

# Southern Nuclear Operating Co. – Vogtle Electric Generating Plant Proposed Units 3 & 4

## Savannah River Considerations

The Southern Nuclear Operating Company – Vogtle Electric Generating Plant, proposed units 3 & 4 (Plant Vogtle) is located in the Burke County, Georgia (Middle Savannah River). The Plant Vogtle surface water withdrawal application request a new withdrawal from the Savannah River for the purpose of supplying cooling water to the proposed new Units 3 & 4. The application withdrawal amounts requested are 74/62 million gallons per day (mgd) on a 24 hour maximum day/ monthly average.

As part of the review of the Plant Vogtle application, the various Savannah River concerns were considered and addressed. The concerns that were considered are listed below and details are presented in the attachments.

1. Savannah River low flows at the plant site (Attachment A)
2. Savannah River water quality at the plant site (Attachment B)
3. Savannah Harbor (Attachment C)
4. Corps of Engineers Savannah River Basin Drought Contingency Plan (Attachment D)
5. Georgia EPD NPDES Permit low flow consideration (Attachment E)

Plant Vogtle Savannah River concerns were evaluated using the worst case loss of water to the Savannah River. It should be noted that the withdrawal quantities will vary depending on the number of times water is recycled. The higher withdrawal quantity pumped uses less re-circulating cycles thus causing higher returns and a smaller consumptive loss of water to the Savannah River. The consumptive loss of water is not a good indicator for facilities utilizing cooling tower technology. A better indicator is the constant evaporative loss of water through the cooling towers. Therefore, the worst case equates to a 49 mgd withdrawal, 8 mgd return water, six re-circulating cycles and constant evaporative loss of water through the cooling towers (30,000 gallons per minute or 43.2 mgd or 66.8 cubic feet per second (cfs)). This scenario causes a consumptive loss to the Savannah River of 88%.

Under the worst case scenario, the Savannah River at the proposed Plant Vogtle will have a small dissolved oxygen (DO) decrease and small temperature increase but both the DO and temperature return to ambient river DO and temperature by the time the flow reaches the downstream Clyo USGS gage. Also, all downstream permitted water intake depths are protected by the Corps of Engineers Savannah River Basin Drought Contingency Plan and are not impacted by the evaporative loss of 66.8 cfs. The proposed Plant Vogtle will not impact the Savannah River.

Under the worst case scenario, the Savannah Harbor salinity and salt water wedge were not impacted by the evaporative loss of 66.8 cfs or thermal discharge from the proposed Plant Vogtle site. There was a small (6%) impact to the Savannah Harbor DO and this impact will be mitigated.

After considering the various Savannah River concerns, the recommendation to the Director of Environmental Protection Division (EPD) is to issue a new Plant Vogtle Surface Water Withdrawal Permit for Units 3 and 4 without a low flow requirement.

Attachment A  
Savannah River Low Flows at the Plant Site

## **Background**

The proposed Plant Vogtle located in Burke County, Georgia on the middle Savannah River is a highly regulated river controlled by three upstream federal reservoirs (Hartwell, Richard B. Russell, Clarks Hill) and the New Savannah Bluff Lock and Dam operated by the U.S. Army Corps of Engineers (USACE). In addition to these three federal reservoirs, there are numerous other dams and control structures located on the Savannah River and its tributaries upstream of Plant Vogtle. These include Stevens Creek Dam located downstream of Clarks Hill Reservoir and Lake Burton, Lake Rabun, Tugaloo Dam and Lake, Lake Toxaway, Lake Yonah, Lake Keowee and Lake Jocassee and all located upstream of Lake Hartwell.

## **Highly Regulated Stream**

The Interim Instream Flow Protection Strategy listed the Savannah River as a highly regulated stream and thus is exempt from the Strategy. Therefore, there is no required 7Q10 or percentage of stream low flow. The Strategy does indicate that EPD and Wildlife Resources Division (WRD) will continue to work to identify a consensus approach to address minimum flow requirements for these highly regulated streams.

## **Non Depletable Flows**

Using EPD databases for the main Savannah River channel, there are no existing or proposed surface water farm withdrawal permits withdrawing from the Savannah River. The existing surface water non-farm permits do not have low flow conditions. The proposed Plant Vogtle proposed Savannah River withdrawals will not cause probable impacts to these existing permits. Currently, there are no proposed surface water non-farm permits for the main Savannah River channel.

## **Low Flow Impacts**

The Savannah River low flows were associated with the proposed Plant Vogtle consumptive use of water (66.8 cfs). Four flow scenarios are described below and presented in Table 1:

1. Observed flow from USGS Gage 02197500 Savannah River at Burtons Ferry BR (1939 – present) was used to provide a general awareness to the size of the Savannah River at or near the proposed Plant Vogtle site. The drainage area above this gage is 8,650 square miles and the drainage area above the proposed Plant Vogtle is approximately 8300 square miles. The annual average flow of the Savannah River as observed at this gage is approximately 10,000 cubic feet per second (cfs).
2. Observed flow from Clarks Hill Reservoir post-impoundment period (1964 – present) was used for the long-term flow record at the proposed Plant Vogtle site. Utilizing this period of record, the USGS Gage 02197000 Savannah River at Augusta and the USGS Gage 02197500 Savannah River at Burtons Ferry BR as well as the drainage area at the proposed Plant Vogtle site were used to derive the low flow at the proposed Plant Vogtle site. The minimum monthly average low flow (4,135 cfs) was in year 2007.
3. Observed flow from USGS Gage 021973269 Savannah River near Waynesboro GA (2005 – present) was used to compare with item 2 above. This gage is located just below the proposed Plant Vogtle site. This gage was used without any flow adjustments. The minimum monthly average low flow (4,070 cfs) was in year 2007.
4. This scenario considers the future uses of the Savannah River and Savannah River low flows. The simulated US Army Corps of Engineers flow from Clarks Hill Reservoir and the Savannah-Upper

Ogeechee Regional Water Plan (SWP) Projected 2050 Water Demand (1939 – 2008) was used to consider potential low flows in the Savannah River. The minimum monthly average low flow was 3,726 cfs.

5. For WRD, the consumptive use of water (66.8 cfs) that is lost from the Savannah River is represented as a stage height in feet at the annual average flow and monthly minimum flows.

Table 1

Comparison of the Proposed Plant Vogtle Water Use and Flow Conditions in the Savannah River

Types of Flow	Magnitude of Flows in the Savannah River Annual Average (cfs)	Vogtle Units 3 & 4 Consumptive Water Use (66.8 cfs) as Percentage of River Flow/Stage (ft)
Observed Flow From USGS Gage 02197500 Savannah River At Burtons Ferry BR (1939 – present)	10,000	0.7% / <0.1
	Magnitude of Flows in the Savannah River Minimum Monthly Average (cfs)	Vogtle Units 3 & 4 Consumptive Water Use (66.8 cfs) as Percentage of River Flow/Stage (ft)
Observed Flow Post-impoundment Period (1964 – present)	4,135	1.6% / 0.1
Observed Flow From USGS Gage 021973269 Savannah River Near Waynesboro GA (2005 – present)	4,070	1.6% / 0.1
Simulated Flow with Corps Operation and Projected 2050 Water Demand (1939 – 2008)	3,726	1.8% / 0.1

Attachment B  
Savannah River Water Quality at the Plant Site

**Downstream Savannah River Water Quality Impacts**

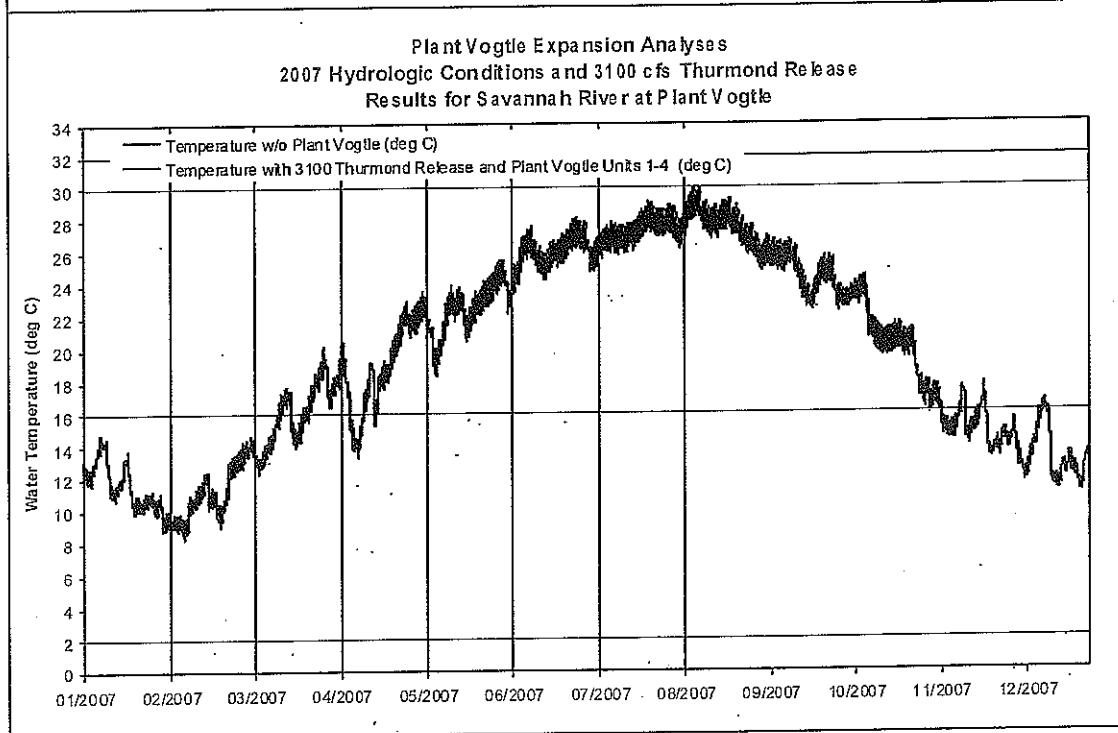
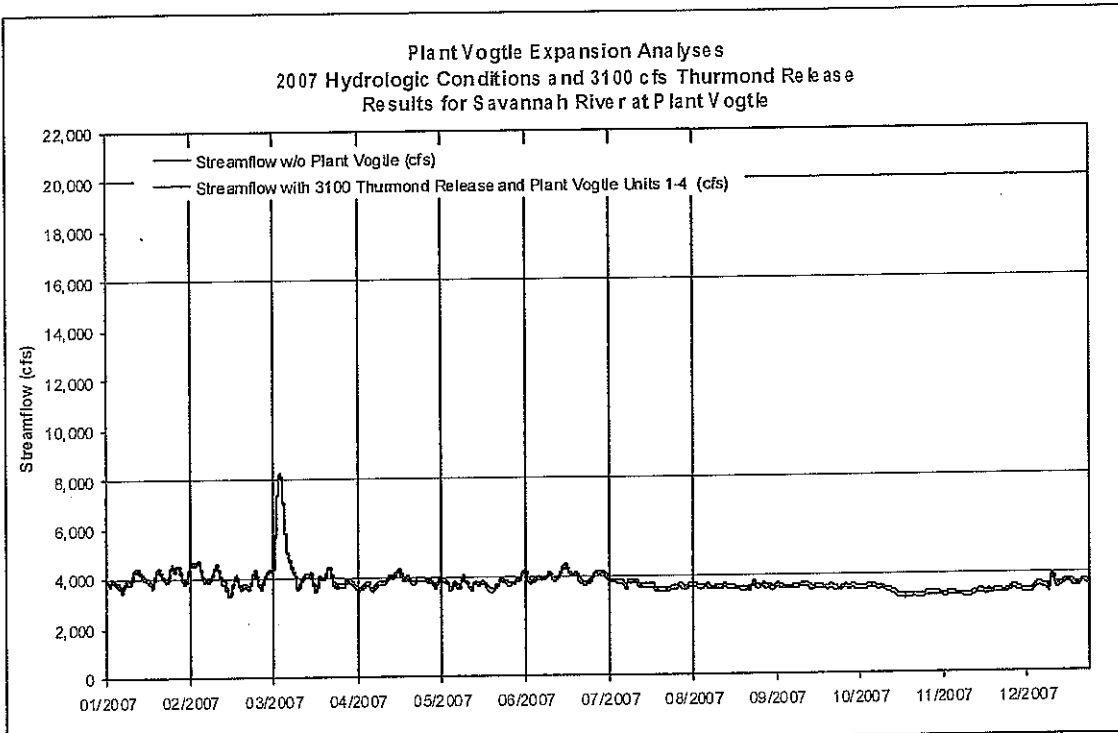
A Savannah River hydrograph was developed to consider any impacts of the proposed Plant Vogtle on the Savannah River. A very conservative low flow scenario was used to evaluate the impact of the consumptive use of water (66.8 cfs) to DO and temperature of the Savannah River.

A conservative constant low flow of 3,100 cfs release all year from Clarks Hill Dam (minimum release used during 2007-2008 for a few months) plus the 2007 hydrologic conditions for the intervening inflows were used to provide the hydrograph used to evaluate the proposed Plant Vogtle consumptive use of water (66.8 cfs). The results of this analysis were graphed (See below) for two locations; the proposed Plant Vogtle site and downstream at Cloyo USGS gage near Cloyo, GA. South Carolina withdrawals from the Savannah River were utilized in the analysis.

The model predicted a small DO decrease and small temperature increase at the proposed Plant Vogtle site but both the DO and temperature return to ambient river DO and temperature by the time the flow reaches the downstream Cloyo USGS gage. However, the flow was reduced by 66.8 cfs at both the proposed Plant Vogtle site and downstream at Cloyo USGS gage near Cloyo, GA.

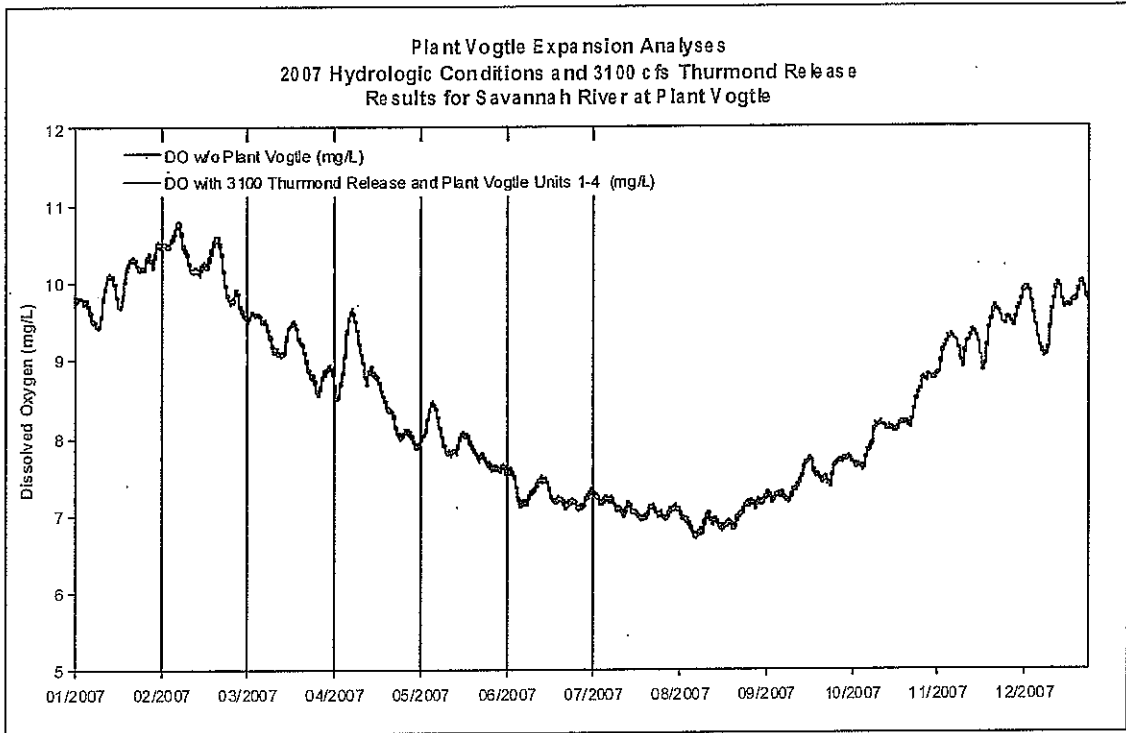
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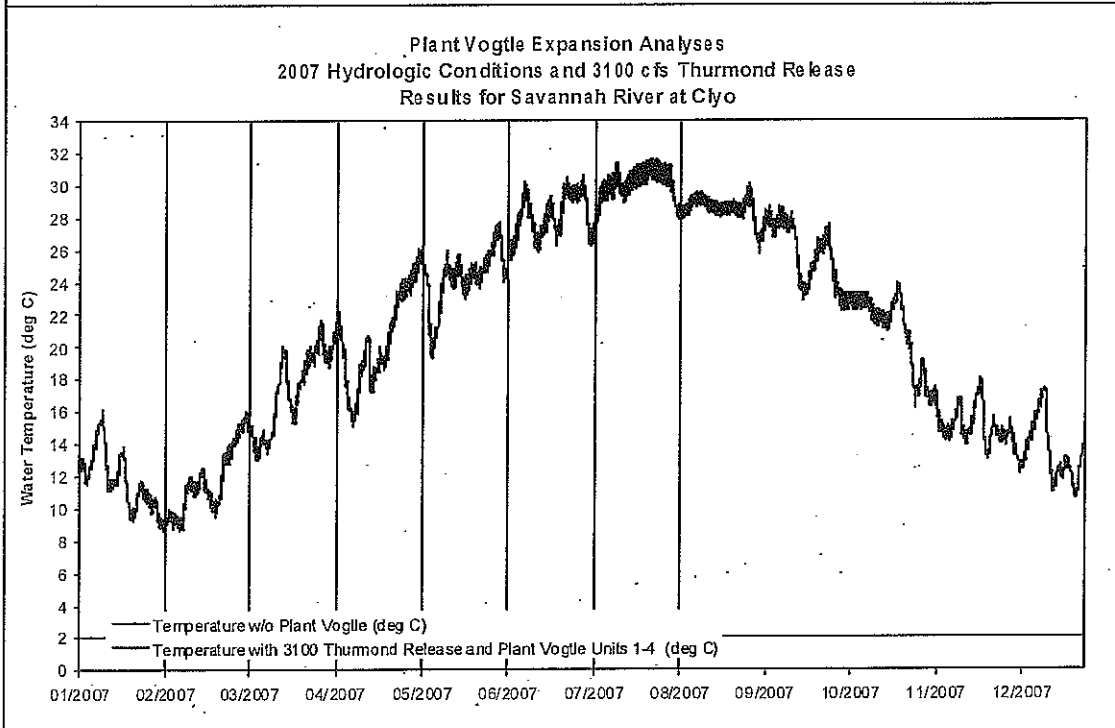
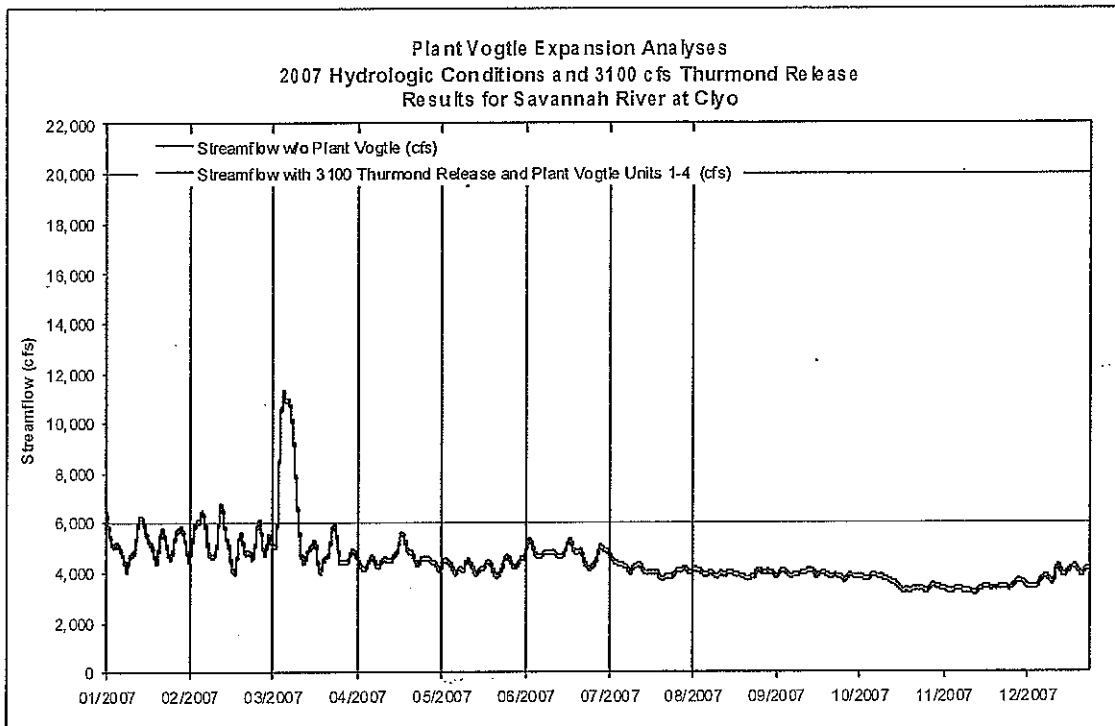
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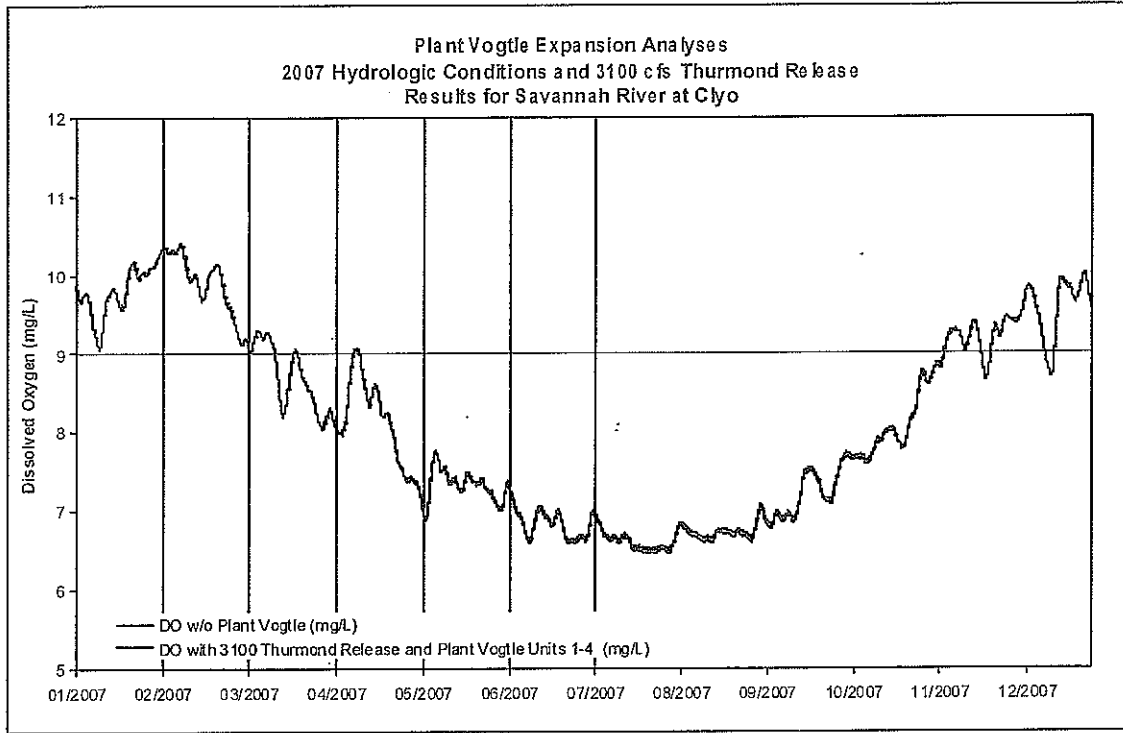
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Attachment C  
Savannah Harbor

The Savannah Harbor and River 1999 TMDL hydrodynamic and water quality models were used to evaluate the potential impacts of the proposed Plant Vogtle Units 3 & 4 cooling towers (PV34) evaporative loss and thermal discharge on the Savannah Harbor's DO, salinity and temperature regimes.

The PV34 cooling towers were modeled with an evaporative loss of 66.84 cfs (30,000 gpm) and a thermal discharge of 12.5 cfs (8.11 mgd) with monthly discharge temperatures ranging from 4 to 8.1 degrees C above ambient river water, see Table 1.

Table 1 – PV34 Thermal Discharge Monthly Temperature Increase over Ambient River Temperature

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delta Temperature (degrees C)	8.1	8	8	6.7	5.2	4.7	4.1	4.3	4.2	4.5	5.1	7

The Savannah Wildlife Refuge is a critical fresh water bird sanctuary and potential water quality impacts near the Refuge were evaluated. The Savannah Harbor and River 1999 TMDL hydrodynamic and water quality models predict the PV34 evaporative loss and thermal discharge has minimal impact on the area around the Refuge, the DO is lowered by 0.006 mg/l; the salinity increased by 0.0015 ppt; and temperature increased by 0.0052 degrees C.

There are concerns about increased salinity intrusion, increasing the salinity and chloride levels at the Savannah River Savannah I&D fresh water intake located on Abercorn Creek. The Savannah Harbor and River 1999 TMDL hydrodynamic and water quality models predict the PV34 evaporative loss and thermal discharge does not change the salinity or chlorides levels in the area of the upper Savannah Harbor where Abercorn Creek is located.

The Savannah Harbor near Hwy. 17 bridge bottom salinity is increased by an average of 0.0072 ppt, indicating the salt water wedge does not intrude any further upstream due to the PV34 evaporative loss and thermal discharge.

The Savannah River model predicted that both DO and temperature were returned to ambient river DO and temperature by the time the flow reached the downstream Clio USGS gage, however the flow was reduced by 66.8 cfs. These Savannah River model results at Clio were imputed into the Savannah Harbor and River 1999 TMDL hydrodynamic and water quality models and compared to the baseline Savannah Harbor TMDL model. The following are the projected impacts due to the decrease headwater flow:

The Savannah Harbor TMDL provides a 0.1 mg/l daily average DO assimilative capacity for the upstream Savannah River and Savannah Harbor dischargers when the Savannah Harbor DO is below 4 mg/l. The Savannah Harbor and River models predict the PV34 evaporative loss and thermal discharge has an 0.006 mg/l DO impact on this 0.1 mg/l DO assimilative capacity, which is 6% of the available assimilative. The proposed Plant Vogtle project will have to provide mitigation for this impact to the DO assimilative capacity.

Attachment D  
Corps of Engineers Savannah River Basin Drought Contingency Plan

The Savannah River Basin Drought Contingency Plan (DCP) March 1989 has been developed to address the operation of the three principal Corps of Engineers impoundments on the Savannah River and their effects on the downstream portion of the river, and to assist the States of Georgia and South Carolina in drought contingency planning in their portions of the Savannah River.

The DCP established the Savannah River Basin Drought Coordination Committee (SRBDCC). This committee is active and has met many times to discuss drought issues in the Savannah River Basin. Currently, there is an on-going set time for a conference call meeting to discuss the drought situation in the Savannah River Basin. The goal is to keep enough water in the impoundments while meeting the environmental needs and to keep enough water in the system to cover all the downstream water intakes. The DCP is adjusted by the committee to meet these two goals.

The proposed Plant Vogtle project is located in the downstream portion of the Savannah River below the Corps of Engineers impoundments and the proposed intake structure will be designed based on the riverbed mean sea level of the Savannah River.

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Attachment E  
Georgia EPD NPDES Permit Low Flow Consideration

The Georgia EPD NPDES Permit evaluated the thermal impacts to the Savannah River during a worst case low flow scenario. The Savannah River low flows used to determine the thermal impact were derived from the USGS Gage 02197000 Savannah River at Augusta, the USGS Gage 02197500 Savannah River at Burtons Ferry BR and the drainage area at the proposed Plant Vogtle site. The calculated 7-day, ten year low river flow was estimated to be 3831 cfs. This low flow was further reduced by the 24-hour maximum day withdrawal requested (114 cfs or 74mgd). The low flow used in the Savannah River to evaluate the thermal impacts was 3717 cfs. For further details, see NPDES permit files.

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