and Aquatic Biology

Ecological effects related to plant construction and operation are discussed in Sections 4.3 and 5.3, respectively. Some cost due to wildlife mortality during construction is anticipated. However, these losses are not expected to be large enough to affect the long-term stability of wildlife populations. The raw water makeup intake structure on the GBRA Calhoun Canal would be designed to minimize the loss of aquatic biota as a result of impingement and entrainment. In addition, construction of the new intake structure should result in only minor and temporary effects to aquatic biology. Section 5.3 states that impacts to aquatic biota from the operation of intake and discharge systems would be SMALL.

10.4.2.3.4 Air Emissions, Effluents, and Wastes

Relatively small amounts of air emissions from diesel generators, auxiliary boilers, and other equipment and vehicles would be generated. Plant Service Water System (PSWS) cooling tower drift would deposit some salt on the immediate surrounding vicinity, but the level is unlikely to result in any measurable impact on plants and vegetation. The PSWS cooling towers would also produce an atmospheric vapor plume.

Small amounts of effluents are discharged into the receiving water. Relatively small amounts of hazardous wastes that need to be managed and disposed pursuant to the Resource Conservation and Recovery Act are generated. Section 3.6 and Subsection 2.3.3 discuss nonradioactive waste systems.

10.4.2.3.5 Radioactive Emissions, Effluents, and Wastes

Minor radioactive air emissions would be released into the atmosphere and discharged to receiving water. Low-level and high-level radioactive wastes would be generated and would be disposed of according to local, state, and federal permitting regulations.

10.4.2.3.6 Materials, Energy, and Uranium

Construction of the two nuclear units results in an irreversible and irretrievable commitment of materials and energy (see Section 10.2). Operation of the reactors contributes to the depletion of uranium.

10.4.2.3.7 Socioeconomic

Sections 4.4 and 5.8 discuss socioeconomic costs related to construction and operation of VCS. Additional public and social services may be required to meet the demands of people moving into the area during construction and operation of VCS. However, these costs should be largely offset by increased tax revenues and economic input from those individuals and their families.

10.4.2.4 Alternative Sites

In Subsection 9.3.3, *Alternative Site Review*, Exelon evaluated environmental impacts of construction and operation of the proposed project at four alternative greenfield sites (Matagorda County, Buckeye, Alpha, and Bravo). Table 10.4-7 identifies the unavoidable adverse environmental impacts of construction and operation of the project as proposed at the four alternative sites.

10.4.3 Summary

As discussed in Chapter 8, there is a growing demand for baseload power and a substantial projected supply shortfall for the region of interest. Without additional capacity, an adequate power reserve margin could not be maintained. The construction and operation of VCS Units 1 and 2 would help to meet this need by supplying 22,900,000 to 25,000,000 MW-hours of electricity per year. However, overnight capital costs related to construction of new power plants, and nuclear power plants in particular, can be substantial.

The two reactor units at VCS would generate electricity that results in a significant reduction in emissions with respect to comparably-sized coal- or gas-fired alternatives. As discussed in this section, VCS also has important strategic implications in terms of lessening dependence of the United States on foreign energy supplies, and their potential interruption, as well as vulnerability to volatile price changes. While the additional direct and indirect creation of jobs places some temporary burden on local services and infrastructure, the annual taxes and revenue generated by new workers contribute to the local economy and fuel future growth.

On balance, the benefits of VCS (diversification of electricity sources, electricity generation to meet growing energy needs with minimal emission of air pollutants, reduction of the nation's vulnerability to foreign energy sources, and reduction of the rate of depletion of fossil-fuel supplies) outweigh the environmental (loss of rangeland habitat in an area having rangeland as the primary land use category, consumption of a small fraction of the available surface water that is contained within the Lower Guadalupe River Basin, loss of individual terrestrial wildlife and aquatic biota without impacting the ecological community as a whole, discharges to surface waters of small amounts of permitted pollutants, radiological releases within regulatory limits, generation of relatively small amounts of nonradioactive and radioactive wastes, and risk to the environment from a severe accident), economic (commitment of types and quantities of materials and energy that are readily available in regional, national, or international markets), and social (risk of severe accident, increased demand for public and social services offset by increased tax revenues) costs. The overall benefit-cost balance, based on the proposed plant, would not be significantly improved by the selection of an alternative site for nuclear-generating units. Furthermore, alternative generating systems do not provide the same benefits as nuclear units, but have similar costs with two major exceptions (air pollution vs. radioactive waste). The trade-off of these two exceptions does not tip the benefit-cost balance to favor an alternative generating system. On the contrary, the risky over-reliance on any one energy source would leave the United States' and Texas' economic future vulnerable.

In conclusion, the construction and operation of the proposed project is needed in the region of interest and the benefits outweigh the environmental, economic, and social costs.

10.4.4 References

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Table 10.4-1
Estimated Avoided Air Pollutant Emissions

Pollutant	Coal Emissions (tons per year/ 3033 MWe)[a]	Gas Emissions (tons per year/ 3033 MWe)[b]
Sulfur dioxide	8,325	55
Nitrogen oxides	2,314	903
Carbon monoxide	3,214	187
Carbon dioxide	30,920,000	9,120,000
Mercury	0.53	0
Particulates having a diameter of less than 10 microns	152	157
Particulates having a diameter of less than 2.5 microns	40	157

a. Based on constructing four ultra-supercritical pulverized coal-fired boiler units to replace the power that would be produced by VCS Units 1 and 2 (see Section 9.2).

b. Based on constructing three natural gas-fired combined cycle units to replace the power that would be produced by VCS Units 1 and 2 (see Section 9.2).

Table 10.4-2
Benefit Summary

Benefit Category	Description
Electricity generated	22,900,000 to 25,000,000 megawatt-hours per year
Generating capacity	3070 megawatts
Fuel diversity and natural gas alternative	Nuclear option to coal- and gas-fired baseload generation
Emissions reduction	Avoidance of 55 to 8325 tons per year sulfur dioxide
	Avoidance of 903 to 2314 tons per year nitrogen oxides
	Avoidance of 187 to 3214 tons per year carbon monoxide
	Avoidance of 9,120,000 to 30,920,000 tons per year carbon dioxide
	Avoidance of up to 0.53 tons per year mercury
	Avoidance of 40 to 157 tons per year particulates
Advanced light water reactor development	Maintaining domestic nuclear technology capability as hedge against possible need to mitigate global warming
Tax payments	Payments over 60-year life of plant. Property tax payments in 2006 dollars of approximately $24 million per year. Franchise tax payments in 2006 dollars could range from approximately $7.0 million to $11 million per year.
Local economy	Add an estimated 2223 jobs to the local economy
Cultural resources	Site investigation adding to local historic and pre-historic knowledge base
Other	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers
	Reduced depletion of finite fossil fuel supplies

Table 10.4-3 (Sheet 1 of 3)
Benefits of the Proposed Project

Benefit Category	Project as Proposed	With Option 1	With Option 2	With Option 3	With Option 4
Description of Project	**As Proposed**	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Monetary Benefits					
Net Electrical Generating Benefits					
Electricity Generated	22,900,000 to 25,000,000 megawatt-hours per year	22,900,000 to 25,000,000 megawatt-hours per year	22,900,000 to 25,000,000 megawatt-hours per year	22,900,000 to 25,000,000 megawatt-hours per year	22,900,000 to 25,000,000 megawatt-hours per year
Generating Capacity	3070 megawatts	3070 megawatts	3070 megawatts	3070 megawatts	3070 megawatts
State and Local tax Payments					
During Construction	Increased property tax payments during the peak construction period	Increased property tax payments during the peak construction period	Increased property tax payments during the peak construction period	Increased property tax payments during the peak construction period	Increased property tax payments during the peak construction period
During Operations	Franchise tax payment between $7 million and $11 million per year. Property tax payments of approximately $24 million per year.	Franchise tax payment between $7 million and $11 million per year. Property tax payments of approximately $24 million per year.	Franchise tax payment between $7 million and $11 million per year. Property tax payments of approximately $24 million per year.	Franchise tax payment between $7 million and $11 million per year. Property tax payments of approximately $24 million per year.	Franchise tax payment between $7 million and $11 million per year. Property tax payments of approximately $24 million per year.
Effects on regional productivity					
During Construction	Peak influx of 5985 construction and 265 operations workers resulting in 4231 indirect jobs. Total of 10,481 new jobs added to local economy.	Peak influx of 5985 construction and 265 operations workers resulting in 4188 indirect jobs. Total of 10,438 new jobs added to local economy.	Peak influx of 5985 construction and 265 operations workers resulting in 4188 indirect jobs. Total of 10,438 new jobs added to local economy.	Peak influx of 5985 construction and 265 operations workers resulting in 4470 indirect jobs. Total of 10,720 new jobs added to local economy.	Peak influx of 5985 construction and 265 operations workers resulting in 4561 indirect jobs. Total of 10,811 new jobs added to local economy.
During Operations	800 direct jobs and 1423 indirect jobs added to local economy	800 direct jobs and 1276 indirect jobs added to local economy	800 direct jobs and 1276 indirect jobs added to local economy	800 direct jobs and 1294 indirect jobs added to local economy	800 direct jobs and 1429 indirect jobs added to local economy

Table 10.4-3 (Sheet 2 of 3)
Benefits of the Proposed Project

Benefit Category	Project as Proposed	With Option 1	With Option 2	With Option 3	With Option 4
Description of Project	**As Proposed**	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Technical and Other Non-monetary Benefits					
Advanced Light Water Reactor Development	Maintaining domestic nuclear technology capability as hedge against possible need to control global climate change	Maintaining domestic nuclear technology capability as hedge against possible need to control global climate change	Maintaining domestic nuclear technology capability as hedge against possible need to control global climate change	Maintaining domestic nuclear technology capability as hedge against possible need to control global climate change	Maintaining domestic nuclear technology capability as hedge against possible need to control global climate change
Improvements to Local Facilities	Minor road repairs and improvements in the vicinity of VCS	Minor road repairs and improvements in the vicinity of the Matagorda County Site	Minor road repairs and improvements in the vicinity of the Buckeye Site	Minor road repairs and improvements in the vicinity of the Alpha Site	Minor road repairs and improvements in the vicinity of the Bravo Site
Fuel Diversity	Nuclear option to coal- and gas-fired baseload generation	Nuclear option to coal- and gas-fired baseload generation	Nuclear option to coal- and gas-fired baseload generation	Nuclear option to coal- and gas-fired baseload generation	Nuclear option to coal- and gas-fired baseload generation
Emissions Reduction	Avoidance of 55 to 8325 tons per year sulfur dioxide; 903 to 2314 tons per year nitrogen oxides; 187 to 3214 tons per year carbon monoxide; 9,120,000 to 30,920,000 tons per year carbon dioxide; up to 0.53 tons per year mercury; and 40 to 157 tons per year particulates	Avoidance of 55 to 8325 tons per year sulfur dioxide; 903 to 2314 tons per year nitrogen oxides; 187 to 3214 tons per year carbon monoxide; 9,120,000 to 30,920,000 tons per year carbon dioxide; up to 0.53 tons per year mercury; and 40 to 157 tons per year particulates	Avoidance of 55 to 8325 tons per year sulfur dioxide; 903 to 2314 tons per year nitrogen oxides; 187 to 3214 tons per year carbon monoxide; 9,120,000 to 30,920,000 tons per year carbon dioxide; up to 0.53 tons per year mercury; and 40 to 157 tons per year particulates	Avoidance of 55 to 8325 tons per year sulfur dioxide; 903 to 2314 tons per year nitrogen oxides; 187 to 3214 tons per year carbon monoxide; 9,120,000 to 30,920,000 tons per year carbon dioxide; up to 0.53 tons per year mercury; and 40 to 157 tons per year particulates	Avoidance of 55 to 8325 tons per year sulfur dioxide; 903 to 2314 tons per year nitrogen oxides; 187 to 3214 tons per year carbon monoxide; 9,120,000 to 30,920,000 tons per year carbon dioxide; up to 0.53 tons per year mercury; and 40 to 157 tons per year particulates

Table 10.4-3 (Sheet 3 of 3)
Benefits of the Proposed Project

Benefit Category	Project as Proposed	With Option 1	With Option 2	With Option 3	With Option 4
Description of Project	**As Proposed**	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Technical and Other Non-monetary Benefits (continued)					
Cultural Resources	Site investigation adding to local historic and pre-historic knowledge base	Site investigation adding to local historic and pre-historic knowledge base	Site investigation adding to local historic and pre-historic knowledge base	Site investigation adding to local historic and pre-historic knowledge base	Site investigation adding to local historic and pre-historic knowledge base
Other	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers; reduced foreign trade deficit; and reduced depletion of finite fossil fuel supplies	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers; reduced foreign trade deficit; and reduced depletion of finite fossil fuel supplies	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers; reduced foreign trade deficit; and reduced depletion of finite fossil fuel supplies	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers; reduced foreign trade deficit; and reduced depletion of finite fossil fuel supplies	Reduced dependence on foreign energy and vulnerability to energy disruptions dictated by foreign powers; reduced foreign trade deficit; and reduced depletion of finite fossil fuel supplies

Table 10.4-4
Nuclear Plant Monetary Costs[a]

Study	Overnight Cost[b] per kW (year)	Overnight Cost per kW Escalated to 2008 Dollars[c]	Construction Cost[d] per kW (year)	Construction Cost per kW Escalated to 2008 Dollars[c]	Levelized Cost[e] per kWh (year)	Levelized Cost per kWh Escalated to 2008 Dollars[c]
CBO May 2008	$2358 (2006) Single unit, including owner's costs (assumed)[f]	$2516	Not estimated		7.2 cents (2006) with 6 years construction period, 90 percent capacity factor, and 40-year plant life	7.7 cents
FPL Oct 2007	$2910–$4298 (2007).[g] Two units, including owner's costs	$3006–$4441	$5079 - $7579 (2007)[h] with 6-year construction period	$5247 - $7829	Not estimated	
Keystone Jun 2007	$2130[i] (2002) Single unit, including all owner's costs (presumed[j])	$2588	$3600 with 5-year construction period and no escalation — $4000 with 6-year construction period and 3.3 percent real escalation (2007)	$4374 - $4860	8.3 cents with 90 percent capacity factor and 40-year levelization period — 11.1 cents with 75 percent capacity factor and 30-year levelization period (2007)	8.6–11.5 cents
TVA Aug 2005	$1611 (2004) Two units, excluding owner's costs	$1834 without owner's costs — $2201 with owner's costs[k]	Not estimated		Not estimated	
Chicago Aug 2004[l]	$1800 (2003) Single unit, including owner's costs	$2117	Not estimated		5.8 cents with 5-year construction period, 90 percent capacity factor, and 40-year levelization period — 7.1 cents with 7-year construction period, 85 percent capacity factor, and 40-year levelization period(2003)	6.8–8.4 cents
MIT Jul 2003	$2000 (2002) Single unit, including all owner's costs[m]	$2430	Not estimated		5.3 cents with 4-year construction period, 85 percent capacity factor, and 40-year levelization period — 7.5 cents with 5-year construction period, 75 percent capacity factor, and 40-year levelization period (2002)	6.4 – 9.1 cents

AFUDC = Allowance for funds used during construction (interest incurred during construction period)

a. Costs summarized in this table do not include transmission and distribution costs.
b. "Overnight Cost" is a convention for expressing the cost of construction as if the plant could be built overnight and therefore does not include escalation or interest costs during construction. Engineering, procurement, and construction costs are included. Some studies include owner's costs, others do not.
c. Escalated at 3.3% per year.
d. "Construction Cost" equals overnight cost plus escalation and interest during construction period and during period until construction starts. Sometimes referred to as "all-in cost."
e. "Levelized Cost" is the constant real wholesale price needed to recover construction and operating costs over lifetime of plant.
f. CBO May 2008 indicates that it relied on the EIA most recent projections. The EIA has indicated that its 2007 projection is an average of construction costs incurred in completed advanced reactor builds in Asia. It is reasonable to conclude that construction costs for completed reactors would include owner's costs and that, therefore, EIA and CBO May 2008 projections include owner's costs.
g. FPL total overnight costs ($3108–$4540) included transmission costs, which have been subtracted here.
h. FPL construction costs ($5426–$8005) included transmission costs, which have been subtracted here. In addition, portions of escalation and AFUDC costs attributable to transmission costs have also been subtracted here.
i. The study presents a construction cost estimate of $2950 per kW, but this value appears to be incorrect. The study indicates that the estimate is an escalation of the average cost of recently constructed units ($2130 per kW) from 2002 to 2007 dollars at 3.3% real and that the estimate is reasonably consistent with the $2500 per kW value used by Paul Joskow in resent presentations (see MIT May 2006). Joskow was the source of costs for recently constructed units and was a contributor to the MIT Jul 2003 study. An estimate of $2950 does not appear to be consistent with a $2500 value. Exelon's calculation, escalating $2130 at 3.3% real results in a 2007 dollar value of $2505, which is consistent with a $2500 value.
j. Assumed because study indicates that estimate is based on cost for units already constructed, so owner's costs would have already been incurred.
k. Assuming owner's costs add 20%.
l. The study included cost information for several technologies. The values included here are those the study identified as "more advanced designs" of "EIA reference case, new nuclear."
m. MIT Jul 2003 indicates that its cost estimate is consistent with recent nuclear plant construction experience abroad. It is reasonable to conclude that construction costs for completed reactors would include owner's costs and that, therefore, MIT 2003 projections include owner's costs.

Table 10.4-5
Coal-fired Plant Monetary Costs[a]

Study	Overnight Cost[b] per kW (year)	Overnight Cost per kW Escalated to 2008 Dollars[c]	Construction Cost[d] per kW (year)	Construction Cost per kW Escalated to 2008 Dollars[c]	Levelized Cost per kWh (year)[e]	Levelized Cost per kWh Escalated to 2008 Dollars[c]
NETL Aug 2007	$1575 without CCS and $2870 with CCS (2007)[f] Excluding owner's costs	Without Owner's Costs: $1627 without CCS and $2965 with CCS With Owner's Costs Added: $1952 without CCS and $3558 with CCS[g]	Not estimated		Without Owner's Costs: 6.3 ¢ without CCS and 11.5 ¢ with CCS With Owner's Costs Added: 7.0 ¢ without CCS and 12.8 ¢ with CCS 85% capacity factor, 20-year levelization period	Without Owner's Costs: 6.5 ¢ without CCS and 11.9 ¢ with CCS With Owner's Costs Added: 7.3 ¢ without CCS and 13.3 ¢ with CCS
CBO May 2008	$1499 (2006) Including owner's costs (assumed)[h]	$1600	Not estimated		No CO_2 Emissions Cap: 5.5 ¢ CO_2 Emissions Capped at 2008 Level:[i] 8.0 ¢ CO_2 Emissions Capped at 85% Below 2008 Level by 2050: 12.8 ¢[j] (2006) with 4 years construction period, 85% capacity factor, and 40-year plant life	No CO_2 Emissions Cap: 5.9 ¢ CO_2 Emissions Capped at 2008 Level: 8.5 ¢ CO_2 Emissions Capped at 85% Below 2008 Level by 2050: 13.7 ¢

CCS = Carbon capture and sequestration
CO_2 = Carbon dioxide

a. Costs summarized in this table do not include transmission and distribution costs.
b. "Overnight Cost" is a convention for expressing the cost of construction as if the plant could be built overnight and therefore does not include escalation or interest costs during construction. Engineering, procurement, and construction costs are included. Some studies include owner's costs, other do not.
c. Escalated at 3.3% per year.
d. "Construction Cost" equals overnight cost plus escalation and interest during construction period and during period until construction starts. Sometimes referred to as "all-in cost."
e. "Levelized Cost" is the constant real wholesale price needed to recover financing, construction, and operating costs over lifetime of plant.
f. Information for supercritical pulverized coal technology.
g. Assuming owner's costs add 20%.
h. Assumed that CBO May 2008 overnight costs include owner's costs so that costs are comparable across different technologies (see Table 10.4-4, footnote 13).
i. Includes charge of $19 per metric ton of CO2 in 2015(CBO May 2008)
j. Includes charge of $55 per metric ton of CO2 in 2015 (CBO May 2008)

Table 10.4-6
Gas-fired Plant Monetary Costs[a]

Study	Overnight Cost[b] per kW (year)	Overnight Cost per kW Escalated to 2008 Dollars[c]	Construction Cost[d] per kW (year)	Construction Cost per kW Escalated to 2008 Dollars[c]	Levelized Cost per kWh (year)[e]	Levelized Cost per kWh Escalated to 2008 Dollars[c]
NETL Aug 2007	$554 without CCS and $1172 with CCS (2007)[f]	Without Owner's Costs: $572 without CCS and $1211 with CCS	Not estimated		Without Owner's Costs: 6.8 ¢ without CCS and 9.7 ¢ with CCS	Without Owner's Costs: 7.0 ¢ without CCS and 10.0 ¢ with CCS
	Excluding owner's costs	With Owner's Costs Added: $687 without CCS and $1453 with CCS[g]			With Owner's Costs Added: 7.1 ¢ without CCS and 10.3 ¢ with CCS	With Owner's Costs Added: 7.3 ¢ without CCS and 10.6 ¢ with CCS
					85% capacity factor, 20-year levelization period	
CBO May 2008	$685 (2006)[h] Including owner's costs (assumed)[i]	$731	Not estimated		No CO_2 Emissions Cap: 5.7 ¢	No CO_2 Emissions Cap: 6.1 ¢
					CO_2 Emissions Capped at 2008 Level:[j] 6.7 ¢	CO_2 Emissions Capped at 2008 Level: 7.1 ¢
					CO_2 Emissions Capped at 85% Below 2008 Level by 2050: 8.6 ¢[k]	CO_2 Emissions Capped at 85% Below 2008 Level by 2050: 9.2 ¢
					(2006) with 4 years construction period, 85% capacity factor, and 40-year plant life	

CCS = Carbon capture and sequestration
CO_2 = Carbon dioxide

a. Costs summarized in this table do not include transmission and distribution costs.
b. "Overnight Cost" is a convention for expressing the cost of construction as if the plant could be built overnight and therefore does not include escalation or interest costs during construction. Engineering, procurement, and construction costs are included. Some studies include owner's costs, other do not.
c. Escalated at 3.3% per year.
d. "Construction Cost" equals overnight cost plus escalation and interest during construction period and during period until construction starts. Sometimes referred to as "all-in cost."
e. "Levelized Cost" is the constant real wholesale price needed to recover financing, construction, and operating costs over lifetime of plant.
f. Information for combined cycle F-class technology.
g. Assuming owner's costs add 20%.
h. Assumed that CBO May 2008 overnight costs include owner's costs so that costs are comparable across different technologies (see Table 10.4-4, footnote 13).
i. Information for conventional technology using combined cycle turbines.
j. Includes charge of $19 per metric ton of CO_2 in 2015 (CBO May 2008).
k. Includes charge of $55 per metric ton of CO_2 in 2015 (CBO May 2008).

Table 10.4-7 (Sheet 1 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Construction				
Land Use	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas within the site. Re-contour and re-vegetate land used for temporary construction purposes. Identify and avoid wetlands. Install fencing around wetlands during construction to protect against inadvertent excursion into the area. (3) Stabilize and contour permanently disturbed locations in accordance with design specifications. (4) Where possible, select corridors that follow existing rights-of-way and do not cross any state or federal parks, wildlife management areas, refuges or preserves. Comply with applicable laws, regulations, and permit requirements. Avoid impacts to streams, ponds, reservoirs, and wetlands.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas within the site. Re-contour and re-vegetate land used for temporary construction purposes. Identify and avoid wetlands. Install fencing around wetlands during construction to protect against inadvertent excursion into the area. (3) Stabilize and contour permanently disturbed locations in accordance with design specifications. (4) Where possible, select corridors that follow existing rights-of-way and do not cross any state or federal parks, wildlife management areas, refuges or preserves. Comply with applicable laws, regulations, and permit requirements. Avoid impacts to streams, ponds, reservoirs, and wetlands.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas within the site. Re-contour and re-vegetate land used for temporary construction purposes. Identify and avoid wetlands. Install fencing around wetlands during construction to protect against inadvertent excursion into the area. (3) Stabilize and contour permanently disturbed locations in accordance with design specifications. (4) Where possible, select corridors that follow existing rights-of-way and do not cross any state or federal parks, wildlife management areas, refuges or preserves. Comply with applicable laws, regulations, and permit requirements. Avoid impacts to streams, ponds, reservoirs, and wetlands.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas within the site. Re-contour and re-vegetate land used for temporary construction purposes. Identify and avoid wetlands. Install fencing around wetlands during construction to protect against inadvertent excursion into the area. (3) Stabilize and contour permanently disturbed locations in accordance with design specifications. (4) Where possible, select corridors that follow existing rights-of-way and do not cross any state or federal parks, wildlife management areas, refuges or preserves. Comply with applicable laws, regulations, and permit requirements. Avoid impacts to streams, ponds, reservoirs, and wetlands.

Table 10.4-7 (Sheet 2 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Construction (continued)				
Land Use (continued)	Unavoidable Adverse Environmental Impacts — (1) Approximately 655 acres of the 1480-acre site disturbed during construction. (2) Construction of new transmission line corridor (approximately 560 acres) in area consisting primarily of pasture and cultivated crops. (3) Construction of access road (4.8 acres), heavy haul road (50 acres), rail spur line (150-200 acres), and makeup water intake and discharge lines (344 acres).	Unavoidable Adverse Environmental Impacts — (1) Approximately all of the 5000-acre site disturbed during construction (including construction of a cooling basin). (2) Construction of new transmission line corridor (approximately 1700 acres) in area consisting primarily of pasture and cultivated crops. (3) Construction of access road (24 acres), rail spur line (17 acres), and makeup water intake line (30 acres).	Unavoidable Adverse Environmental Impacts — (1) Approximately 300 acres of the 2000-acre site disturbed during construction. (2) Construction of new transmission line corridor (approximately 1360 acres) in area consisting primarily of pasture and cultivated crops. (3) Development of Allen's Creek Reservoir would inundate approximately 9500 acres of land adjacent to the site. (4) Construction of access road (24 acres) and rail spur line (10 acres).	Unavoidable Adverse Environmental Impacts — (1) Approximately 3500 of the 5000-acre site disturbed during construction (including construction of storage basin). (2) Construction of new transmission line corridor (approximately 1965 acres) in area consisting primarily of pasture and cultivated crops. (3) Construction of access road (24 acres), rail spur line (16 acres), and water pipeline corridor (46 acres).
Hydrology and Water Use	Mitigation Measure — (1) Comply with applicable water rights requirements, laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. Unavoidable Adverse Environmental Impacts — (1) Withdraw surface water from the Gulf Intercoastal Waterway (GIWW). (2) Install groundwater wells and pump groundwater for use during construction. (3) Install excavation dewatering wells for temporary use during construction.	Mitigation Measure — (1) Comply with applicable water rights requirements, laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. Unavoidable Adverse Environmental Impacts — (1) Withdraw surface water from the Colorado River. (2) Install groundwater wells and pump groundwater for use during construction. (3) Install excavation dewatering wells for temporary use during construction.	Mitigation Measure — (1) Comply with applicable water rights requirements, laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. Unavoidable Adverse Environmental Impacts —(1) Impound Allen's Creek and divert some flow from the Brazos River for the cooling basin and alter drainage patterns. (2) Withdraw surface water from Allen's Creek Reservoir. (3) Install groundwater wells and pump groundwater for use during construction. (4) Install excavation dewatering wells for temporary use during construction.	Mitigation Measure — (1) Comply with applicable water rights requirements, laws, regulations, and permit requirements, good engineering and construction practices, and recognized environmental best management practices. Unavoidable Adverse Environmental Impacts — (1) Withdraw surface water from the Cedar Creek Reservoir. (2) Install groundwater wells and pump groundwater for use during construction. (3) Install excavation dewatering wells for temporary use during construction.

Table 10.4-7 (Sheet 3 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Construction (continued)				
Ecology (Terrestrial and Aquatic)	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, and good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas. Unavoidable Adverse Environmental Impacts — (1) Construction activities would result in the permanent loss of approximately 655 acres of habitat. (2) Shoreline construction and dredging would destroy a small amount of aquatic habitat temporarily. (3) Transmission line routes could require crossing of waterbodies or erection of towers within waterbodies.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, and good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas. Unavoidable Adverse Environmental Impacts — (1) Construction activities would result in the permanent loss of 5000 acres of habitat. (2) Shoreline construction and dredging would destroy a small amount of aquatic habitat temporarily. (3) Transmission line routes could require crossing of waterbodies or erection of towers within waterbodies.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, and good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas. Unavoidable Adverse Environmental Impacts — (1) Construction activities would result in the permanent loss of 300 acres of habitat for facility structures. An additional 9500 acres of terrestrial habitat would be permanently lost from development of the Allen's Creek Reservoir. (2) Shoreline construction and dredging would destroy a small amount of aquatic habitat temporarily. (3) Transmission line routes could require crossing of waterbodies or erection of towers within waterbodies.	Mitigation Measure — (1) Comply with applicable laws, regulations, and permit requirements, and good engineering and construction practices, and recognized environmental best management practices. (2) Restrict construction to designated areas. Unavoidable Adverse Environmental Impacts — (1) Construction activities would result in the permanent loss of 3500 acres of habitat. (2) Shoreline construction and dredging would destroy a small amount of aquatic habitat temporarily. (3) Transmission line routes could require crossing of waterbodies or erection of towers within waterbodies.
Meteorology and Atmospheric Releases	Mitigation Measure — (1) Develop and implement a plan to minimize dust by one or more of the following methods: pave disturbed areas, stabilize construction roads and spoil piles, use water suppression or soil adhesives to minimize dust, cover truck loads and debris stockpiles, reduce material handling, limit vehicle speed, suspend activities during high winds and extreme air pollution events, re-vegetate medians and slopes, and visually inspect emission control equipment. (2) Phase construction to minimize daily emissions. Regularly service all equipment and operate in accordance with local, state, and federal emission requirements.	Mitigation Measure — (1) Develop and implement a plan to minimize dust by one or more of the following methods: pave disturbed areas, stabilize construction roads and spoil piles, use water suppression or soil adhesives to minimize dust, cover truck loads and debris stockpiles, reduce material handling, limit vehicle speed, suspend activities during high winds and extreme air pollution events, re-vegetate medians and slopes, and visually inspect emission control equipment. (2) Phase construction to minimize daily emissions. Regularly service all equipment and operate in accordance with local, state, and federal emission requirements.	Mitigation Measure — (1) Develop and implement a plan to minimize dust by one or more of the following methods: pave disturbed areas, stabilize construction roads and spoil piles, use water suppression or soil adhesives to minimize dust, cover truck loads and debris stockpiles, reduce material handling, limit vehicle speed, suspend activities during high winds and extreme air pollution events, re-vegetate medians and slopes, and visually inspect emission control equipment. (2) Phase construction to minimize daily emissions. Regularly service all equipment and operate in accordance with local, state, and federal emission requirements.	Mitigation Measure — (1) Develop and implement a plan to minimize dust by one or more of the following methods: pave disturbed areas, stabilize construction roads and spoil piles, use water suppression or soil adhesives to minimize dust, cover truck loads and debris stockpiles, reduce material handling, limit vehicle speed, suspend activities during high winds and extreme air pollution events, re-vegetate medians and slopes, and visually inspect emission control equipment. (2) Phase construction to minimize daily emissions. Regularly service all equipment and operate in accordance with local, state, and federal emission requirements.

Table 10.4-7 (Sheet 4 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

Category	With Option 1 Proposed Project at Matagorda County Site	With Option 2 Proposed Project at Buckeye Site	With Option 3 Proposed Project at Alpha Site	With Option 4 Proposed Project at Bravo Site
Construction (continued)				
Meteorology and Atmospheric Releases (continued)	Unavoidable Adverse Environmental Impacts — (1) Equipment emissions and ground-disturbing activities cause suspension of fugitive dust and fine particulate matter in the air on a temporary basis.	Unavoidable Adverse Environmental Impacts — (1) Equipment emissions and ground-disturbing activities cause suspension of fugitive dust and fine particulate matter in the air on a temporary basis.	Unavoidable Adverse Environmental Impacts — (1) Equipment emissions and ground-disturbing activities cause suspension of fugitive dust and fine particulate matter in the air on a temporary basis.	Unavoidable Adverse Environmental Impacts — (1) Equipment emissions and ground-disturbing activities cause suspension of fugitive dust and fine particulate matter in the air on a temporary basis.
Radiological	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.
Socioeconomics	Adverse Impact Mitigation Measure — (1) Project-related employment would increase gradually. Any increased demand for local services would be offset by increased property and sales/use tax revenues generated by the construction project, which counties and cities could use to add staff, facilities, equipment, and services. Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Construction-related population influx of 16,273 would increase the resident-to-police/firefighter ratios. Construction-related direct and indirect workers would also add to school enrollment. All school districts within the region of influence have excess capacity. (2) Users of the GIWW would be impacted by construction activities and structures.	Adverse Impact Mitigation Measure — (1) Project-related employment would increase gradually. Any increased demand for local services would be offset by increased property and sales/use tax revenues generated by the construction project, which counties and cities could use to add staff, facilities, equipment, and services. Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Construction-related population influx of 16,273 would increase the resident-to-police/firefighter ratios. Construction-related direct and indirect workers would also add to school enrollment. All school districts within the region of influence have excess capacity. (2) Users of the Colorado River would be impacted by construction activities and structures.	Adverse Impact Mitigation Measure — (1) Project-related employment would increase gradually. Any increased demand for local services would be offset by Increased property and sales/use tax revenues generated by the construction project, which counties and cities could use to add staff, facilities, equipment, and services. Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Construction-related population influx of 16,273 would increase the resident-to-police/firefighter ratios. Construction-related direct and indirect workers would also add to school enrollment. All school districts within the region of influence have excess capacity. (2) Users of Allen's Creek and the Brazos River would be impacted by construction activities and structures.	Adverse Impact Mitigation Measure — (1) Project-related employment would increase gradually. Any increased demand for local services would be offset by Increased property and sales/use tax revenues generated by the construction project, which counties and cities could use to add staff, facilities, equipment and services. Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Construction-related population influx of 16,273 would increase the resident-to-police/firefighter ratios. Construction-related direct and indirect workers would also add to school enrollment. All school districts within the region of influence have excess capacity. (2) Users of Cedar Creek Reservoir would be impacted by construction activities and structures.

Table 10.4-7 (Sheet 5 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Construction (continued)				
Environmental Justice	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.
Operation				
Land Use	Mitigation Measure — (1) None for continued land use conversion. (2) The transmission service provider (TSP) who would own and operate the offsite transmission lines would establish corridor vegetation management and line maintenance procedures for the proposed connector lines or incorporate the new lines under existing procedural plans. Unavoidable Adverse Environmental Impacts — (1) Approximately 655 acres of land would be permanently dedicated to the plant until decommissioning. (2) Operation and maintenance of transmission lines and corridors. Operation would be potentially compatible with cultivation, grazing, and hunting, but preclude residential and industrial use.	Mitigation Measure — (1) None for continued land use conversion. (2) The transmission service provider (TSP) who would own and operate the offsite transmission lines would establish corridor vegetation management and line maintenance procedures for the proposed connector lines or incorporate the new lines under existing procedural plans. Unavoidable Adverse Environmental Impacts — (1) Approximately 5000 acres of land would be permanently dedicated to the plant until decommissioning. (2) Operation and maintenance of transmission lines and corridors. Operation would be potentially compatible with cultivation, grazing, and hunting, but preclude residential and industrial use.	Mitigation Measure — (1) None for continued land use conversion. (2) The transmission service provider (TSP) who would own and operate the offsite transmission lines would establish corridor vegetation management and line maintenance procedures for the proposed connector lines or incorporate the new lines under existing procedural plans. Unavoidable Adverse Environmental Impacts – (1) Approximately 300 acres of land would be permanently dedicated to the plant until decommissioning. An additional 9500 acres would be permanently inundated for the Allen's Creek Reservoir. (2) Operation and maintenance of transmission lines and corridors. Operation would be potentially compatible with cultivation, grazing, and hunting, but preclude residential and industrial use.	Mitigation Measure — (1) None for continued land use conversion. (2) The transmission service provider (TSP) who would own and operate the offsite transmission lines would establish corridor vegetation management and line maintenance procedures for the proposed connector lines or incorporate the new lines under existing procedural plans. Unavoidable Adverse Environmental Impacts — (1) Approximately 3500 acres of land would be permanently dedicated to the plant until decommissioning. (2) Operation and maintenance of transmission lines and corridors. Operation would be potentially compatible with cultivation, grazing, and hunting, but preclude residential and industrial use.

Table 10.4-7 (Sheet 6 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Operation (continued)				
Hydrology and Water Use	Mitigation Measure — (1) Comply with GIWW water withdrawal requirements and restrictions. (2) Comply with Texas Pollutant Discharge Elimination System permit limits for blowdown discharges. (3) Comply with groundwater permits. Unavoidable Adverse Environmental Impacts — (1) Water would be withdrawn from the GIWW to replace water lost to evaporation, drift, seepage, and blowdown. Water would be added back to the Tres Palacios Bay through blowdown discharge. The consumptive use of water would be approximately 57,800 gpm. (2) Groundwater withdrawal through onsite wells to meet an estimated operations demand of 425 gpm (normal) to 902 gpm (maximum).	Mitigation Measure — (1) Comply with LCRA water withdrawal requirements and restrictions. (2) Comply with Texas Pollutant Discharge Elimination System permit limits for blowdown discharges. (3) Comply with groundwater permits. Unavoidable Adverse Environmental Impacts — (1) Water would be withdrawn from the Colorado River to replace water lost to evaporation, drift, seepage, and blowdown. Water would be added back to the Colorado River through blowdown discharge. The consumptive use of surface water would range from 43,200 gpm under normal use conditions to 64,500 gpm for maximum use conditions. (2) Groundwater withdrawal through onsite wells to meet an estimated operations demand of 425 gpm (normal) to 902 gpm (maximum).	Mitigation Measure — (1) Comply with water withdrawal requirements and restrictions. (2) Comply with Texas Pollutant Discharge Elimination System permit limits for blowdown discharges. (3) Comply with groundwater permits. Unavoidable Adverse Environmental Impacts — (1) Water would be withdrawn from Allen's Creek Reservoir to replace water lost to evaporation, drift, seepage, and blowdown. Water would be added to the Brazos River through blowdown discharge. The consumptive use of water would be approximately 57,800 gpm. (2) Groundwater withdrawal through onsite wells to meet an estimated operations demand of 425 gpm (normal) to 902 gpm (maximum).	Mitigation Measure — (1) Comply with water withdrawal requirements and restrictions. (2) Comply with Texas Pollutant Discharge Elimination System permit limits for blowdown discharges. (3) Comply with groundwater permits. Unavoidable Adverse Environmental Impacts — (1) Water would be withdrawn from Cedar Creek Reservoir or Richland Chambers Reservoir to replace water lost to evaporation, drift, seepage, and blowdown. Water would be added to the Trinity River through blowdown discharge. The consumptive use of surface water would be approximately 57,800 gpm. (2) Groundwater withdrawal through onsite wells to meet an estimated operations demand of 425 gpm (normal) to 902 gpm (maximum).
Terrestrial Ecology	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.
Aquatic Ecology	Mitigation Measure – (1) The cooling water intake structure on the GIWW would be designed to minimize impingement mortality. (2) Comply with U.S. EPA and Texas regulations addressing discharges to surface water.	Mitigation Measure – (1) The cooling water intake structure on the Colorado River would be designed to minimize impingement mortality. (2) Comply with U.S. EPA and Texas regulations addressing discharges to surface water.	Mitigation Measure — (1) The cooling water intake structure on Allen's Creek Reservoir would be designed to minimize impingement mortality. (2) Comply with U.S. EPA and Texas regulations addressing discharges to surface water.	Mitigation Measure — (1) The cooling water intake structure on Cedar Creek Reservoir would be designed to minimize impingement mortality. (2) Comply with U.S. EPA and Texas regulations addressing discharges to surface water.

Table 10.4-7 (Sheet 7 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Operation (continued)				
Aquatic Ecology (continued)	Unavoidable Adverse Environmental Impacts — (1) Small number of juvenile and adult fish would be impinged at the Raw Water Makeup system intake. (2) Fish eggs and larvae would be entrained at the Raw Water Makeup system intake.	Unavoidable Adverse Environmental Impacts — (1) Small number of juvenile and adult fish would be impinged at the Raw Water Makeup system intake. (2) Fish eggs and larvae would be entrained at the Raw Water Makeup system intake.	Unavoidable Adverse Environmental Impacts — (1) Small number of juvenile and adult fish would be impinged at the Raw Water Makeup system intake. (2) Fish eggs and larvae would be entrained at the Raw Water Makeup system intake.	Unavoidable Adverse Environmental Impacts — (1) Small number of juvenile and adult fish would be impinged at the Raw Water Makeup system intake. (2) Fish eggs and larvae would be entrained at the Raw Water Makeup system intake.
Meteorology and Atmospheric Releases	Mitigation Measure — (1) None for cooling towers. (2) Comply with the state of Texas permit limits and regulations for operating air emission sources. Unavoidable Adverse Environmental Impacts — (1) Operation of PSWS and circulating water system cooling towers would result in noise, salt deposition, minor shadowing, and a very small increase in precipitation. Noise attenuates quickly so noise levels would be minimal of the site boundary. Salt deposition of less than the amount necessary to result in damage to vegetation. (2) Air emissions from auxiliary systems operated on an intermittent basis.	Mitigation Measure — (1) None for cooling towers. (2) Comply with the state of Texas permit limits and regulations for operating air emission sources. Unavoidable Adverse Environmental Impacts — (1) Operation of PSWS cooling towers would result in noise, salt deposition, minor shadowing, and a very small increase in precipitation. Noise attenuates quickly so noise levels would be minimal of the site boundary. Salt deposition of less than the amount necessary to result in damage to vegetation. (2) Air emissions from auxiliary systems operated on an intermittent basis.	Mitigation Measure — (1) None for cooling towers. (2) Comply with the state of Texas permit limits and regulations for operating air emission sources. Unavoidable Adverse Environmental Impacts — (1) Operation of PSWS and circulating water system cooling towers would result in noise, salt deposition, minor shadowing, and a very small increase in precipitation. Noise attenuates quickly so noise levels would be minimal of the site boundary. Salt deposition of less than the amount necessary to result in damage to vegetation. (2) Air emissions from auxiliary systems operated on an intermittent basis.	Mitigation Measure — (1) None for cooling towers. (2) Comply with the state of Texas permit limits and regulations for operating air emission sources. Unavoidable Adverse Environmental Impacts — (1) Operation of PSWS and circulating water system cooling towers would result in noise, salt deposition, minor shadowing, and a very small increase in precipitation. Noise attenuates quickly so noise levels would be minimal of the site boundary. Salt deposition of less than the amount necessary to result in damage to vegetation. (2) Air emissions from auxiliary systems operated on an intermittent basis.
Radiological	Mitigation Measure — (1) Monitor radiological releases as required by radiological monitoring program. (2) Implement waste minimization program.	Mitigation Measure — (1) Monitor radiological releases as required by radiological monitoring program. (2) Implement waste minimization program.	Mitigation Measure — (1) Monitor radiological releases as required by radiological monitoring program. (2) Implement waste minimization program.	Mitigation Measure — (1) Monitor radiological releases as required by radiological monitoring program. (2) Implement waste minimization program.

Table 10.4-7 (Sheet 8 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

Category	With Option 1 Proposed Project at Matagorda County Site	With Option 2 Proposed Project at Buckeye Site	With Option 3 Proposed Project at Alpha Site	With Option 4 Proposed Project at Bravo Site
Operation (continued)				
Radiological (continued)	Unavoidable Adverse Environmental Impacts — (1) Annual maximum dose of 60 person-rem per unit to workers. (2) Estimated doses to the public that are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190. (3) Dose to terrestrial and aquatic ecosystems from chronic radiation exposure (less than 100 mrad/day) caused by the small discharges of radioactive liquids and gases. (4) Generation of radioactive waste (5) Dose to public and workers due to the transport of nuclear fuel.	Unavoidable Adverse Environmental Impacts — (1) Annual maximum dose of 60 person-rem per unit to workers. (2) Estimated doses to the public that are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190. (3) Dose to terrestrial and aquatic ecosystems from chronic radiation exposure (less than 100 mrad/day) caused by the small discharges of radioactive liquids and gases. (4) Generation of radioactive waste (5) Dose to public and workers due to the transport of nuclear fuel	Unavoidable Adverse Environmental Impacts — (1) Annual maximum dose of 60 person-rem per unit to workers. (2) Estimated doses to the public that are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190. (3) Dose to terrestrial and aquatic ecosystems from chronic radiation exposure (less than 100 mrad/day) caused by the small discharges of radioactive liquids and gases. (4) Generation of radioactive waste (5) Dose to public and workers due to the transport of nuclear fuel.	Unavoidable Adverse Environmental Impacts — (1) Annual maximum dose of 60 person-rem per unit to workers. (2) Estimated doses to the public that are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190. (3) Dose to terrestrial and aquatic ecosystems from chronic radiation exposure (less than 100 mrad/day) caused by the small discharges of radioactive liquids and gases. (4) Generation of radioactive waste (5) Dose to public and workers due to the transport of nuclear fuel.
Socioeconomics	Mitigation Measure — (1) Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Operations-related direct and indirect workers would increase demand for community services within the ROI over pre-construction conditions, but much less than the construction-related population. (2) Users of the GIWW and Tres Palacios Bay would be visually impacted by plant and water intake/discharge structures.	Mitigation Measure — (1) Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Operations-related direct and indirect workers would increase demand for community services within the ROI over pre-construction conditions, but much less than the construction-related population. (2) Users of the Colorado River would be visually impacted by plant and water intake/discharge structures.	Mitigation Measure — (1) Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Operations-related direct and indirect workers would increase demand for community services within the ROI over pre-construction conditions, but much less than the construction-related population. (2) Users of the Allen’s Creek Reservoir and Brazos River would be visually impacted by plant and water intake/discharge structures.	Mitigation Measure — (1) Communicate regularly with local and regional governmental officials about the project and its schedules, allowing local and regional officials ample opportunity to plan for the population influx. Unavoidable Adverse Environmental Impacts — (1) Operations-related direct and indirect workers would increase demand for community services within the ROI over pre-construction conditions, but much less than the construction-related population. (2) Users of the Cedar Creek Reservoir or Richard Chambers Reservoir and Trinity River would be visually impacted by plant and water intake/discharge structures.

Table 10.4-7 (Sheet 9 of 9)
Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites

	With Option 1	With Option 2	With Option 3	With Option 4
Category	**Proposed Project at Matagorda County Site**	**Proposed Project at Buckeye Site**	**Proposed Project at Alpha Site**	**Proposed Project at Bravo Site**
Operation (continued)				
Environmental Justice	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts.	Adverse Impact — No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified. Mitigation Measure — No mitigation needed. Unavoidable Adverse Environmental Impacts — No unavoidable adverse impacts