Progress Energy

Serial: NPD-NRC-2009-205 10CFR52.79
September 14, 2009

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 2 AND 3
DOCKET NOS. 52-022 AND 52-023
SUPPLEMENT 3 TO RESPONSE TO USACE REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ENVIRONMENTAL REVIEW

References:

1. Letter from Donald Palmrose (NRC) to James Scarola (PEC), dated November 13, 2008, "Request for Additional Information Regarding the Environmental Review of the Combined License Application for Shearon Harris Nuclear Power Plant, Units 2 and 3"
2. Letter from Garry D. Miller (PEC) to U.S. Nuclear Regulatory Commission (NRC), dated February 12, 2009, "Response to USACE Request for Additional Information Regarding the Environmental Review", Serial NPD-NRC-2009-023
3. Letter from Garry D. Miller (PEC) to U.S. Nuclear Regulatory Commission (NRC), dated April 28, 2009, "Supplement 1 to Response to USACE Request for Additional Information Regarding the Environmental Review", Serial NPD-NRC-2009-083
4. Letter from Garry D. Miller (PEC) to U.S. Nuclear Regulatory Commission (NRC), dated July 29, 2009, "Supplement 2 to Response to USACE Request for Additional Information Regarding the Environmental Review", Serial NPD-NRC-2009-173

Ladies and Gentlemen:

Progress Energy Carolinas, Inc. (PEC) hereby submits a supplemental response to the United States Army Corps of Engineers (USACE) request for additional information (RAI) provided in Enclosure 2 of Reference 1. A revised response to one of the USACE RAI questions (USACE-15) is provided in the enclosure to this letter.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (919) 546-6107.

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NRO

Progress Energy Carolinas, Inc.
P.O. Box 1551
Raleigh, NC 27602

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

Executed on September 14, 2009.

Sincerely,

Garry D. Miller
General Manager
Nuclear Plant Development

Enclosure/Attachment

cc: U.S. NRC Region II, Regional Administrator
U.S. NRC Resident Inspector, SHNPP Unit 1
Mr. Brian Hughes, U.S. NRC Project Manager
Dr. Donald Palmrose, U.S. NRC Environmental Project Manager
Mr. Monte Matthews, U.S. Army Corps of Engineers

Shearon Harris Nuclear Power Plant Units 2 and 3
Supplement 3 to Response to USACE Request for Additional Information Regarding the Environmental Review, dated November 13, 2008

NRC RAI #	Progress Energy RAI #	Progress Energy Response
USACE-1	H-0351	February 12, 2009; Serial NPD-NRC-2009-023
USACE-2	H-0352	February 12, 2009; Serial NPD-NRC-2009-023
USACE-3	H-0353	February 12, 2009; Serial NPD-NRC-2009-023
USACE-4	H-0354	February 12, 2009; Serial NPD-NRC-2009-023
USACE-5	H-0355	February 12, 2009; Serial NPD-NRC-2009-023
USACE-6	H-0356	February 12, 2009; Serial NPD-NRC-2009-023
USACE-7	H-0357	February 12, 2009; Serial NPD-NRC-2009-023
USACE-8	H-0358	February 12, 2009; Serial NPD-NRC-2009-023
USACE-9	H-0359	February 12, 2009; Serial NPD-NRC-2009-023
USACE-10	H-0360	February 12, 2009; Serial NPD-NRC-2009-023
USACE-11	H-0361	February 12, 2009; Serial NPD-NRC-2009-023
USACE-12	H-0362	February 12, 2009; Serial NPD-NRC-2009-023
USACE-13	H-0363	February 12, 2009; Serial NPD-NRC-2009-023
USACE-14	H-0364	February 12, 2009; Serial NPD-NRC-2009-023
USACE-15	H-0484	Revised response enclosed – see following pages
USACE-16	H-0366	February 12, 2009; Serial NPD-NRC-2009-023
USACE-17	H-0367	February 12, 2009; Serial NPD-NRC-2009-023
USACE-18	H-0368	February 12, 2009; Serial NPD-NRC-2009-023
USACE-19	H-0369	February 12, 2009; Serial NPD-NRC-2009-023
USACE-20	H-0370	February 12, 2009; Serial NPD-NRC-2009-023
USACE-21	H-0371	February 12, 2009; Serial NPD-NRC-2009-023
USACE-22	H-0372	February 12, 2009; Serial NPD-NRC-2009-023
USACE-23	H-0373	February 12, 2009; Serial NPD-NRC-2009-023
USACE-24	H-0374	February 12, 2009; Serial NPD-NRC-2009-023
USACE-25	H-0375	February 12, 2009; Serial NPD-NRC-2009-023
USACE-26	H-0376	February 12, 2009; Serial NPD-NRC-2009-023
USACE-27	H-0377	February 12, 2009; Serial NPD-NRC-2009-023
USACE-28	H-0481	July 29, 2009; Serial NPD-NRC-2009-173
USACE-29	H-0379	February 12, 2009; Serial NPD-NRC-2009-023
USACE-30	H-0380	February 12, 2009; Serial NPD-NRC-2009-023
USACE-31	H-0457	April 28, 2009; Serial NPD-NRC-2009-083

Attachment	Associated NRC RAI #	Pages Included
Tech Memo 338884-TMEM-107	USACE-15	12

NRC Letter No.: HAR-RAI-LTR-ER-USACE-001

NRC Letter Date: November 13, 2008

NRC Review of Environmental Report

NRC RAI #: USACE-15 (ER Subsection 9.3.2.2.1.5)

Text of NRC RAI:

Please provide avoidance and minimization measures on impacts to streams and wetlands.

This information is required for regulatory compliance (example, only unavoidable impacts are allowed).

PGN RAI ID #: H-484

PGN Response to NRC RAI:

Environmental Report (ER) Subsection 9.3.2.2.1.5 describes aquatic ecology at the HAR site as part of the comparison of the alternative sites. The majority of the impacts to streams and wetlands related to the preferred alternative are associated with raising the level of the lake. A technical analysis determined that a reservoir level of 240 feet would be necessary to provide cooling water to ensure reliable operation of the three nuclear reactors in the case of an extreme drought under future demand conditions. This analysis is summarized in Attachment USACE-15A.

Associated HAR COL Application Revisions:

None.

Attachments/Enclosures:

Attachment USACE-15A: Tech Memo Number 338884-TMEM-107, Revision 1, "Determination of Harris Reservoir Storage Requirements" [12 pages]

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Form No.: 338884-FM-TM-001, Rev 0

Tech Memo Approval Form

Tech Memo Number: 338884-TMEM-107
Revision: 1
Project: 338884
Review Date: 9/9/09

Tech Memo Title:
Determination of Harris Reservoir Storage Requirements

Revision History:

Revision Number	Description	Approval Date	Affected Pages
0	Initial submittal for formal review.	9/2/09	all
1	Revised Figures 2 and 3 to add figure labels	09/09/2009	9 and 10

Document Review and Approval

Originator:	Klaus Albertin/ Scientist Name/Position Klaus Albt Signature	9/9/09 Date
Reviewer	Scott Freeman/ Technical Manager Name/Position Scott Freeman Signature	9/9/09 Date
Project Manager:	Lorin Young/Project Manager Name/Position Lorin Young Signature	09/09/2009 Approval Date

Determination of Harris Reservoir Storage Requirements

Introduction

Harris Reservoir is a manmade reservoir that provides cooling and process water for the Shearon Harris Nuclear Power Plant Unit 1 (HNP) in Wake County, North Carolina. Harris Reservoir and the Auxiliary Reservoir are known together as Harris Lake. This technical memorandum focuses solely on Harris Reservoir.

Progress Energy Carolinas, Inc. (PEC) proposes to construct two additional reactor units, Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR), collocated with the HNP. These units, along with the HNP, would use Harris Reservoir for cooling water makeup. While the existing lake is adequate to support the operation of HNP, additional water will be needed to support the new HAR units. The Buckhorn Creek watershed alone cannot supply the additional water, so future operating needs must be met through supplementation with water from the Cape Fear River plus additional storage. PEC has evaluated the water storage requirements for reliable operation of all units at the site, taking into account design constraints that require that the lake level go no lower than 220′ at any time for safe, reliable operation. To provide adequate storage and a reserve for cooling water makeup during extended drought periods, PEC proposes to raise the water level of Harris Reservoir to an operating level of 240 feet. The added capacity will enable the three units to operate during drought periods with reduced withdrawals from the Cape Fear River, thereby minimizing adverse impacts to aquatic life and water users in the region.

A technical analysis determined that a reservoir level of 240 feet would be necessary to provide cooling water to ensure reliable operation of the three nuclear reactors in the case of an extreme drought under future demand conditions (Sargent & Lundy, 2009). This analysis included hydrologic and meteorological data from October 1939 to September 2008, estimates of plant consumptive use, assumptions about maximum withdrawal amounts from the Cape Fear River based on future demands, and an assumed minimum release from Harris Reservoir. Additional evaluations based on the configuration of the dam and safety-related probable maximum flood (PMF) analyses were used to determine that the operating level of 240 feet would also meet safety requirements. This memorandum describes the factors that affect the determination of the required reservoir level.

Need for the Project

As described in Chapter 8 of the HAR Combined License Application (COLA) Part 3: Environmental Report (Progress Energy, 2008a), power demands in the region are expected to grow in the future. Regional planners predict the following:

- An increase in PEC customers of more than 20,000 annually.
- An additional 4 million people in North Carolina by 2030.
- A corresponding increase in electrical demand for residential and commercial users.

To meet the increased electrical demand, PEC is proposing to add 2,803 megawatts (MW) of generating capacity to its service area. PEC has proposed constructing two additional reactor units (HAR) at the Shearon Harris site that would provide approximately 2,000 MW of power to the region.

Harris Reservoir is currently used to supply cooling water for the HNP. The two additional reactors would also use Harris Reservoir for cooling water makeup. It is estimated that the normal net consumptive usage for the additional reactor units would be approximately 63 cubic feet per second (cfs) (Sargent and Lundy, 2009), primarily due to evaporation from the cooling towers.

The current normal operating level of Harris Reservoir is 220 feet. To ensure adequate cooling water while at the same time minimizing adverse impacts to the Cape Fear River basin and its users, the reservoir capacity needs to be increased.

Cooling Water Supply

The Buckhorn Creek Drainage Basin (see Figure 1), which is approximately 70 square miles (mi^2) in size, is the primary source of water for Harris Reservoir. Runoff from this watershed provides sufficient makeup water required for the current operation of the HNP. However, the Buckhorn Creek Drainage Basin will not supply sufficient water to maintain the proposed increase in reservoir level during long-term operation of the three reactors. PEC has proposed to pump water from the Cape Fear River to Harris Lake to supplement the water supply. An alternate source of water has been proposed by the Western Wake Partners, but has not been demonstrated to be a viable alternative at this time.

The Western Wake Partners, composed of the Towns of Apex, Cary, Morrisville and Holly Springs, are proposing to build a WRF in southwestern Wake County to provide wastewater treatment for this growing area. The proposed WRF will discharge an estimated 24 million gallons per day (mgd) by the year 2020 (Phase I) and 38 mgd by the year 2050 (Phase II). The Western Wake Partners have received speculative limits from the North Carolina Division of Water Quality (NCDWQ) for a discharge to the Cape Fear River below Buckhorn Dam.

The Western Wake Partners have proposed that the WRF discharge could be relocated from the Cape Fear River to Harris Lake to supplement the water supply. The WRF project is currently in the planning stages, and additional technical analyses and negotiations with stakeholders are ongoing. A supplement to the project's Environmental Impact Statement and a revised National Pollutant Discharge Elimination System (NPDES) permit for the WRF would be required to allow a discharge to Harris Lake. In addition, regulations related to interbasin transfers may disallow a discharge from the WRF to Harris Reservoir. The timing constraints for the WRF project, plus the other factors outlined above, make this alternative not viable at this time. Even if this alternative were viable, the proposed WRF discharges would not provide sufficient supplemental water to maintain Harris Reservoir levels at the proposed 240-foot elevation. Some level of pumping from the Cape Fear River would still be required.

Since the Buckhorn Creek drainage area cannot meet the project's water supply requirements makeup water from the Cape Fear River to Harris Reservoir is the only reliable option. The current plan calls for three pumps to withdraw water from the Cape Fear River between B. Everett Jordan Lake and Buckhorn Dam, with each pump capable of pumping 20,000 gallons per minute (28.8 mgd, 44.6 cfs) for a maximum rate of 60,000 gpm (86.6 mgd, 134 cfs).

Cape Fear River Water Supply Evaluation

The Cape Fear River is a viable source of water supply to meet the demands of the three reactors. However, the needs of other users in the basin must be considered. A number of municipalities in the Cape Fear River Basin rely on surface water for their water supply (see Figure 1). Jordan Lake is managed to provide water supply to municipalities above Harris Reservoir and to maintain a minimum discharge to support downstream users and aquatic life. To support aquatic life and other downstream uses, flows in the Cape Fear River are augmented by releases from the B. Everett Jordan Dam.

Jordan Lake is considered to be split into three volumes: flood, conservation, and sediment storage. The conservation storage volume is further split into a water supply pool and a water quality pool. The water quality portion of the conservation storage volume is used to augment flows in the Cape Fear River.

Based on the U.S. Army Corps of Engineers (USACE) Jordan Lake Rules, the dam is operated to maintain a target flow in the Cape Fear River of 600 cfs (387.8 mgd) at the USGS gage at Lillington under non-drought conditions. The current and expected future needs for water from the Cape Fear River and the multi-purpose functioning of Jordan Lake as managed by the USACE call for water users in the Cape Fear River Basin to optimize their resources and manage water needs for the benefit of the entire system. Current withdrawals from Jordan Reservoir for water supply purposes are approximately 26.2 cfs (16.9 mgd). These are expected to increase to 97.9 cfs (63.3 mgd) by 2030 and 113.8 cfs (73.6 mgd) by 2050 (NC DWR, 2008). Under drought conditions, the level of the conservation storage volume decreases since inflows to the lake are limited but withdrawals and releases continue. Releases from the dam are allowed to decrease to as low as 40 cfs (25.9 mgd) depending on the volume remaining in the conservation storage volume.

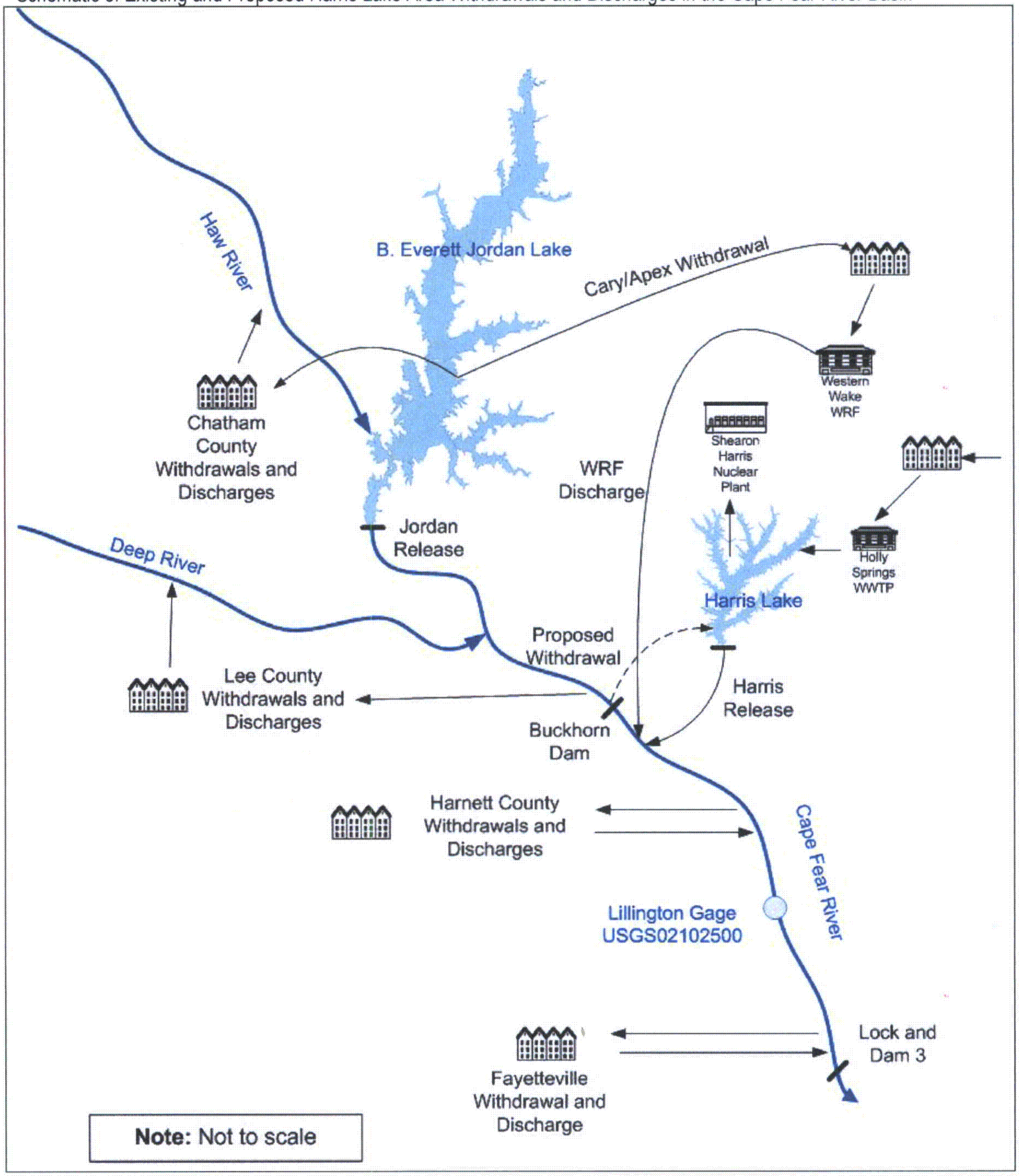
Expansion of Harris Reservoir would provide storage capacity to enable PEC to reduce withdrawals from the Cape Fear River when necessitated by low water or drought conditions, while maintaining reliable operation of the power generating units. When the Cape Fear River flows are adequate to support the withdrawal of makeup water, additional withdrawals can restore Harris Reservoir to the normal operating level. The flexibility provided by the expanded reservoir would minimize drought period withdrawals from the river and impacts to aquatic resources in the Cape Fear River.

An analysis was performed to demonstrate the need for the water storage volume that corresponds to a 240′ reservoir level. Using a conservative example water withdrawal scenario and historic flow data for the Cape Fear River, results show that during an extended drought period such as that from 1985 through 1988 the lake would fall below the 220′ minimum operating level and impact operation of the units at the site. These results demonstrate that the 240′ lake level is needed for reliable operation. Operating rules for withdrawals from the Cape Fear River, when developed, may reflect lower Cape Fear River flow thresholds rather than those analyzed for this effort.

Estimation of Water Availability

Estimates of availability of Cape Fear River water were developed based on the North Carolina Division of Water Resources' (NCDWR's) Cape Fear River Hydrologic Model (CFRBHM). The CFRBHM was developed by the NCDWR to evaluate water supply in the Cape Fear River Basin. The scope of the model includes all significant withdrawals and discharges from the headwaters of the Cape Fear River to U.S. Lock and Dam Number 1. The model simulates hydrology and hydraulics in the Cape Fear River Basin as a set of nodes, representing storage and demands, and a set of links, which define the inflows, outflows, and the routing within the system. Withdrawals and discharges are defined through the use of time series records, patterns, or operational control language (OCL) rules. Inflows to the system are primarily due to rainfall runoff and point source discharges.

FIGURE 1
Schematic of Existing and Proposed Harris Lake Area Withdrawals and Discharges in the Cape Fear River Basin



The CFRBHM model dynamically simulates inflows, routing, and storage for all nodes and links in the system. The CFRBHM model was updated in 2008 to include three scenarios: 2003 (existing), 2030, and 2050. The 2050 scenario was used to estimate water availability for HAR under a future scenario. While the 2050 scenario does not include all the growth that is expected during the plant life cycle of the HAR (projected to be to the year 2080), it does provide an indication of the increased demand that is expected in the basin.

The daily Cape Fear River flows calculated with the CFRBHM model for each scenario were obtained from DWR. The CFRBHM does not include data from October 2004 through December 2008. For this reason, observed data from USGS 02102500 (Cape Fear River at Lillington, NC) were used to complete the time series from 1939 through December 2008. Since the period from October 2004 through December 2008 does not include the increased future demand, it is expected that modeled flow rates in the Cape Fear River would be lower. However, 2007 was an extreme drought year and it was deemed important to include this period for the Harris Reservoir analysis.

The daily values were processed based on a set of rules to ensure that withdrawals do not cause water to be released from Jordan Lake. This example calculation is conservative and does not reflect the actual operating scenarios and withdrawal rules that will be developed after in-stream flow studies are completed. Under current USACE management rules, flow is released from Jordan Lake when flow at Lillington falls below 600 cfs (387.8 mgd). For this example, a 25 percent increase was added to this value to handle the highly variable nature of instream flow. This results in a minimum instream flow of 750 cfs (484.7 mgd). PEC is planning to use a system of three pumps, each rated at 44.6 cfs (28.8 mgd). These pumps could be turned on individually, allowing for an incremental increase in pumping that maintains flow at levels above 750 cfs (484.7 mgd). For this example, a flow level of 800 cfs (517.1 mgd) was selected as the first trigger point to prevent pumping from immediately dropping Cape Fear River below 750 cfs (484.7 mgd) when the first pump was activated and triggering a release from Jordan Lake. Additional increments of 50 cfs (32.3 mgd) provide trigger points for the additional pumps. The set of triggers used to determine pumping rates are presented in Table 1. These triggers are intended to provide an estimate of the days when pumping could occur under this example scenario. They are not intended to reflect PEC's position regarding the appropriate operating scenarios and withdrawal rules, which will be developed in consultation with appropriate regulatory agency representatives after in-stream flow studies are completed.

TABLE 1
Cape Fear River Flow and Associated Possible Pumping Rates Used for Modeling Example

Cape Fear River Flow at Lillington (cfs)	Number of Operating Withdrawal Pumps	Maximum Withdrawal Pumping Rate (cfs)
<800	0	0
800-850	1	44.6
850-900	2	89.2
>900	3	133.6

The daily Cape Fear River flow rate was evaluated using the above rules and the maximum allowable rate was selected for each day. The daily pumping rates were then averaged to provide the monthly average flows used by the Sargent and Lundy reservoir level estimation analysis (Sargent & Lundy, 2009).

Reservoir Level Estimation Analysis

Harris Reservoir levels were computed by Sargent & Lundy (2009) using a water balance calculation for the period from 1939 through 2008. This analysis included hydrologic and meteorological input data, estimates of plant consumptive use, assumptions on maximum withdrawal amounts from the Cape Fear River based on future demands, and a minimum release from Harris Reservoir.

The results of these calculations are shown in Figure 2. Based on the historical inflows and meteorology, the most severe extended drought period was from 1985 through 1988. Figure 3 focuses on the reservoir level during the 1978 to 2008 period. This figure shows that a reservoir volume of at least 177,932 acre feet (ac-ft) (equivalent to a reservoir level of 240 feet) provides sufficient storage to maintain the reservoir level above the minimum design basis of 220 feet in all but the most extreme drought period. This would allow for continued operation of the three units during all but the most extreme events.

However, these estimates do not account for increasing water demands in the region during the life cycle of the HAR. It is anticipated that water demand would continue to increase from 2050 to 2080, further restricting water supply in the Cape Fear River Basin. While a lake level higher than 240 feet would provide additional storage to offset potential water restrictions, other considerations, including plant safety described in the following section, limit the maximum reservoir level to 240 feet.

Reservoir Level Constraints

Three primary factors were considered in the evaluation of the operating reservoir level:

1) reactor safety in the event of an extreme flood; 2) impacts to nearby landowners in the event of an extreme flood; and 3) configuration of the Main Dam structure.

A PMF analysis was performed in support of the HAR COLA Part 2: Final Safety Analysis Report (Progress Energy, 2008b). This analysis determined that a reservoir level of not more than 240 feet provides an adequate margin against flooding of the HAR reactors.

PEC owns the property around the reservoir up to an elevation of 243 feet. Raising the reservoir elevation to 240 feet will not impact current non-PEC landowners around the reservoir. This minimizes the potential impacts to other landowners due to flooding if the reservoir is maintained at the 240-foot elevation.

The Main Dam was constructed to accommodate reservoir elevations up to 250 feet. This is 30 feet above the current normal operating level and 10 feet above the proposed 240-foot elevation. The dam configuration can accommodate a reservoir elevation of 240 feet without major modification. These factors indicate that an elevation of not more than 240 feet can be safely maintained for Harris Reservoir.

Figure 2
Progress Energy Carolina
Harris Advanced Reactor Units 2&3
Lake Level Variation due to Different Makeup Pumping Rates from Cape Fear River

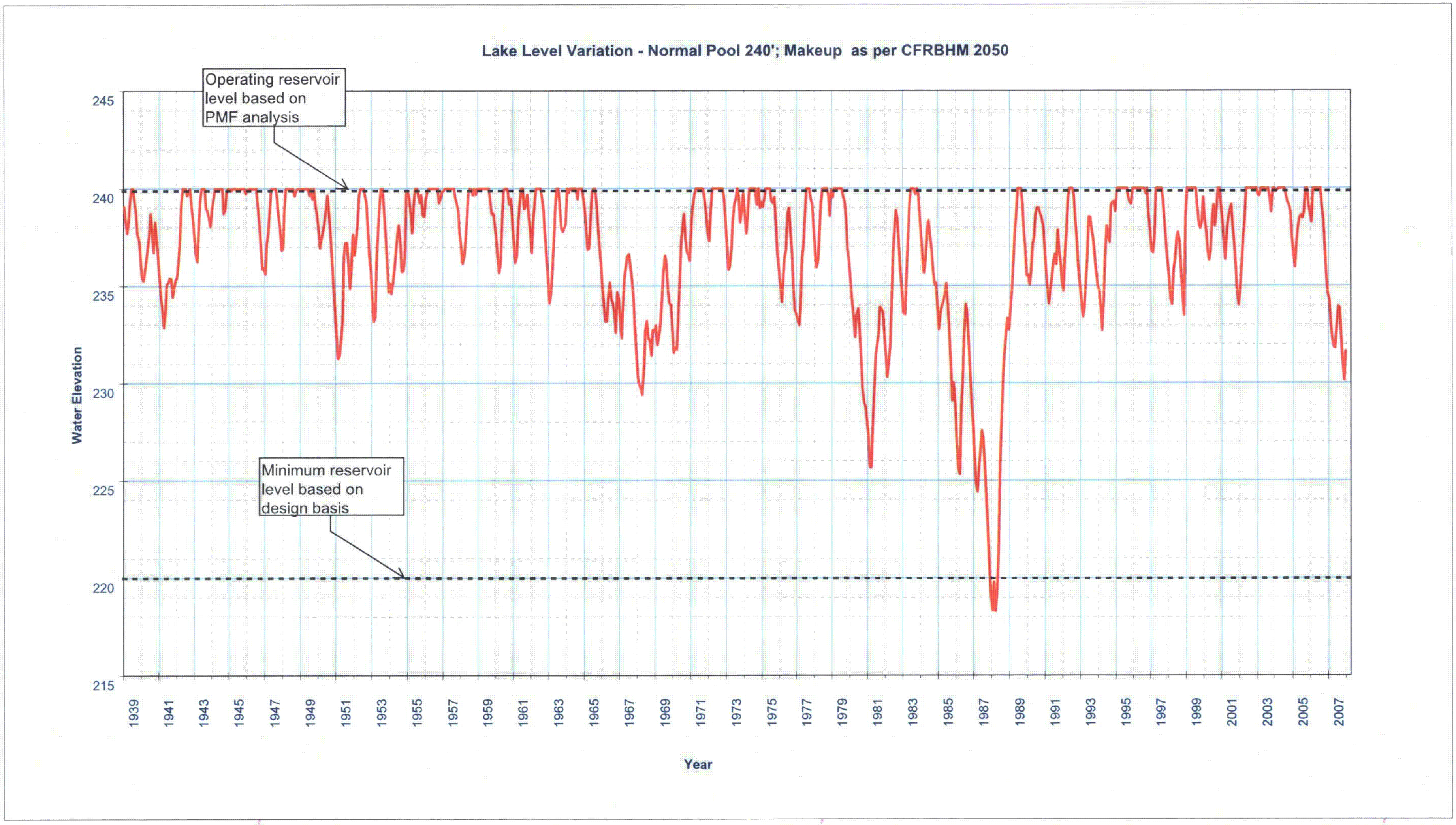
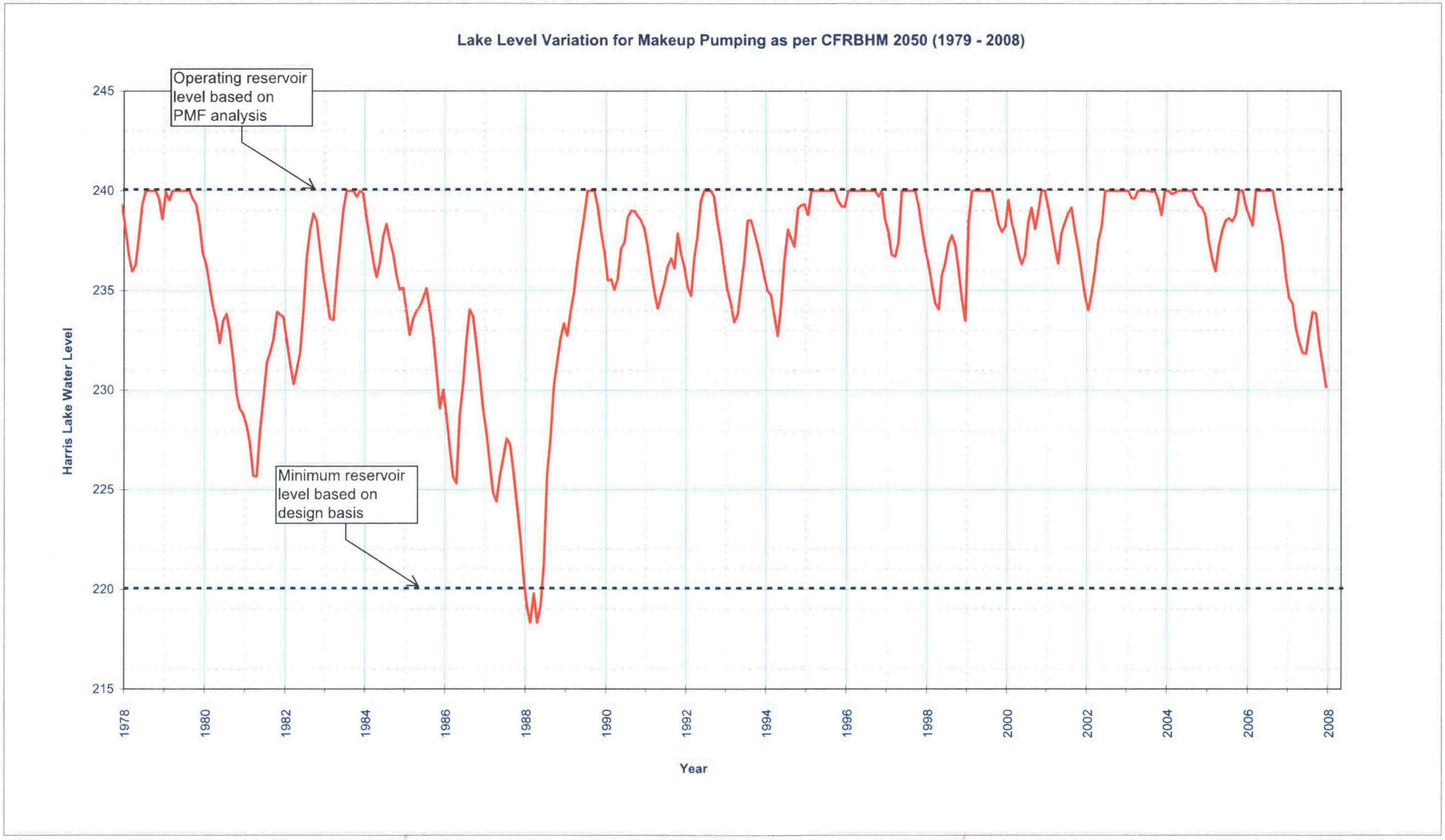


Figure 3
Progress Energy Carolina
Harris Advanced Reactor Units 2&3
Lake Level Variation due to Different Makeup Pumping Rates from Cape Fear River



Benefits of Increased Reservoir Level

The addition of two reactor units and the proposed increase in reservoir level will provide benefits locally and to the region, including the following benefits:

- Provide reliable base-load power to the region to meet future needs even during drought conditions.
- Increase Harris Reservoir shoreline area and related habitats.
- Increase Harris Reservoir aquatic habitat.
- Increase flow releases from the Main Dam to downstream Buckhorn Creek.

The proposed increase in reservoir level will minimize, if not avoid, long-term impacts on HNP operation and PEC's customers in the service area if sufficient cooling water is unavailable from Harris Reservoir or the Cape Fear River Basin during drought conditions. Without the project, the HAR may need to reduce generation levels to maintain safe operation, which will reduce available electrical power to users in the region.

By providing a buffer to drought conditions, the proposed increase in reservoir level will not only increase aquatic habitat, but also protect Harris Reservoir water quality and ecological integrity during extended periods of drought conditions.

The additional storage facilitated by the proposed increase in reservoir level will also allow for additional releases from Harris Reservoir to downstream Buckhorn Creek and ultimately the Cape Fear River Basin. There are currently no requirements for releases from Harris Reservoir to downstream Buckhorn Creek, although future release requirements may be promulgated to protect downstream aquatic habitat. Increasing the reservoir level and downstream releases will improve base flows and aquatic habitat conditions in downstream Buckhorn Creek and ultimately to the Cape Fear River.

Conclusions

A technical analysis determined that a reservoir level of 240 feet is necessary to provide sufficient cooling water storage and ensure reliable operation of three nuclear reactors during extreme drought. To avoid impacting Jordan Lake water levels, aquatic life, and users of the Cape Fear River, withdrawals from the Cape Fear River may be restricted during extreme drought periods. Under these conditions, a large storage reservoir of cooling water will greatly extend the period during which the reactors can operate with no net water consumption from the Cape Fear River. Future power and water demand forecasts indicate that both water use and power consumption will be high in the region in the upcoming years. A 240-foot elevation in Harris Reservoir will support the purpose and need of the project, providing continued reliable power generation from the three Shearon Harris units during all but the most extended drought situations.

References

NCDWR. 2008. Cape Fear River Basin Surface Water Assessment Modeling of Future Water Use Scenarios. North Carolina Division of Water Resources. Raleigh, NC.

Progress Energy. 2008a. HAR COLA Part 2: Final Safety Analysis Report. Progress Energy Carolinas, Inc. Raleigh, NC.

Progress Energy. 2008b. HAR COLA Part 3: Environmental Report. Progress Energy Carolinas, Inc. Raleigh, NC.

Sargent and Lundy, LLC. 2009. Lake Level Variation Due to Variable Makeup Pumping Rates from Cape Fear River. HAG-XK01-GER-004, Rev 0.