9.4 Alternative Plant and Transmission Systems

This section discusses alternative plant and transmission systems for the proposed ~~ABWRs at the STP site~~ STP 3 & 4 site. Subsection 9.4.1 evaluates alternative heat dissipation systems, Subsection 9.4.2 evaluates alternative circulating water systems, and Subsection 9.4.3 evaluates alternative transmission systems. This evaluation of alternatives includes comparison with the proposed system to identify those systems that are environmentally preferable and environmentally equivalent to the proposed system. If any alternative is identified as environmentally preferable, it is compared with the proposed system on a benefit-cost basis to determine if any such system should be considered as a preferred alternative to the proposed system.

9.4.1 Heat Dissipation Systems

9.4.1.1 Screening of Alternative Heat Dissipation Systems

This section discusses alternatives to the proposed heat dissipation system (Section 3.4). Alternatives considered are those generally included in the broad categories of once through and closed cycle systems. The closed-cycle category includes the following types of heat dissipation systems:

- Cooling ponds
- Spray canals
- Mechanical draft wet cooling towers
- Natural draft wet cooling towers
- Wet/dry cooling towers
- Dry cooling towers

Alternative cooling systems were evaluated in the Construction Phase Environmental Report for STP 1 & 2 (Reference 9.4-1). An initial environmental screening of alternatives for STP 3 & 4 was performed to eliminate those systems that are obviously unsuitable for use at the STP site as discussed below.

Once-through cooling was eliminated from consideration as a viable alternative to a closed-cycle cooling system because of insufficient water flow rates in the Colorado River. A once-through cooling system would significantly raise the temperature of the Colorado River and the salinity profile of the river would be significantly altered. In addition, EPA regulations governing cooling water intake structures under Section 316(b) of the Clean Water Act make it difficult for steam electric generating plants to use once-through cooling systems. For these reasons, once-through cooling was eliminated from further evaluation.

Dry cooling towers were considered as a potential closed-cycle heat dissipation alternative for STP 1 & 2 (Reference 9.4-1). STPNOC concluded dry cooling was not a viable option because of high costs, operational problems, inadequate technology, and a lack of sufficient operating experience with large nuclear generating units. In its preamble to the final rule addressing cooling water intake structures for new facilities (66 FR 65256; December 18, 2001), EPA rejected dry cooling as the best available technology for a national standard for similar reasons. Dry cooling carries high capital and operating and maintenance costs. Manufacturers of large steam turbines have not yet developed turbine designs for reliable and efficient operation over the wide range of backpressures required for dry cooling towers. Dry cooling has a detrimental effect on electricity production by reducing the efficiency of steam turbines. Dry cooling requires the facility to use more energy than would be required with wet cooling towers to produce the same amount of electricity. This energy penalty is most significant in the warmer southern regions during summer months (periods of maximum dry-bulb temperature) when the demand for electricity is at its peak, such as the location of the STP facility. The energy penalty would result in an increase in environmental impacts as replacement generating capacity would be needed to offset the loss in efficiency from dry cooling. EPA concluded that dry cooling is appropriate in areas with limited water available for cooling or where the source of cooling water is associated with extremely sensitive biological resources (e.g., endangered species, specially protected areas). The site-specific conditions do not warrant further consideration of dry cooling for STP 3 & 4.

Four closed-cycle evaporative cooling tower systems, a closed-cycle spray canal, and a closed-cycle cooling reservoir were evaluated in detail for STP 1 & 2, including their economic costs and environmental impacts. These same alternatives are considered for STP 3 & 4. A screening comparison of the alternatives is provided in Table s 9.4-1 and 9.4-2. The analysis presented in the Construction Phase Environmental Report for STP 1 & 2 considered alternative systems for two net 1250 MWe nuclear generating units. The relative impacts of the heat dissipation system alternatives would be similar for the ABWR units (net 1300 MWe each) proposed as STP 3 & 4. Consequently, the evaluation presented in the Construction Phase Environmental Report for STP 1 & 2 (Reference 9.4-1) serves as the basis for the comparison of heat dissipation alternatives for STP 3 & 4.

9.4.1.1.1 Cooling Pond

This section describes and evaluates the feasible alternative heat dissipation systems that use a closed-cycle cooling reservoir. As described in Section 3.4, a closed-cycle cooling system using the existing Main Cooling Reservoir (MCR), supplemented by mechanical draft cooling towers, is the preferred alternative for STP 3 & 4. Because of the intermittent nature of makeup water pumping operations (see Section 3.4), storage capacity is required to account for losses that occur during periods when no makeup water is available to offset them. In a simulated operation of the MCR over the projected 40-year operating life of STP 1 & 2 (Reference 9.4-1), STPNOC determined that a maximum storage volume of 162,400 acre-feet was required. An additional 24,600 acre-feet are required to provide sufficient cooling surface area to maintain reasonable plant efficiency for STP 1 & 2 following the worst drought period on record.

As an alternative to the 7000-acre surface area selected for the MCR, a reduced MCR area of 3500 acres was previously considered as part of the initial STP 1 & 2 site evaluation. The reduction in MCR surface area reduced the net natural evaporative losses; however, the remaining losses still resulted in an estimated total storage requirement of 126,000 acre-feet. This storage volume would require a normal operating elevation for the reduced area MCR of 58.3 ft mean sea level (MSL). STPNOC considered a normal maximum operating level higher than approximately 49 feet MSL to be impracticable given the limitations on plant layout and design. The potential effects resulting from a breach of the MCR embankment and the subsequent rush of water into the plant and the economics of the embankment construction make the higher operating level impractical. Consequently a 7000-acre reservoir was selected as the design basis for the STP site.

STPNOC concluded in the STP 1 & 2 construction phase ER that the 7000-acre MCR would provide adequate cooling capacity for a design thermal load of approximately 5000 MWe. This is roughly the combined load of STP 1 & 2 (two 1250 MWe units) and 3 & 4 (two 1300 MWe units). STPNOC recently reevaluated the thermal performance of the MCR and concluded the cooling capacity was adequate to support the heat load of STP 1 & 2 and STP 3 & 4.

Makeup water would be pumped to the MCR on an intermittent basis from the estuarine portion of the Colorado River. If necessary, blowdown from the MCR would be discharged to the river. The makeup and blowdown requirements for the MCR are described in Section 3.4.

For the spray canal and cooling tower alternatives in the STP 1 & 2 construction phase ER, STPNOC evaluated the withdrawal of makeup water from the freshwater portion of the Colorado River upstream of the Fabridam near Bay City, and transport of this water supply to the STP site via canal. Because of water availability considerations and thermal regulations for the Colorado River, STPNOC had estimated an 1800-acre storage reservoir for makeup water and a 325-acre holding reservoir for blowdown would be required to operate the spray canal and cooling tower alternative systems for STP 1 & 2 (Reference 9.4-1). For the application of these alternative heat dissipation systems to STP 3 & 4, STPNOC assumed the MCR could perform the functions of the additional reservoirs and the only land requirements would be those associated with the cooling system components (e.g., spray canal or cooling towers, piping, intake and return structures). Other attributes of these heat dissipation alternatives are described in the following sections.

9.4.1.1.2 Spray Canal

This alternative would add a new canal equipped with an array of spray modules to promote evaporative cooling. The spray canal evaluated for STP 1 & 2 had an effective length of 20,250 feet and a width of 200 feet. The power spray modules would be placed in rows of four across the canal and spaced approximately 180 feet apart in the direction of flow in the canal. Each spray module would contain a single nozzle powered by a 75-horsepower motor. Each pass would consist of a row of four spray nozzles across the canal. The canal would contain 448 power spray module units and 112 passes with each module floating on the surface of the water.

Condenser water would be cooled by pumping the water in the canal through the spray nozzles, thereby breaking the water into small droplets. The spray from each nozzle would rise to a height of approximately 16 feet and fall in a circular pattern with a diameter of approximately 50 feet at the surface of the canal. Since the water droplets are cooled by evaporation and by sensible heat transfer, due to increased surface area of the water droplets, the water temperature falling back into the canal is reduced. Circulation of the cooling air would be provided by the prevailing wind at the ambient temperature and by the vertical velocity resulting from the increased buoyancy of the warm, moist air.

9.4.1.1.3 Mechanical Draft Wet Cooling Towers

This alternative consists of three towers, each containing 12 cells, for each nuclear generating unit. The towers would be located with their longitudinal axes parallel to the direction of prevailing wind to minimize aerodynamic downwash of the exhaust plumes to ground level and to enhance the merging of the exhaust plumes from adjacent cells, increasing the plume rise. Ground-level fogging and icing would be minimized as would the channeling of moist air from the exhaust of one tower to the intake of another. A fan would be located near the top of each cell, to draw ambient air into and through the cell. The warmed water from the condenser would be cooled by evaporative and sensible heat transfer by contact with the ambient air in the fill (packing) section of each cell.

9.4.1.1.4 Natural Draft Wet Cooling Towers

This alternative consists of a single hyperbolic tower, 500 feet high, for each nuclear generating unit. The density difference between the ambient air outside the tower and the warm moist air inside would provide the driving force for the air circulation through the tower. The natural draft tower must be relatively tall to achieve adequate air flow rates through the tower. Circulating water leaving the condenser is sprayed by nozzles into the fill section of the tower, where the droplets are brought in contact with the circulating air. The water is cooled through evaporative and sensible heat transfer. Because of the relatively high release points and the buoyancy of the plumes from natural draft towers, recirculation of the exhaust between towers is generally not encountered. The positioning of natural draft towers within the STP site boundaries is less critical than for other evaporative heat dissipation alternatives.

9.4.1.1.5 Mechanical Draft Wet/Dry Cooling Towers

This alternative consists of four towers, each containing 12 cells, for each nuclear generating unit. Similar to the mechanical draft towers discussed previously, these towers would be located with their longitudinal axes parallel to the direction of prevailing wind to minimize recirculation of the exhaust plume. STPNOC evaluated a parallel path variety of wet/dry cooling towers in which the air-cooled heat exchanger is located above an evaporative wet section. The wet section of the tower would be similar to that of the mechanical draft wet tower described above. Warmed water from the condenser first passes through the tube side of the air-cooled heat exchanger, where it is cooled by a stream of ambient air. A fan located above the dry section draws the ambient air through the tower. The partially cooled water then passes through the wet section of the tower, where it is further cooled by evaporative and sensible heat transfer. The air streams from both the wet and dry sections of the tower are thoroughly mixed before being exhausted to the atmosphere. The mixed exhaust stream is in an unsaturated condition which reduces the potential for fogging. For the type of wet/dry towers under consideration, the relative humidity of the exhaust air would be approximately 70% over the entire range of operating conditions.

This type of cooling tower is used primarily in areas where plume abatement is necessary for aesthetic reasons or to minimize fogging and icing produced by the tower plume. Wet/dry cooling towers use approximately two-thirds to one-half less water than wet cooling towers (Reference 9.4-2). Neither of these advantages is significant for the STP site. Additionally, somewhat more land is required for the wet/dry cooling tower because of the additional equipment (fans and cooling coils) required in the tower assembly. The same disadvantages described above for dry cooling towers would also apply to the dry cooling portion of the wet/dry cooling tower. The dry cooling process is not as efficient as the wet cooling process because it requires the movement of a large amount of air through the heat exchanger to achieve the necessary cooling. This movement is accomplished by fans. This results in less net electrical power for distribution. Consequently, there would be an increase in environmental impacts because a replacement generating capacity would be needed to offset the loss in efficiency from dry cooling.

9.4.1.1.6 Fan-Assisted Natural Draft Cooling Towers

Fan-assisted natural draft towers combine some of the characteristics of mechanical and natural draft towers. This alternative consists of three cooling towers for each nuclear generating unit. For STP 1 & 2, STPNOC had evaluated a tower height of 176.5 feet and base diameter of 206 feet. Each tower is equipped with a single fan near the exit of the tower. Air circulation is achieved by both the forced draft produced by the fan and the natural draft resulting from the difference in density between air inside and outside of the tower. Recirculation of warm moist air between towers would occur infrequently given the discharge height of the tower.

9.4.1.2 Analysis of Alternative Heat Dissipation Systems

Six closed-cycle cooling systems are considered suitable heat dissipation systems for the STP site and are evaluated in detail. A cooling pond (the MCR) was selected as the preferred alternative and evaluated in Chapters 4 and 5 of the ER. In accordance with NUREG-1555, the five alternative heat dissipation systems were evaluated for land use, water use, and other environmental requirements. The screening comparison of these alternatives is presented in Tables 9.4-1 and 9.4-2. None of the alternative systems is considered environmentally preferable to the MCR, which is the proposed heat dissipation system for STP 3 & 4.

9.4.2 Circulating Water Systems

In accordance with NUREG-1555, this section considers alternatives to the following components of the plant circulating water system:

- intake systems

- discharge systems
- water supply
- water treatment

NUREG-1555 indicates that the applicant should consider only those alternatives that are applicable at the proposed site and are compatible with the proposed heat dissipation system. As discussed in Section 9.4.1, six closed-cycle cooling systems are considered viable heat dissipation systems for the STP site.

Heat dissipation with each of the alternative systems relies on evaporation for heat transfer. The water from the cooling system lost to the atmosphere through evaporation must be replaced. In addition, this evaporation would result in an increase in the concentration of solids in the circulating water. To control solids, a portion of the recirculated water must be removed, or blown down, and replaced with fresh water. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) would be lost from the cooling tower systems. Makeup water pumped from the Colorado River intake structure (Subsection 9.4.2.1) would be used to replace water lost by evaporation, blowdown, and drift from the cooling systems. Blowdown water would be returned to the river via a discharge structure at the shoreline (Subsection 9.4.2.2).

9.4.2.1 Intake Systems

Standard technical practice was followed in siting and designing the makeup water intake structure at the Colorado River for the original plant. The intake structure was designed originally to serve four units, so no additional design modifications are required for this project. The intake bays, fish screens, trash racks, and bypass system are already operational for STP 1 & 2. The refurbishment of the intake structure to accommodate STP 3 & 4 will consist of installing new pumps and traveling screens in existing housings.

As described in Subsection 5.3.1.2, when required, water will be pumped from the Colorado River through a shoreline intake system at 0.5 feet per second, and passed through trash racks and through traveling screens with a 3/8-inch (9.5 millimeters) mesh. The traveling screens will operate intermittently to coincide with the intermittent withdrawal of river water. Fish collected on the screens can be returned to the river by being washed off and sluiced through a fish bypass pipe. The point of return is at the downstream end of the intake structure, approximately 0.6 meters (2 feet) below normal water elevation.

Approach and through-screen velocities are regulated by EPA and the states and subject to review under best management practices (40 CFR 401.14). The approach velocity for STP 1 & 2 was designed to be 0.5 feet per second (Subsection 5.3.1.2). The approach velocity of 0.5 feet per second is not expected to change when STP 3 & 4 become operational (Subsection 5.3.1.2). Alternate locations for the STP 3 & 4 water intake would increase the amount of land impacted by construction. In addition, pumping costs could increase because of a longer distance from the makeup water intake to the MCR. No environmentally preferable alternatives to the use of the existing makeup water intake structure or alternative locations for a makeup water intake structure were identified.

As part of the proposed heat dissipation system, STPNOC considered four potential designs/locations for the STP 3 & 4 circulating water intake structure at the MCR.

- Option 1 – Intake structure located along the dike separating the STP 1 & 2 circulating water intake structure and return.
- Option 2 – Intake structure located to the west of the combined STP 1 & 2 and STP 3 & 4 circulating water return flows, intakes and discharges separated by dikes.
- Option 3 – Offshore intake positioned directly south of the STP 1 & 2 intake structure. Piping from intake to run through the dike to a shoreline structure located to the west of the STP 1 & 2 intake
- Option 4 – Intake structure located immediately adjacent to the STP 1 & 2 intake structure, portion of dike removed to accommodate placement of STP 3 & 4 intake structure between STP 1 & 2 intake and discharge outfall

Table 9.4-3 provides a comparison of these alternative circulating water intake designs/locations. Option 1 was selected as the preferred alternative. Each of the other options had at least one factor (cooling efficiency, construction cost, interference with ongoing plant operations) that prevented it from being a viable option. None of the other options were environmentally preferable to the proposed design.

9.4.2.2 Discharge Systems

As described in Section 3.4, the circulating water system for STP 3 & 4 would be a closed-cycle cooling reservoir system. All cooling system discharges, including blowdown from the mechanical draft cooling towers that serve as the Ultimate Heat Sink (UHS), would be discharged to the MCR via a new circulating water return. The design is similar to the existing circulating water return for STP 1 & 2. No environmentally preferable alternatives to the proposed return were identified.

A dike will separate the circulating water intake structure and return to avoid recirculation and to promote cooling efficiency by lengthening the cooling water flow path. The new circulating water return from STP 3 & 4 would be located adjacent to the existing STP 1 & 2 return. The location of the return and placement of dikes would be determined by the location of the circulating water intake structure for STP 3 & 4 and associated pipe routing (see Subsection 9.4.2.1).

MCR water quality, and thus the quality of any blowdown water from the MCR, is maintained by selective diversion from the Colorado River during high river flow conditions (>1200 cubic feet per second). The maximum operating level of the MCR was increased from 45 to 47 feet MSL to take advantage of reservoir makeup opportunities when river flows are high. Projections on water quality in the MCR and additional upstream demands on the Colorado River could necessitate the use of the permitted reservoir blowdown system to maintain water quality (Reference 9.4-3).

As discussed in Section 3.4, blowdown from the MCR would be directed to the Colorado River via the existing blowdown structure, which includes a 1.1-mile-long discharge line that extends downstream along the west bank of the river and is equipped with seven discharge ports. One or more of the ports may be opened, depending on river flows, to promote rapid mixing of the effluent. Because the blowdown flow would be a small percentage of the Colorado River flow (Subsection 5.3.2), the effect on temperature downstream in the Colorado River would be negligible, and limited to an area in the immediate vicinity of the blowdown line. Similarly, chemical discharges would mix quickly with the larger freshwater flow of the Colorado River and impacts to aquatic communities will be small. Because STPNOC has proposed to use the existing blowdown structure and the impacts of its operation are SMALL, no consideration of alternatives to the proposed design was needed.

9.4.2.3 Water Supply

The Colorado River would supply makeup water to the MCR to replace evaporative and seepage losses. Circulating water would be withdrawn from the MCR for condenser and turbine system cooling. The circulating water would be returned to the MCR. Groundwater wells would provide makeup water to the UHS (two mechanical draft cooling towers) and, indirectly (as blowdown from the towers) to the MCR. During normal operation, approximately 500 gpm of groundwater would be returned as surface water to the MCR (Table 3.3.1).

Hydrological studies in support of construction of STP 1 & 2 (Reference 9.4-1) showed a dependable supply of unappropriated water in the Colorado River during the six winter months of October through March. These studies involved an assessment for the years 1949 to 1971, and indicated that this water supply can be supplemented from flood flows during the other periods of the year. These conclusions remain valid for STP 3 & 4. The 7000-acre MCR is required for storage given the recurrence of droughts. Reservoir water quality is maintained by selective pumping from the Colorado River during high flow conditions. STPNOC has developed guidelines for water management during drought conditions that require actions at decreasing MCR levels. These guidelines allow water quality to be reduced in order to maintain MCR level during drought conditions (Reference 9.4-3).

In support of STP 1 & 2, STPNOC considered obtaining makeup water for the MCR from the Gulf of Mexico. While the use of makeup water from the Gulf of Mexico on a continuous basis would reduce the required size of the MCR, the costs associated with transporting makeup water and returning blowdown approximately 18 miles to the Gulf of Mexico make this alternative economically unattractive in comparison to using estuarine water from the Colorado River. Use of salt water from the Gulf of Mexico was also less desirable than the use of estuarine waters because of engineering problems associated with saltwater operation and because of the ecological impacts associated with the long pipeline and with the withdrawal of makeup water from, and the discharge of blowdown to, the Gulf. This alternative is not environmental preferable to the proposed makeup water supply from the Colorado River.

In the case of the cooling reservoir, makeup water would be pumped on an intermittent basis from the estuarine portion of the Colorado River. The makeup and blowdown schemes for the MCR are described in Section 3.4. In the case of the spray canal or cooling tower systems, makeup water would be withdrawn from the freshwater portion of the Colorado River above the Fabridam near Bay City. The makeup water would be transported to the site via canal. Because of water availability considerations and thermal regulations for the river, STPNOC estimated an 1800-acre storage reservoir for makeup water and a 325-acre holding reservoir for blowdown would be required to operate the spray canal or cooling tower alternative heat dissipation systems (Reference 9.4-1). In evaluating alternative heat dissipation systems for STP 3 & 4, STPNOC assumed the functions of these additional reservoirs could be performed by the existing MCR with water supplied from the freshwater portion of the Colorado River. Construction of these additional reservoirs would not be environmentally preferable to use of the existing MCR.

STPNOC estimates that a supply of approximately 60,000 acre-feet per year of makeup water from upstream sources would be required to operate the spray canal or cooling tower alternative systems for STP 1 & 2 during years of relatively low rainfall and high gross evaporation from the onsite reservoir. The cost of purchasing makeup water from the reservoirs near Austin was estimated at $15 per acre-foot during the planning for STP 1 & 2 (Reference 9.4-1) and would be higher now. In the case of the cooling pond (MCR) alternative, makeup water could be supplied from the estuarine portion of the Colorado River for the cost of pumping. Alternative sources of water, such as the use of the reservoirs near Austin, would represent a future loss of that freshwater supply for alternative uses and would not be environmentally preferable to the current STP water supply from the estuarine portion of the Colorado River.

9.4.2.4 Water Treatment

As described in Subsection 3.3.2, the Colorado River would be the source of makeup water to the MCR which provides cooling for the new units' circulating water system. This water supply would be treated by injecting biocides at the intake structure to control biofouling in the circulating water system and associated piping. Because STP 3 & 4 would use the same water supply as the existing units, STPNOC expects that makeup and process water for the proposed units would be treated in the same manner.

Biocides or chemical additives would be from those approved by the U.S. Environmental Protection Agency or the state of Texas and the volume and concentration of each constituent discharged to the environment would meet the requirements established in the ~~TPDES~~ Texas Pollutant Discharge Elimination System (TPDES) permit. This permit would be revised, as necessary, to accommodate the construction and operational needs of STP 3 & 4. The final choice of water treatment chemicals or combination of chemicals would be dictated by makeup water conditions, technical feasibility, economics, and discharge permit requirements. Since the discharges from the system would be subject to TPDES permit limitations that consider aquatic impacts, these limitations would ensure that there would be no significant impact from these discharges and, thus, different water treatment chemicals would be not be environmentally preferable to the existing impacts.

9.4.3 Transmission Systems

New 345kV towers and lines would be constructed from the new STP 3 & 4 switchyard to connect to existing transmission lines on the STP site. Some modifications to the transmission system would be required; however, no new transmission lines or offsite rights-of-way would be associated with STP 3 & 4. Because the additional power provided by STP 3 & 4 would be transmitted over without significant additional environmental impacts, no new transmission system alternatives were considered.

Some modifications to the transmission system would be required. The Electric Reliability Council of Texas (ERCOT) Screening Study (Reference 9.4-4) calls for approximately 20 miles of conductor replacement to accommodate the additional current. There would be no change in line voltage and no new corridors would be needed. As discussed in Section 3.7, some towers would be replaced in order to maintain the National Electric Safety Code (NESC) standards in sag clearance.

To reduce the potential of vehicle-to-ground short-circuit shock to vehicles parked beneath the lines, all existing STP transmission lines are currently designed to provide clearances consistent with the NESC 5-milliamp rule and AEP and CenterPoint engineering standards. The upgrade of the existing transmission system described in Section 3.7 and Subsection 2.2.2.2 would likely change the geometry of the power lines, because the new conductors would sag differently and new towers would likely be taller. All transmission lines would continue to comply with the NESC and AEP and CenterPoint engineering standards.

The ERCOT Screening Study (Reference 9.4-4) identifies that some system improvements are needed to reduce thermal overloads caused by increased energy exports that would come from STP associated with the proposed interconnection. As discussed in Subsection 3.7.1, electrical design parameters, including transmission design voltage or voltages, line capacity, conductor type and configuration, spacing between phases, minimum conductor clearances to ground, maximum predicted electrical-field strength(s) at 1 meter above grade, the predicted electric-field strength(s) at the edge of rights-of way in kilovolts per meter, and the design for these values will be established from the final AEP Interconnection study.

The AEP Interconnection Study (Reference 9.4-5) evaluated a total of 11 different options to accommodate STP 3 & 4. These options consisted of different combinations of upgrades to transmission lines and alternative substation configurations. Five of the options were eliminated for technical feasibility reasons, while three other options were eliminated because they did not demonstrate a superior benefit compared to the retained options. Three options were retained for further detailed engineering analysis (Reference 9.4-5). STPNOC expects that the environmental impacts of any of these three options would be similar.

9.4.4 References

9.4-1 STP (South Texas Project) 1974. South Texas Project Units 1 & 2 Environmental Report, Amendment 2, October 25.

9.4-2 "Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities," EPA (U.S. Environmental Protection Agency), EPA-821-R-01-036, November, 2001.

9.4-3 STPNOC (South Texas Project Nuclear Operating Company) 2005. Water Conservation Plan, South Texas Project Electric Generating Station, Rev. 1, May 1.

9.4-4 ERCOT (Electric Reliability Council of Texas) 2007. 15INR0008 Generation Interconnect Screening Study, Matagorda County, TX. January 8.

9.4-5 "Interconnection Study for New Generation in Matagorda County," AEP (American Electric Power Service Corporation) 2007. 15NR0008, June.

Table 9.4-1 Screening of Alternative Heat Dissipation Systems (Alternatives 1 through 3)

Factors Affecting System Selection	Cooling Reservoir (Base Case)	Spray Canal	Mechanical Draft Wet Cooling Tower (MDCT)
Land Use: Onsite Land Considerations [1]	Existing 7,000-acre MCR currently operating at the STP site.	Spray canal system (approximately 150 acres) could be placed within the existing STP site. An additional 680 acres would be required for the intake canal corridor.	MDCT system (approximately 70 acres) could be placed within the existing STP site. An additional 630 acres would be required for the intake canal corridor. System could be placed within the confines of the existing STP site.
Land Use: Terrain considerations	Terrain features of the STP site support a cooling reservoir with adequate capacity to support four units.	Terrain features of the STP site are suitable for a spray canal system.	Terrain features of the STP site are suitable for a MDCT system.
Water Use: Annual Average Consumptive Use (acre-ft/yr)	43,000	47,000	45,000
Atmospheric Effects	NUREG-1555 notes that the plume from a cooling pond like the MCR would exist as a fog over the pond or as ground level fog evaporating within 300 meters from the pond, or lift to become stratus for winds less than or equal to 2.2 meters per second. Elevated plumes and the associated shadowing would not be expected from operation of the MCR. In addition, NUREG-1555 concludes that drift from a cooling pond or lake would not need to be considered.	A spray canal system could produce a low-lying visible water droplet plume and encourage formation of fog above the heated pond. These impacts would be localized and short-lived, and would not disrupt the viewscape.	The system would emit water droplets (drift) and intermittently produce a visible vapor plume. The drift droplets would be a minor source of particulate matter and salt deposition. The water vapor plume would not contribute to fogging or icing conditions on local road systems. Aesthetic impacts from the visible plume would be small.
Thermal and Physical Effects	Thermal load to the MCR would be additive to the thermal load from STP 1 & 2. The MCR was designed to accommodate the thermal load of four units.	Thermal load would be rejected to the spray canal reducing the thermal load to the MCR relative to the base case. Discharges to the Colorado River would meet water quality standards.	MDCT system would discharge a small thermal load to the MCR relative to the base case. Discharges to the Colorado River would meet water quality standards.

Table 9.4-1 Screening of Alternative Heat Dissipation Systems (Alternatives 1 through 3) (Continued)

Factors Affecting System Selection	Cooling Reservoir (Base Case)	Spray Canal	Mechanical Draft Wet Cooling Tower (MDCT)
Noise Impacts [2]	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 43 dBA.	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 42 dBA.	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 52 dBA.
Aesthetics and Recreational Benefits	Consumptive water use and discharges for the cooling reservoir would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.	Consumptive water use and discharges for a spray canal system would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.	MDCT structures would pose higher visual impacts than cooling reservoir or spray canal alternatives. The plumes resemble clouds and would not disrupt the viewscape. Consumptive water use and discharges for a MDCT system would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.
Legislative Restrictions	Approach and through-screen velocities are regulated by EPA and subject to review under best management practices (see Section 5.3.1.2). The approach velocity for the intake for STP 1 & 2 was designed to be 0.5 fps. The intake structure built for STP 1 & 2 has unused pumping capacity to accommodate the new units. The approach velocity of 0.5 fps is not expected to change when STP 3 & 4 become operational.	Intake structure would meet Section 316(b) of the CWA and the implementing regulations, as applicable. TPDES discharge permit thermal discharge limitation would address the additional thermal load from blowdown. Storage of makeup and blowdown at the STP site would mitigate the impacts to the river. Regulatory restrictions would not negatively impact application of this heat dissipation system.	Intake structure would meet Section 316(b) of the CWA and the implementing regulations, as applicable. TPDES discharge permit thermal discharge limitation would address the additional thermal load from blowdown. Storage of makeup and blowdown at the STP site would mitigate the impacts to the river. Regulatory restrictions would not negatively impact application of this heat dissipation system.
Is this a suitable alternative for the STP site?	Yes	Yes	Yes

[1] Acreage does not include land requirements (2,25 acres) associated with storage reservoirs for makeup water and blowdown for the spray canal and cooling towers systems. The existing 7000-acre MCR was assumed to fulfill these water storage requirements.

[2] Continuous noise only. Estimate does not include intermittent noise due to makeup pumps and traveling water screens at the intake locations.

Table 9.4-2 Screening of Alternative Heat Dissipation Systems (Alternatives 4 through 6)

Factors Affecting System Selection	Natural Draft Wet Cooling Towers (NDCT)	Mechanical Draft Wet/Dry Cooling Towers (MDW/DCT)	Fan-Assisted Natural Draft Cooling Towers (FNDCT)
Land Use: Onsite Land Considerations [1]	NDCT system (approximately 80 acres) could be placed within the existing STP site. An additional 630 acres would be required for the intake canal corridor.	MDW/DCT system (~70 acres) could be placed within the existing STP site. An additional 630 acres would be required for the intake canal corridor.	Fan-assisted NDCT system (approximately 70 acres) could be placed within the existing STP site. An additional 630 acres would be required for the intake canal corridor.
Land Use: Terrain considerations	Terrain features of the STP site are suitable for a NDCT system.	Terrain features of the STP site are suitable for a MDW/DCT system.	Terrain features of the STP site are suitable for a fan-assisted NDCT system.
Water Use: Annual Average Consumptive Use (acre-ft/yr)	45,000	42,000	45,000
Atmospheric Effects	The system would emit water droplets (drift) and intermittently produce a visible vapor plume. The drift droplets would be a minor source of particulate matter and salt deposition. The water vapor plume would not contribute to fogging or icing conditions on local road systems. Aesthetic impacts from the visible plume would be small.	The system would emit water droplets (drift) and intermittently produce a visible vapor plume. The drift droplets would be a minor source of particulate matter and salt deposition. The water vapor plume would result in minimal additional fogging but no icing conditions on local road systems. Aesthetic impacts from the visible plume would be small.	The system would emit water droplets (drift) and intermittently produce a visible vapor plume. The drift droplets would be a minor source of particulate matter and salt deposition. The water vapor plume would not contribute to fogging or icing conditions on local road systems. Aesthetic impacts from the visible plume would be small.
Thermal and Physical Effects	NDCT system would discharge a small thermal load to the MCR relative to the base case. Discharges to the Colorado River would meet water quality standards.	MDW/DCT system would discharge a small thermal load to the MCR relative to the base case. Discharges to the Colorado River would meet water quality standards.	Fan-assisted NDCT system would discharge a small thermal load to the MCR relative to the base case. Discharges to the Colorado River would meet water quality standards.
Noise Impacts [2]	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 44 dBA.	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 52 dBA.	Emits broadband noise that is largely indistinguishable from background and unobtrusive. Continuous noise level at site boundary estimated at 54 dBA.

Table 9.4-2 Screening of Alternative Heat Dissipation Systems (Alternatives 4 through 6) (Continued)

Factors Affecting System Selection	Natural Draft Wet Cooling Towers (NDCT)	Mechanical Draft Wet/Dry Cooling Towers (MDW/DCT)	Fan-Assisted Natural Draft Cooling Towers (FNDCT)
Aesthetics and Recreational Benefits	NDCT structures would pose the highest visual impact due to their height (approximately 500 feet). The plumes resemble clouds and would not disrupt the viewscape. Consumptive water use and discharges for a NDCT system would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.	MDW/DCT structures would pose higher visual impacts than cooling reservoir or spray canal alternatives. The plumes resemble clouds and would not disrupt the viewscape. Consumptive water use and discharges for a MDW/DCT system would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.	Fan-assisted NDCT structures (height ~180 ft) would pose visual impacts greater than MDCT but less than conventional NDCT. The plumes resemble clouds and would not disrupt the viewscape. Consumptive water use and discharges for a fan-assisted NDCT system would be consistent with minimum stream flow requirements for Colorado River navigation and environmental maintenance, fish and wildlife water demand, and recreation.
Legislative Restrictions	Intake structure would meet Section 316(b) of the CWA and the implementing regulations, as applicable. TPDES discharge permit thermal discharge limitation would address the additional thermal load from blowdown. Storage of makeup and blowdown at the STP site would mitigate the impacts to the river. Regulatory restrictions would not negatively impact application of this heat dissipation system.	Intake structure would meet Section 316(b) of the CWA and the implementing regulations, as applicable. TPDES discharge permit thermal discharge limitation would address the additional thermal load from blowdown. Storage of makeup and blowdown at the STP site would mitigate the impacts to the river. Regulatory restrictions would not negatively impact application of this heat dissipation system.	Intake structure would meet Section 316(b) of the CWA and the implementing regulations, as applicable. TPDES discharge permit thermal discharge limitation would address the additional thermal load from blowdown. Storage of makeup and blowdown at the STP site would mitigate the impacts to the river. Regulatory restrictions would not negatively impact application of this heat dissipation system.
Is this a suitable alternative for the STP site?	Yes	Yes	Yes

[1] Acreage does not include land requirements (2125 acres) associated with storage reservoirs for makeup water and blowdown for the spray canal and cooling towers systems. The existing 7000-acre MCR was assumed to fulfill these water storage requirements.

[2] Continuous noise only. Estimate does not include intermittent noise due to makeup pumps and traveling water screens at the intake locations.

Table 9.4-3 Comparison of Alternative Circulating Water Intake Structure Locations at the MCR

Attribute	Option 1 – Intake Along Existing Dike	Option 2 - Intake West of Combined STP 1 & 2 and 3 & 4 Discharge	Option 3 – Offshore Intake	Option 4 – Intake Between Existing STP 1 & 2 Intake and Discharge
MCR Perimeter Embankment Integrity	Provides sufficient clear distance from the excavation for construction of the intake structure to the perimeter embankment to pose no risk to embankment integrity	Intake structure located at least 200 feet from base of perimeter embankment to eliminate possible stability issues and embankment displacement/deformation. Approximately 400 foot width cut from top of berm to allow passage for circulating water piping.	Similar to Option 2	Similar to Option 2
Room for Expansion	Location can accommodate a larger intake structure with minor adjustments	NA	NA	Limited space and accessibility for construction activities. Location does not allow for expansion (e.g., if required flow rates increase due to condenser configuration)
Ease of Construction	Optimum access allowing straight forward construction methods	NA	Cost of underwater construction would be prohibitively high	Circulating water piping would block existing access road from embankment base road to top of berm road. Unacceptable to obstruct the access road as it is used daily to service the STP 1 & 2 intake structure.
Cooling Efficiency	NA	Could impede cooling efficiency by the MCR as it reduces by half the cooling water flow path between the discharge outfall and the respective intakes of either the existing plant or the new units	NA	NA

Table 9.4-3 Comparison of Alternative Circulating Water Intake Structure Locations at the MCR (Continued)

Attribute	Option 1 – Intake Along Existing Dike	Option 2 - Intake West of Combined STP 1 & 2 and 3 & 4 Discharge	Option 3 – Offshore Intake	Option 4 – Intake Between Existing STP 1 & 2 Intake and Discharge
Cost	Slightly longer circulating water piping runs to power block	Shorter circulating water piping runs to power block but requires removal of 1600 feet of existing divider dike and installation of 3400 feet of new divider dike. Dike modification costs not offset by reduced piping cost.	Shorter circulating water piping runs to power block but requires multiple offshore velocity caps and large culverts penetrating the divider dike. Costs of underwater construction not offset by reduced piping cost.	Shorter circulating water piping runs to power block than Option 1, but longer than Options 2 and 3.
Viable for STP site?	Yes	No	No	No