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## 2.6 Geology

This section summarizes the geological conditions at the VCS site. The site information is subdivided into two categories: physiography and stratigraphy. An evaluation of how plant construction and operations activities or infrastructure could interact with the geological features at the site to produce adverse environmental impacts is also provided. The information provided in these sections has been developed in accordance with the guidance provided in Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations.*

The geological information in this section is based on the information contained in SSAR Subsection 2.5.1, *Basic Geologic and Seismic Information*.

### 2.6.1 Geological Conditions

#### 2.6.1.1 Physiography

The VCS site covers an area of approximately 11,500 acres (46.5 $km^2$) and is located in Victoria County in southern Texas. The site area is located within the Gulf Coastal Plains physiographic province (Figure 2.6-1) (Texas Bureau of Economic Geology 1996). Topography in the vicinity of the VCS site is characteristic of the Gulf Coastal Plains with gently rolling terrain. The ground elevations at the site, before preconstruction and construction activities, range from approximately 85 feet (26 meters) North American Vertical Datum of 1988 (NAVD 88) in the north to about 65 feet (20 meters NAVD 88) in the south to slightly above 15 feet (4.6 meters NAVD 88) in the southeast where it borders the Guadalupe River.

The site is drained by ephemeral streams that form a dendritic drainage pattern. The longest stream on the site is Dry Kuy Creek, which has headwaters near the northwest corner of the site. It flows for more than 5 miles (8 km) and joins Kuy Creek about a half-mile south of the site boundary. This creek is an ephemeral tributary of the Guadalupe River; the Guadalupe River discharges into the San Antonio Bay about 7 miles (11 km) southeast of the confluence of the San Antonio and Guadalupe Rivers (Figure 2.6-2).

The eastern edge of the site is bounded by the Guadalupe River floodplain. The Union Pacific Railway right-of-way forms the southern boundary and Kuy Creek and U.S. Highway 77 forms the western boundary. The northern boundary is identified by a gravel ranch road about a half-mile north of the north gate to the VCS site. The VCS site is generally covered with grass, low-lying brush, or woodlands. The site is easily accessible by foot or standard vehicle.

The VCS units will be constructed at a present grade elevation of approximately 80 feet (24 meters). Engineered fill will be used to raise the plant grade elevation to a final grade elevation of approximately 95 feet (29 meters) NAVD 88 at the power block area.

### 2.6.1.2 **Stratigraphy**

The VCS site is underlain by Paleocene to Holocene age Coastal Plains sediments which are, in turn, underlain by about 21,000 feet (4 miles or 6.4 km) of Mesozoic age sediments above extended, thin continental basement. The Cenozoic age sediments are estimated to be over 20,000 feet (3.8 miles or 6 km). The only borings that have been advanced into the Cenozoic and Mesozoic sediments in the area are those drilled for petroleum exploration purposes. These borings are generally limited to depths of around 6000 feet below the ground surface. Figures 2.6-3 and 2.6-4 are generalized stratigraphic columns for the site and vicinity taken from published data. The site stratigraphy is described in more detail in SSAR Subsection 2.5.1.

The long-term southward migration of the Gulf shoreline has been overprinted in late Cenozoic time with relatively minor marine regressions and transgressions associated with sea level changes during glacial and interglacial periods. Within the site vicinity, some of these glacial cycles are recorded in the deposition of the Beaumont and Lissie formations (the major Pleistocene formations). Both formations were deposited during interglacial transgressions as facies of alluvial fan-delta systems.

The near-surface sediments in the Victoria County region belong to the Beaumont Formation. From the Louisiana/Texas border to the Rio Grande, the Beaumont Formation is recognized as a series of multiple, cross-cutting and/or superimposed incised stream channel fills and over-bank deposits formed during glacio-eustatic cycles (Blum and Aslan 2006). The Beaumont Formation is composed of poorly bedded, marly, reddish-brown clay interbedded with lenses of sand (Barnes 1992); its thickness beneath the VCS site is between 100–200 feet (30–61 meters) (Blum and Price 1998).

The older Lissie Formation crops out in the site vicinity as levee deposits, distributary sands, and flood basin mud with a combined thickness of roughly 200 feet (61 meters) (Barnes 1987). The formation was deposited in low energy depositional environments, resulting in clay-rich surfaces. The sub-aerially exposed Lissie surface is morphologically subdued and has a relatively uniform seaward dip of 4.4–6.6 feet per mile (0.8–1.3 meters per km). Where exposed at the ground surface, the distinct gradient of the Lissie Formation surface allows it to be easily distinguished from stratigraphically higher and chronologically younger units like the Beaumont Formation. The age of the top of the Lissie Formation is estimated to be about 700 thousand years (ka) (Winker 1979).

## 2.6.2 **Geological Impacts**

Based on the geological conditions at the VCS site (SSAR Subsections 2.5.1 and 2.5.3), there are no known geological conditions that could result in plant construction or operation adversely impacting the environment. This conclusion is based on the following:

- The absence of capable tectonic sources (SSAR Subsections 2.5.1.2 and 2.5.3) at the VCS site eliminates the possibility of seismological impacts, namely design exceedence ground shaking and surface fault rupture. Non-tectonic growth faults may be present at the site within the Cenozoic and Mesozoic age sediments. Surface faulting is not expected to occur as a result of construction or operation of the proposed facility.
- Surface settlement, as a result of facility construction, is expected to be insignificant. If settlement does occur, it can be mitigated by regrading the site during construction.
- The geologic strata are not subject to dissolution.
- Permanent dewatering during operations will not be required at the VCS site because the static water table is deep enough that further reduction is not necessary.
- Water supply wells at the site will supply groundwater to the plant for other than process cooling purposes. The wells will be constructed at depths of between about 500–700 feet (150–210 meters) below the ground surface. This may result in subsidence of the sediments underlying the plant. The amount of potential subsidence is related to change in piezometric head and the amount of clay underlying the site. A 1992 study performed by Camp Dresser & McKee estimates that the land surface subsidence in Victoria County would be 0.3 feet using unit-compaction coefficients derived for the Chicot and Evangeline aquifers in the Houston area. This estimate is consistent with the Texas Water Development Board regional study of subsidence (Ratzlaff 1982) estimate of less than 6 inches based on 1973 data. The 1982 value is attributed to production of oil and gas rather than groundwater withdrawal.
- There are no natural slopes proximal to the VCS construction site that could be adversely impacted by foundation excavation, loading resulting from construction of the proposed structures, or infiltration of precipitation as a result of surface modifications. The slopes associated with construction of the cooling basin will be considered in the design and construction of the cooling basin.
- Potentially adverse impacts that could result from the placement of fill at the VCS construction site plant area will be mitigated by earthwork design.

Some short-term geological conditions that could impact the environment associated with construction and operation of the plant are described below.

- Disposal of excavated material will likely be required either on site or offsite. Generally accepted methods will be used to mitigate the potential for erosion of this material at the disposal site.
- Temporary dewatering of foundation excavations may impact groundwater levels in the water table aquifer. These impacts are described in Subsection 4.2.1.2.

### 2.6.3 References

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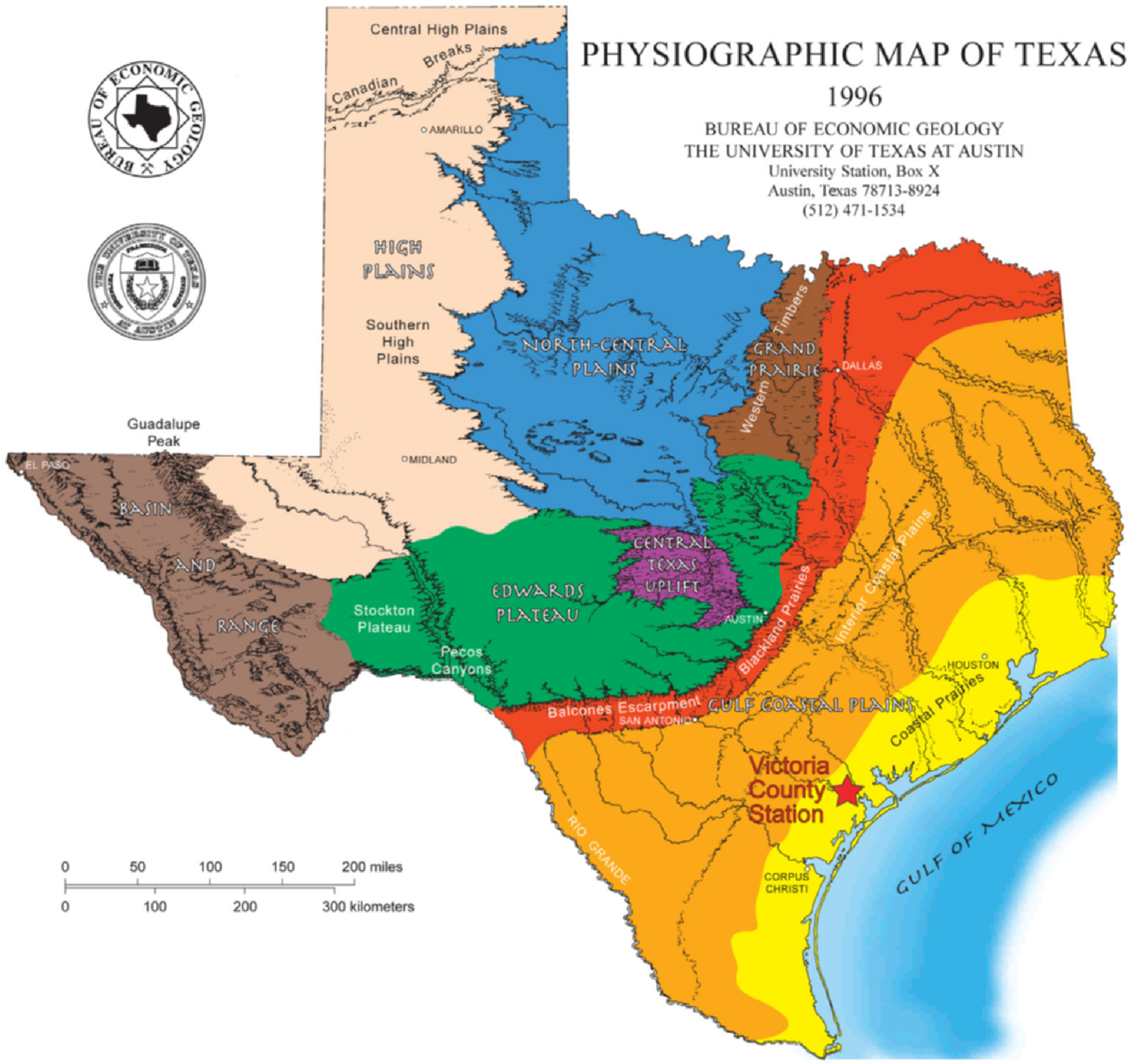
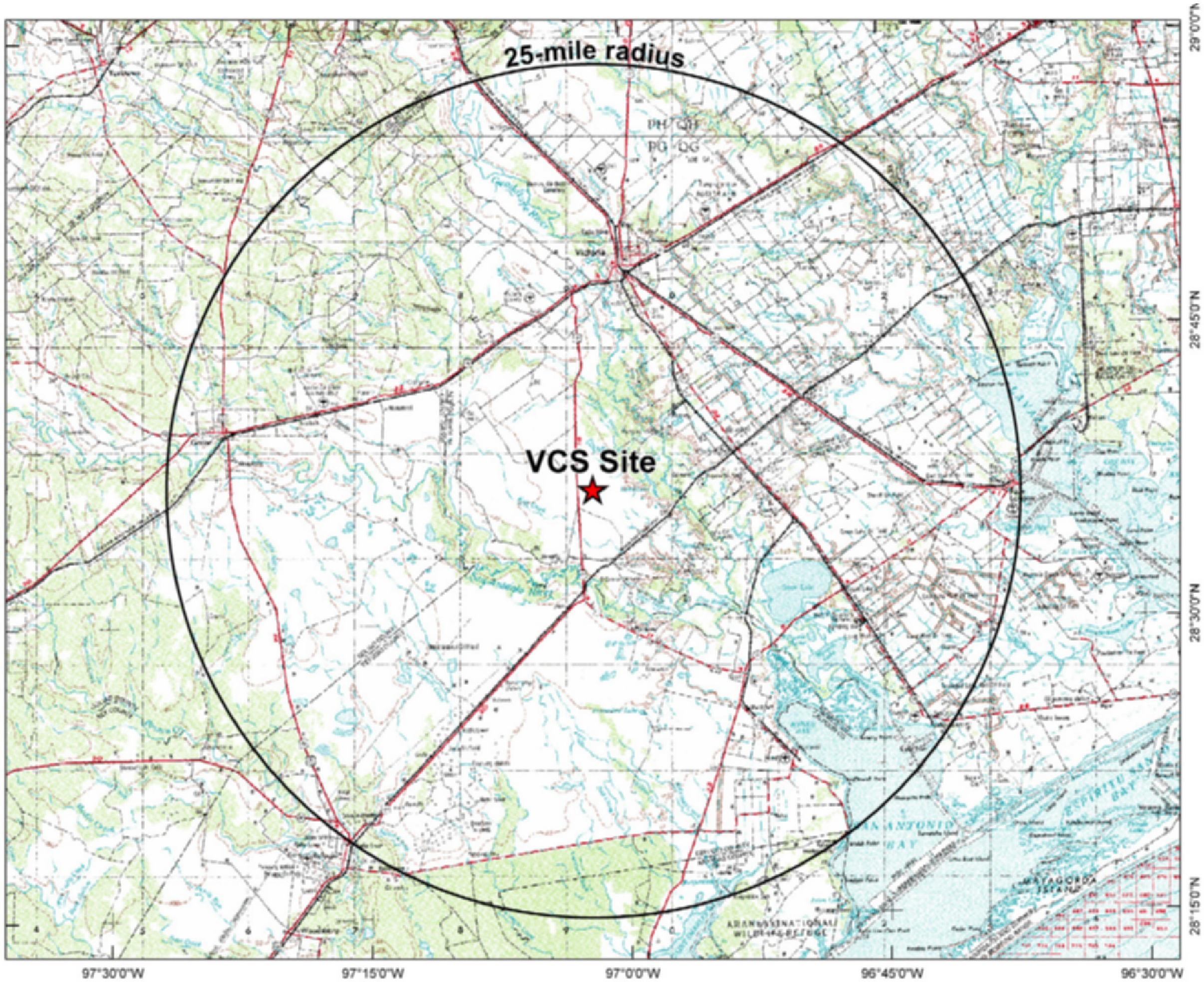
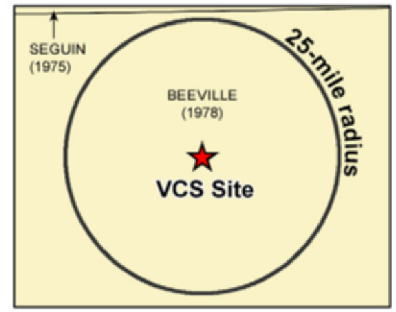



| PROVINCE | MAX. ELEV. (ft) | MIN. ELEV. (ft) | TOPOGRAPHY | GEOLOGIC STRUCTURE | BEDROCK TYPES |
|---|---|---|---|---|---|
| Gulf Coastal Plains | | | | | |
| Coastal Prairies | 300 | 0 | Nearly flat prairie, <1 ft/mi to Gulf | Nearly flat strata | Deltaic sands and muds |
| Interior Coastal Plains | 800 | 300 | Parallel ridges (questas) and valleys | Beds tilted toward Gulf | Unconsolidated sands and muds |
| Blackland Prairies | 1000 | 450 | Low rolling terrain | Beds tilted south and east | Chalks and marls |
| Grand Prairie | 1250 | 450 | Low stairstep hills west; plains east | Strata dip east | Calcareous east; sandy west |
| Edwards Plateau | | | | | |
| Principal | 3000 | 450 | Flat upper surface with box canyons | Beds dip south; normal faulted | Limestones and dolomites |
| Pecos Canyons | 2000 | 1200 | Steep-walled canyons | | Limestones and dolomites |
| Stockton Plateau | 4200 | 1700 | Mesa-formed terrain; highs to west | Unfaulted, near-horizontal beds | Carbonates and alluvial sediments |
| Central Texas Uplift | 2000 | 800 | Knobby plain; surrounded by questas | Centripetal dips, strongly faulted | Granites; metamorphics; sediments |
| North-Central Plains | 3000 | 900 | Low north-south ridges (questas) | West dip; minor faults | Limestones; sandstones; shales |
| High Plains | | | | | |
| Central | 4750 | 2900 | Flat prairies slope east and south | Slight dips east and south | Eolian silts and fine sands |
| Canadian Breaks | 3800 | 2350 | Highly dissected; local solution valleys | | |
| Southern | 3800 | 2200 | Flat; many playas; local dune fields | | |
| Basin and Range | 8750 | 1700 | North-south mountains and basins | Some complex folding and faulting | Igneous; metamorphics; sediments |

Source: Texas Bureau of Economic Geology, 1996

**Figure 2.6-1 Map of Physiographic Provinces**




Index of USGS quadrangle topographic maps Seguin (1975), Beevile (1978) (1:250,000) used as base

**Explanation**

Elevation contour interval 50 feet

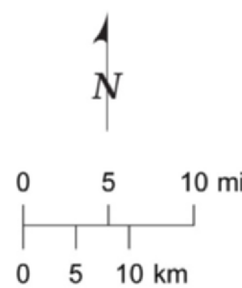



**Figure 2.6-2 Topographic Map (25-Mile Radius)**

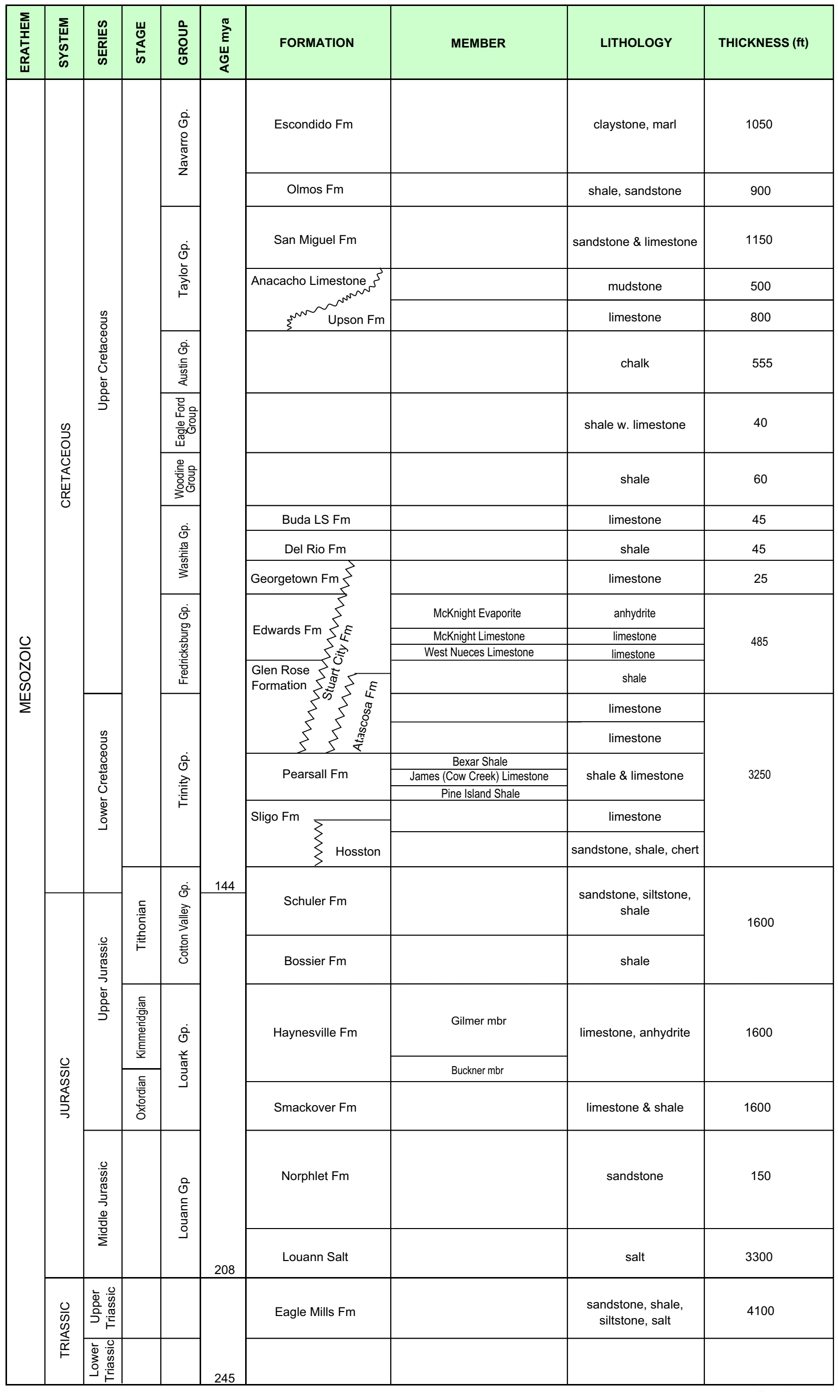



**Figure 2.6-3 Mesozoic Stratigraphic Column**

| ERATHEM | SYSTEM | SERIES | AGE m.y. | Victoria County Station | | Approximate Thickness Undifferentiated (feet) | Approximate elevation of formation top (feet) | Hydrostratigraphy | |
|---|---|---|---|---|---|---|---|---|---|
| CENOZOIC | QUATERNARY | Holocene | 0.10 | Alluvium & Terrace Deposits | Undifferentiated Deweyville Terrace Deposits | 0-50 | | | |
| | | Pleistocene | 2 | | Beaumont Fm<br>Lissie Fm<br>Willis Formation | 400<br>600-700 | 0±<br>-400 | Coastal Lowlands Aquifer System | Chicot aquifer |
| | TERTIARY | Pliocene | 5 | Goliad sand | | 800<br>to 1,000 | -1,000<br>to -1,100 | | Evangeline aquifer |
| | | Miocene | 24 | Fleming Formation<br>Oakville Sandstone | | 3,400<br>to 4,500 | -1,800<br>to -2,100 | | Burkeville Confining System<br>Jasper aquifer |
| | | Oligocene | | Catahoula Tuff | Catahoula Sand<br>Anahuac Formation<br>Frio Formation | 3,000 | -5,200<br>to<br>-6,600 | | Catahoula Confining System |
| | | | 38 | Frio Clay (Vicksburg Group) | | 200 | -8,000<br>to -9,600 | Coastal Uplands Aquifer System | Vicksburg - Jackson Confining System |
| | | Eocene | | Jackson Group | Whitsett<br>Manning clay<br>Welborn<br>Caddell | 500<br>to 1,100 | -8,400<br>to<br>-9,800 | | |
| | | | | Claiborne Group | Yegua<br>Cook Mountain<br>Sparta Sand<br>Weches Fm<br>Queen City Snd<br>Reklaw Fm<br>Carrizo | 1,400<br>to<br>4,500 | -8,900<br>to<br>-10,900 | | Upper Claiborne Aquifer<br>Middle Claiborne Confining System<br>Midddle Claiborne Aquifer<br>Confining System<br>Lower Claiborne-Upper Wilcox Aquifer |
| | | | 58 | Wilcox Group | Undifferentiated | 2,000 | -10,300<br>to<br>-15,400 | | Middle Wilcox Aquifer<br>Not Present |
| | | Paleocene | 66 | Midway Grp | Wills Point<br>Kincaid Fm | 2,500 | -12,300<br>to -17,400 | Midway Confining System | |

**Figure 2.6-4 Cenozoic Stratigraphic Column**