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March 9, 2010

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555
ATTN: David B. Matthews, Director
Division of New Reactor Licensing

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 3 AND 4
DOCKET NUMBERS 52-034 AND 52-035
SUPPLEMENTAL INFORMATION FOR ENVIRONMENTAL REVIEW REQUESTS FOR ADDITIONAL INFORMATION HYD-11, HYD-18, AND HYD-19

Dear Sir:

Luminant Generation Company LLC (Luminant) submits herein supplemental information for the responses to Environmental Review Requests for Additional Information (RAIs) HYD-11, HYD-18, and HYD-19 for the Combined License Application for Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4. The three RAIs involve the ambient flow field in Lake Granbury in the vicinity of the Units 3 and 4 makeup water intake and discharge; changes to the flow field from the operation of Units 3 and 4; and the impact of those changes on aquatic biota.

Should you have any questions regarding this supplemental information, please contact Don Woodlan (254-897-6887, Donald.Woodlan@luminant.com) or me.

There are no commitments in this letter.

I state under penalty of perjury that the foregoing is true and correct.

Executed on March 9, 2010.

Sincerely,

Luminant Generation Company LLC

Donald R. Woodlan for

Rafael Flores

Attachment: Supplemental Response for Request for Additional Information HYD-11/18/19

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NRO

Electronic distribution w/attachment

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SUPPLEMENTAL RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI REGARDING THE ENVIRONMENTAL REVIEW

DATE OF RAI ISSUE: 6/26/2009

QUESTION NO.: HYD-11/18/19

The three RAIs involve the ambient flow field in Lake Granbury in the vicinity of the Units 3 and 4 makeup water intake and discharge; changes to that flow field from the operation of Units 3 and 4; and the impact of those changes on aquatic biota.

SUPPLEMENTAL INFORMATION

1.0 <u>Issue</u>

The NRC staff and contract reviewers (NRC) have recently asked questions regarding the ambient current patterns in Lake Granbury and the effect of CPNPP Units 3 and 4 intake and discharge induced current pattern alterations on aquatic biota. This information is intended to be used to assess the impact of current alterations on the life forms in this portion of the lake. The detailed information requested would require sophisticated modeling. Discrete current modeling requires special expertise, is very expensive, and is expected to take more than a year to complete. Luminant believes it is unnecessary to perform the modeling to meet the guidance of the NEPA and ESRP. Due to the dynamic nature of Lake Granbury, the description of the hydrodynamics provided in previous correspondence and discussions will allow sufficient assessment of the intake and discharge effects on the aquatic biota. An overview of the impact on the flows in Lake Granbury and the subsequent potential for impact on the aquatic biota are provided below.

Section 2 provides an assessment of the impacts of intakes and discharges on water conditions in Lake Granbury. This section demonstrates that sufficient information exists to conclude that intakes and discharges from operation of CPNPP Units 3 and 4 will not have a significant impact on the conditions in the Lake.

Section 3 provides an assessment of the impacts of intakes and discharges on aquatic biota in Lake Granbury. This section demonstrates that sufficient information exists to conclude that intakes and discharges from operation of CPNPP Units 3 and 4 will not have a significant impact on the biota in the Lake.

In light of the above, Section 4 concludes that additional assessments of Lake Granbury are not warranted.

2.0 Assessment of Impacts on Flow Pattern in Lake Granbury Due to Intake/Discharge from its 3 and 4

Hydrologic alterations to Lake Granbury resulting from CPNPP Units 3 and 4 operations will be similar to those identified through Lake Granbury's historical use as both a cooling water source and discharge location for local power plants.

Two flow scenarios are expected during CPNPP Units 3 and 4 operations.

High-flow scenario – when flows or releases through DeCordova Bend Dam, located approximately 800 feet downstream of the Units 3 and 4 discharges, exceed intake diversions from CPNPP Units 1 through 4 and Wolf Hollow Generating Station, located 6,020 feet upstream of the Units 3 and 4 discharge.

Low-flow scenario – when intake diversions from CPNPP Units 1 through 4 and Wolf Hollow exceed releases through DeCordova Bend Dam.

Section 2.1 discusses the existing conditions in Lake Granbury and shows that, in general, the flows of water into and out of the lake are sufficient to ensure mixing of the lake water, such that the lake is not thermally stratified.

Section 2.2 discusses the impacts of proposed intakes from operation of CPNPP Units 3 and 4 and shows that the intakes will not significantly alter existing flow patterns through the Lake.

Section 2.3 discusses the impacts of proposed discharges from operation of CPNPP Units 3 and 4 and shows that the discharges will not significantly alter the existing temperatures or chemical composition of the water in the Lake.

In light of that information, Section 2.4 concludes that additional monitoring of the flow patterns in Lake is not warranted and would be unduly burdensome.

2.1 Existing Conditions in Lake Granbury and Mixing

Available historical temperature data for Lake Granbury indicate a predominately fully-mixed water body during any flow condition.

The following information extracted from the Ward Report supports the conclusion that Lake Granbury is adequately mixed and not thermally stratified (submitted to the NRC via Luminant letter TXNB-09052 dated October 8, 2009 and also located in the electronic reading room).

"Flows into the lake and out of the lake, i.e., through-flow, which is dominated by the flow in the Brazos, vary widely in response to the storm-dominated climatology of North Texas. Typically, the higher annual flows are experienced in the late spring (April – June) and a secondary maximum occurs in the fall; however, this pattern is widely variable from year to year. This wide range in through-flow induces a Jekyll-Hyde dichotomy in the behavior of Granbury. Only when through-flow is low enough that the waters in the reservoir are quiescent and respond to the seasonal march of temperature and insolation, does the reservoir behave like a subtropical lake." [Ward 2008]

"In such a subtropical lake, the increased heating with the advance of spring produces a buoyant surface layer, called the *epilimnion*, that continues to collect warmed water and gradually deepens into summer. The zone of fall-off in temperature with depth, the *thermocline*, is a layer of vertical density gradient. Because the warm buoyant epilimnion water lies on top of the cool dense water below the thermocline, the *hypolimnion*, this stratification opposes vertical water movement and becomes self-stabilizing, resisting the exchange of water between epilimnion and hypolimnion. As the season advances from spring to summer, and epilimnion and hypolimnion become increasingly isolated, dissolved oxygen (DO) is retained in the epilimnion due to its continuing influx from surface reaeration and from photosynthesis in the light-illuminated near-surface layer, but is no longer mixed downward into the hypolimnion. Here DO is consumed by microbiological respiration, until the hypolimnion becomes anoxic. A roll-off in DO with depth, called the *oxycline*, from high concentrations in the epilimnion to zero in the hypolimnion, occurs at, or just above the level of the thermocline." [Ward 2008].

"A disturbance of sufficient strength, such as a thunderstorm or influx of flood water, can disrupt the temperature stratification and mix the waters in the lake. The stability of the thermocline is the key parameter that dictates whether the vertical structure of the lake can withstand such an event. As the season progresses into fall, cooling of the epilimnion reduces the thermocline stability to the point that fall storms begin to mix out the vertical structure. In the case of Granbury, an inspection of field data indicates that summer stratification is not manifested under high-flow conditions, even in the heat of summer." [Ward 2008].

"It is necessary to have a means of differentiating the high-flow conditions, in which Granbury behaves as an enlarged river, from the low-flow conditions, in which the reservoir is quiescent and behaves like a lake. The simplest measure of the effect of through-flow Q on reservoir quality is the residence time, Tr = V / Q, where V is the volume of the lake.

"This is time required for a parcel of water located at the head of the lake to move to the spillway of the dam at the specified flow rate Q, in other words, the time needed for the through-flow Q to replace the contents of the lake. For Granbury, a rule of thumb is a residence time of more than two months is indicative of a quasi-quiescent lacustrine behavior, and a residence time substantially less than one month a dynamic lotic (flowing) behavior. Analyses of forty (40) years of hydrologic data indicate twenty-one (21) summers would fail to qualify as protracted low-flow periods."

Regarding annual throughflow of Lake Granbury in volumes of lake per year it is estimated that "Over the 58-year simulation period, the annual spills and releases from Granbury average about eight times the volume of the reservoir, and the annual evaporative deficit averages one-fifth (20%) of the volume of the reservoir." [Ward 2008].

For Lake Granbury, seasonal patterns in stratification exhibited in the absence of high inflows include vertical homogeneity in the temperature structure in the winter with stratification developing through the spring. The stratification in Granbury is relatively weak, and is quantified by the density gradient at the thermocline. Additionally, a shallow "radiation thermocline" often forms due to solar radiation under calm conditions in Lake Granbury; however, even with radiation thermoclines, the occurrences of substantial density stratification are relatively rare, cumulatively about 12% of the data, both for all flow conditions and for low flows only. [Ward 2008].

2.2 Impacts of Intakes by CPNPP Units 3 and 4 on Flow Patterns

The following information extracted from the December 15, 2009 Freese & Nichols Memorandum submitted to the NRC on December 18, 2009 via Luminant letter TXNB-09087 (ML093620032) explains the flow alterations resultant from CPNPP Units 3 and 4 operations.

Modeling was performed simulating outflows from Lake Granbury at 2020 conditions assuming no demand for CPNPP Units 3 and 4, and assuming demands of 90,152 and 103,717 acre-feet per year for CPNPP Units 3 and 4 operations. The modeling shows that CPNPP Units 3 and 4 outflows from Lake Granbury are similar for larger and smaller outflows currently modeled for Lake Granbury. As the volume of the outflows decreases, the difference between the no-demand model scenario and the 90,152 and 103,717 acre-feet per year demand scenarios becomes slightly more pronounced, with generally lower outflows with Units 3 and 4 demands. At the lowest end of the flow range flows are governed by the constant minimum release of 28 cfs. It should be noted that the CORMIX model and the white paper on thermal stratification and bathymetry both assessed impacts based upon 28 cfs or no-flow conditions. The outflows from Lake Granbury are similar at both the 90,152 and 103,177 acre-feet per year demands.

Further, the modeling shows that the increased demands for CPNPP Units 3 and 4 will cause Lake Granbury elevation levels to be lower during drier periods. At the 90,152 acre-feet per year demand level, which is the typical demand expected from the new units, the maximum level change is 2.5 feet in Lake Granbury during the period of most severe drawdown. On average, elevations in Lake Granbury will be 0.4 feet lower with Units 3 and 4 in operation. All but the highest and lowest outflows from Lake Granbury will be reduced as well.

Based on the operating history of the existing Squaw Creek Reservoir (SCR) make-up water intakes on Lake Granbury during times of high- or low-flow through Lake Granbury, intake-induced current pattern alterations have not destabilized Lake Granbury with respect to its designated uses. Texas Commission on Environmental Quality (TCEQ) sampling and monitoring data under the Clean Water Act do not identify current pattern alterations resultant from power plant intake diversions as contributing to any degradation of Lake Granbury. [TECQ 2008, TCEQ 2010]

The ambient flow field of the lower portion of Lake Granbury is currently altered by SCR make-up diversions, Wolf Hollow diversions, and DeCordova Steam Electric Station once-through cooling operations. The degree to which ambient current patterns are altered is mainly a function of the diversion rate and at each intake location and flow through the reservoir (i.e., dam releases). Increased withdrawals for CPNPP Units 3 and 4 operations would not alter current patterns during high-flow conditions to a degree that would be considered destabilizing to Lake Granbury, as the dominating flow path would be through the dam. During low-flow conditions, when combined intake flows from all users exceed DeCordova Dam releases, Brazos River Authority-controlled releases from upstream Possum Kingdom Lake would provide sufficient flow to meet the diversions of CPNPP Units 3 and 4 as well as any other users in Lake Granbury and the Brazos River downstream. Similarly it is not anticipated that the addition of the CPNPP Units 3 and 4 diversion would impact water quality to the degree of destabilizing Lake Granbury.

2.3 Temperature and Chemical Impacts of Discharges from CPNPP Units 3 and 4

During high-flow conditions, effluent from CPNPP Units 3 and 4 is expected to mix quickly and exit Lake Granbury through DeCordova Bend Dam. This expectation is based upon the dominating flow pattern toward the dam during high-flow conditions and the close proximity of the diffusers to the dam. During low-flow conditions, recirculation current patterns may develop between Units 3 and 4 discharge and intake lines. However, the volume of water contained in this reach of Lake Granbury has been shown to be sufficient to dissipate the thermal plume of Units 3 and 4.

Ambient current patterns are altered when cooling water for Units 3 and 4 is diverted from Lake Granbury and returned from the cooling towers during low-flow conditions.

Units 3 and 4 blowdown is discharged near the dam. The path of the discharge plume will depend upon the amount of water being released through the dam and the rate at which water is being diverted for plant operations upstream. Based on the diffuser design and location, the distance between the discharge and intake (1.14 miles), the width of the lake (0.375 miles), the volume of water contained within this area (9668 acre-feet), and mixing of freshwater make-up from upstream reservoir releases, there is no reason to assume that local channeling of concentrated effluent will occur between the discharge and intake.

Broad recirculation current patterns may occur under certain conditions; for example, when the Units 3 and 4 discharge flow rates exceed the flow through the dam. However, no adverse impacts are expected because the effluent has been treated and is near the ambient water temperature of Lake Granbury.

Chemical impacts from Units 3 and 4 effluents are mitigated during low flow by water treatment and mixing with freshwater from upstream releases. As discussed in the Supplemental Information to Request for Additional Information GEN-03 [Luminant letter TXNB-09087 dated December 18, 2009 (ML093620032)], and discussed in ER Subsection 5.2.3.4, water treatment chemicals for the cooling tower are designed to be consumed by the system with residual concentrations remaining in the effluent only as trace amounts or non-detectable. As a conservative design measure, effluent limits were assumed to be below Lake Granbury water quality standards at the end-of-pipe with no credit for a mixing zone [see Luminant letter TXNB-09021 dated May 27, 2009 (ML091490263) for information that supports these conclusions]. When the Blowdown Treatment Facility is operating, it is expected that the blowdown discharged to Lake Granbury will be of better quality than ambient water in Lake Granbury.

Based on the nature of the Units 3 and 4 effluent from the cooling tower basins to Lake Granbury, through a treatment system and an approximately 7-mile pipeline, there is no technical reason to expect adverse temperature or chemical impacts in the lake as a whole or in any isolated locations within the lake.

2.4 Summary

In summary, the diversions and returns needed to support CPNPP Units 3 and 4 would not significantly alter the currents in Lake Granbury beyond the range of flows and potential flow paths seen normally. Because the heated circulating water passes through cooling towers (considered Best Available Technology for thermal treatment) and the return water is treated to regulatory requirements, there is no reason to project temperature or chemical concentrations either generally or locally in Lake Granbury. The flows, temperatures and chemical content of the lake would not be disturbed by CPNPP Units 3 and 4 operations in a manner that would have more than a very minimal impact on the environment.

In light of the above information, Luminant believes that the additional monitoring requested by the NRC staff is unnecessary and would be unduly burdensome. Luminant has researched what it believes to be the work effort required to obtain the level of hydrodynamic detail that the Staff is requesting: one year of seasonal current profiling, water temperature, and meteorological data collection at Lake Granbury. Specifically, ambient data would need to be collected in two-week intervals over four seasons by placing three Acoustic Doppler Current Profilers (ADCP) in Lake Granbury; one at the intake, one at the proposed discharge location and two between the intake and the discharge. Meteorology and water temperature data would also need to be collected. The ADCP would then be used to calibrate the Generalized Environmental Modeling System for Surface Waters (GEMMS). The GEMMS model would show the ambient hydrodynamics of Lake Granbury to which Units 3 and 4 intake and discharge data could be applied. The one-year data collected would be applied to a surface modeling program at a cost of $200,000 to $250,000. Luminant believes collection of such data is not warranted as the expected hydrologic alterations resultant from Units 3 and 4 operations described above do not represent an impact that would be destabilizing.

3.0 Impacts of Lake Granbury Flow Changes on Ecology (Aquatic Biota)

This section discusses the existing communities of aquatic biota in the area of Lake Granbury near the proposed intake and discharge of CPNPP Units 3 and 4, and demonstrates that the intakes and discharges would not have a significant environmental impact on aquatic biota.

3.1 Fish

The intake and discharge structures are located in the lower section of Lake Granbury. Banks in this area tend to be steep, and rocky and littoral areas are minimal. Aquatic surveys revealed a few individuals of common fish and invertebrate species (ER Subsection 2.4.2). Pelagic habitat in the lower portion of Lake Granbury is not conducive to developing a diverse aquatic community.

Lake Granbury has been devastated by golden algae blooms in recent years. In 2007 and 2008, four experimental varying mesh gill nets set for over 15 hours revealed low numbers of fish in the lower reservoir. Four game species comprised of two white bass, a single stripped bass, one crappie, and four channel catfish were identified during the summer sampling event. Winter sampling efforts in Lake Granbury revealed four species of game fish including white bass (8), largemouth bass (1), channel catfish (31), and white crappie (4). Small numbers of common carp (32), gizzard shad (38), freshwater drum (1), and smallmouth buffalo (5) were also identified for the combined total of winter and summer sampling efforts.

In addition to lack of habitat, the golden algae blooms cause annual fish kills in several Lake Granbury locations, but waters near the dam are particularly affected. Fish populations near the dam are so blighted by golden algae in recent years that most don't currently reside in this portion of the lake.

A 1978 larval fish study was performed in Lake Granbury near the intake structure to determine impacts associated with the makeup water carried to the existing plant. The study was designed to encompass the peak period of larval abundance in the reservoir. Nine genera of larval fish common to lentic habitat were identified. Threadfin shad were found to be most abundant comprising 85 percent of total fish collected. Silversides and freshwater drum were also identified in most samples. The study concluded that the lower portion of Lake Granbury is not an area which provides unique spawning and nursery habitat for fishes in Lake Granbury.

Aquatic habitat adjacent to the intake and discharge structures is marginal. Banks are steep and rocky, leaving little littoral area that would invite a diverse population of fish or younger fish. Sampling in the lower portion of Lake Granbury revealed few adult fish species present in all four seasons. Previous sampling of larval fish found 85 percent to be threadfin shad. No habitat suitable for spawning was identified in the lower portion of Lake Granbury.

The Units 3 and 4 intake through-screen velocity will remain below 0.5 ft/sec. Most fish can swim from an intake velocity of this magnitude and as previously established, larval fish are few in the lower portion of Lake Granbury. With regard to temperature, chemical constituents and flow patterns, the discharge system designed for CPNPP Units 3 and 4 is not anticipated to substantially affect Lake Granbury. Because the intake and discharge system designed for Units 3 and 4 will minimally affect the aquatic environment in the lower portion of Lake Granbury and comparatively few fish utilize aquatic habitat in this portion of the reservoir, it is not anticipated the intake or discharge system will affect fish or fish habitat in Lake Granbury.

3.2 Invertebrates

A 2007-2008 survey of the benthos indicated the majority of invertebrates in the lower portion of Lake Granbury consisted of chironomids, which are quite hardy. In the lower portion of Lake Granbury, habitat conducive to a diverse invertebrate assemblage is low as the banks are steep and the substrate was either silt or bedrock.

Because the intake and discharge system designed for CPNPP Units 3 and 4 will minimally affect the aquatic environment in the lower portion of Lake Granbury and few invertebrates utilize aquatic habitat in this portion of the reservoir, it is not anticipated the intake or discharge system will affect invertebrates or invertebrate habitat in Lake Granbury.

3.3 Plankton

Plankton communities in the lower section of Lake Granbury in a 2007-2008 survey consisted predominantly of calanoids and cyclopoids followed by rotifers and cladocerans. Plankton identified in Lake Granbury is ubiquitous throughout freshwater systems.

Mobile zooplankton undergoes daily vertical migration within the water column. Although zooplankton migrates through various strata and benefits of stratification are noted, migration appears to be largely dependent on light penetration through the water column rather than a temperature or dissolved oxygen differential. Predation in aquatic environments is visual and by migrating to deeper darker surroundings during daylight hours, predation is avoided. Conversely, surface phytoplankton, on which zooplankton feed, synthesize proteins at night and carbohydrates during the day. Therefore, the food quality available for zooplankton consumption increases at night. A possible benefit of a stratified environment is that growth efficiency is somewhat greater at lower temperatures. During the day, when food quality is poorer and predation is higher at the surface, migrating zooplankton can take advantage of increased growth rates due to the temperature differential a stratified environment would provide. However, it is unclear to what extent a stratified environment would benefit zooplankton, because populations vary in a manner that cannot be linked to the presence of a stratified environment. Lake Granbury experiences a limited and weak temperature stratification during the spring where plankton may benefit. During the remainder of the year, stratification has not been detected.

Planktonic species identified in Lake Granbury are common, ubiquitous to freshwater systems and hardy. It is not anticipated plankton populations would be adversely affected by changes to the flow regime in Lake Granbury.

Plankton has limited mobility and is subject to localized environmental changes and the currents. Plankton will be entrained in the intake system and present at the discharge. Because planktonic species identified in Lake Granbury are prolific in nature, and are common and ubiquitous to freshwater systems throughout Texas, the intake system designed for CPNPP Units 3 and 4 will not affect the planktonic populations of the reservoir.

3.4 Ecology Summary

Organisms identified in the region of Lake Granbury where the intake and discharge are located are sparse, hardy, and common to most water bodies throughout Texas and in many cases, indicative of poor aquatic habitat. No unique habitats were located at the lower region of Lake Granbury. Additionally, no unique, rare, or important species were detected. The intake and discharge system was designed according to best available technology and is not anticipated to affect biotic populations or habitat in Lake Granbury.

4.0 Conclusion

As shown above, Luminant has provided an assessment of the expected flow conditions in Lake Granbury resulting from the operation of CPNPP Units 3 and 4. Based on the results of this description, the expected impact on the ecology (aquatic biota) in Lake Granbury is SMALL to none. This approach meets the requirements of NEPA, 10 CFR 51, and the ESRP. A more detailed modeling of Lake Granbury is not required.

References

[TCEQ 2008] 2008 Texas Water Quality Inventory and 303(d) List. Texas Commission on Environmental Quality (TCEQ). Accessed March 2010. http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/08twqi/twqi08.html.

[TCEQ 2010] 2010 Draft Texas Water Quality Inventory and 303(d) List. Texas Commission on Environmental Quality (TCEQ). Accessed March 2010. http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/10twqi/public_comment.html.

[Ward 2008] Ward, George H, *Potential Impacts of Comanche Peak Cooling Tower Operation on Total Dissolved Solids in the Lower Reach of Lake Granbury*, January 31, 2008 (ML091120524).