ATTACHMENT A. NRC NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

Southern Nuclear Operating Company has prepared this Environmental Report – Operating License Renewal Stage for the Edwin I. Hatch Nuclear Plant (HNP) in accordance with the requirements of 10 CFR 51.53. Included in the regulation is a list of environmental issues that the U.S. Nuclear Regulatory Commission (NRC) developed from the analysis presented in NRC's Generic Environmental Impact Statement (Reference 1), which examines possible environmental impacts that could occur as a result of renewing licenses of individual nuclear power plants. These 92 issues are listed in Table B-1 of Appendix B to Subpart A of Part 51 and are provided in Table A-1 of this document. For expediency, numbers have been assigned to each issue as it appears in Table B-1 and are referenced throughout this Environmental Report. Table A-1 also provides a cross-reference for each of NRC's environmental issues to the respective environmental report section where that issue is discussed.

Reference

1. NUREG-1437, Volume 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants," December 1996.

Table A-1. HNP environmental report discussion of license renewal national environmental policy act issues (page 1 of 3).

	Issue[a]	Category	Section of this Environmental Report
1.	Impacts of refurbishment on surface water quality	1	3.1.1
2.	Impacts of refurbishment on surface water use	1	3.1.1
3.	Altered current patterns at intake and discharge structures	1	3.1.1
4.	Altered salinity gradients	1	3.1.1
5.	Altered thermal stratification of lakes	1	NA[b]
6.	Temperature effects on sediment transport capacity	1	3.1.1
7.	Scouring caused by discharged cooling water	1	3.1.1
8.	Eutrophication	1	3.1.1
9.	Discharge of chlorine or other biocides	1	3.1.1
10.	Discharge of sanitary wastes and minor chemical spills	1	3.1.1
11.	Discharge of other metals in waste water	1	3.1.1
12.	Water use conflicts (plants with once-through cooling systems)	1	NA[c]
13.	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	3.1.2
14.	Refurbishment impacts to aquatic resources	1	3.1.1
15.	Accumulation of contaminants in sediments or biota	1	3.1.1
16.	Entrainment of phytoplankton and zooplankton	1	3.1.1
17.	Cold shock	1	3.1.1
18.	Thermal plume barrier to migrating fish	1	3.1.1
19.	Distribution of aquatic organisms	1	3.1.1
20.	Premature emergence of aquatic insects	1	3.1.1
21.	Gas supersaturation (gas bubble disease)	1	3.1.1
22.	Low dissolved oxygen in the discharge	1	3.1.1
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	3.1.1
24.	Stimulation of nuisance organisms (e.g., shipworms)	1	3.1.1
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	NA[c]
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	NA[c]
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	NA[c]
28.	Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	3.1.1
29.	Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	3.1.1
30.	Heat shock for plants with cooling-tower-based heat dissipation systems	1	3.1.1
31.	Impacts of refurbishment on ground-water use and quality	1	3.1.1
32.	Ground-water use conflicts (potable and service water; plants that use < 100 gpm)	1	NA[d]
33.	Ground-water use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	2	3.1.3

Table A-1. HNP environmental report discussion of license renewal national environmental policy act issues (page 2 of 3).

	Issue[a]	Category	Section of this Environmental Report
34.	Ground-water use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	3.1.3
35.	Ground-water use conflicts (Ranney wells)	2	NA[e]
36.	Ground-water quality degradation (Ranney wells)	1	NA[e]
37.	Ground-water quality degradation (saltwater intrusion)	1	3.1.1
38.	Ground-water quality degradation (cooling ponds in salt marshes)	1	NA[c]
39.	Ground-water quality degradation (cooling ponds at inland sites)	2	NA[c]
40.	Refurbishment impacts to terrestrial resources	2	3.1.4
41.	Cooling tower impacts on crops and ornamental vegetation	1	3.1.1
42.	Cooling tower impacts on native plants	1	3.1.1
43.	Bird collisions with cooling towers	1	NA[f]
44.	Cooling pond impacts on terrestrial resources	1	NA[c]
45.	Power line right-of-way management (cutting and herbicide application)	1	3.1.1
46.	Bird collisions with power lines	1	3.1.1
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	3.1.1
48.	Floodplains and wetlands on power line right of way	1	3.1.1
49.	Threatened or endangered species	2	3.1.5
50.	Air quality during refurbishment (non-attainment and maintenance areas)	2	3.1.6
51.	Air quality effects of transmission lines	1	3.1.1
52.	Onsite land use	1	3.1.1
53.	Power line right of way	1	3.1.1
54.	Radiation exposures to the public during refurbishment	1	3.1.1
55.	Occupational radiation exposures during refurbishment	1	3.1.1
56.	Microbiological organisms (occupational health)	1	3.1.1
57.	Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	3.1.7
58.	Noise	1	3.1.1
59.	Electromagnetic fields, acute effects (electric shock)	2	3.1.8
60.	Electromagnetic fields, chronic effects	NA[g]	NA[g]
61.	Radiation exposures to public (license renewal term)	1	3.1.1
62.	Occupational radiation exposures (license renewal term)	1	3.1.1
63.	Housing impacts	2	3.1.9
64.	Public services: public safety, social services, and tourism and recreation	1	3.1.1
65.	Public services: public utilities	2	3.1.10
66.	Public services, education (refurbishment)	2	3.1.11
67.	Public services, education (license renewal term)	1	3.1.1
68.	Offsite land use (refurbishment)	2	3.1.12

Table A-1. HNP environmental report discussion of license renewal national environmental policy act issues (page 3 of 3).

	Issue[a]	Category	Section of this Environmental Report
69.	Offsite land use (license renewal term)	2	3.1.13
70.	Public services, transportation	2	3.1.14
71.	Historic and archaeological resources	2	3.1.15
72.	Aesthetic impacts (refurbishment)	1	3.1.1
73.	Aesthetic impacts (license renewal term)	1	3.1.1
74.	Aesthetic impacts of transmission lines (license renewal term)	1	3.1.1
75.	Design basis accidents	1	3.1.1
76.	Severe accidents	2	3.1.16
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	1	3.1.1
78.	Offsite radiological impacts (collective effects)	1	3.1.1
79.	Offsite radiological impacts (spent fuel and high level waste disposal)	1	3.1.1
80.	Nonradiological impacts of the uranium fuel cycle	1	3.1.1
81.	Low-level waste storage and disposal	1	3.1.1
82.	Mixed waste storage and disposal	1	3.1.1
83.	On-site spent fuel	1	3.1.1
84.	Nonradiological waste	1	3.1.1
85.	Transportation	1	3.1.1
86.	Radiation doses (decommissioning)	1	3.1.1
87.	Waste management (decommissioning)	1	3.1.1
88.	Air quality (decommissioning)	1	3.1.1
89.	Water quality (decommissioning)	1	3.1.1
90.	Ecological resources (decommissioning)	1	3.1.1
91.	Socioeconomic impacts (decommissioning)	1	3.1.1
92.	Environmental justice	NA[g]	3.1.18

a. Source: 10 CFR Part 51, Subpart A, Appendix B, Table B-1 (Issue numbers added to facilitate discussion.)
b. Not applicable because HNP is not located on a lake.
c. Not applicable because HNP does not use a cooling pond or once-through heat dissipation system.
d. Not applicable because HNP uses > 100 gpm of groundwater.
e. Not applicable because HNP does not use Ranney wells.
f. Not applicable because HNP does not use natural draft cooling towers (NUREG-1437, Section 4.3.5.2).
g. Not applicable because the categorization and impact finding definitions do not apply to this issue (10 CFR 51, Subpart A, Appendix B, Table B-1, footnote 4).

ATTACHMENT B. SURFACE WATER WITHDRAWAL IMPACT ASSESSMENT

B.1 Surface Water Impact Calculations

The U.S. Geological Survey (USGS) measures streamflow characteristics at locations, called gauging stations, throughout the U.S. The USGS has prepared tables, called rating tables, that show the relationship between the height of water at a gauging station and the volume of water, called discharge, passing that station. For example, Rating Table 13 for USGS Gauging Station 02225000, located in Georgia on the Altamaha River at the U. S. Highway 1 bridge indicates that if the gauge height reading is 8.7 feet, the USGS has calculated that the river discharge at that time is 11,520 cubic feet per second. Conversely, if the river discharge were 9,619 cubic feet per second, the expected gauge height reading would be 7.7 feet. A copy of Rating Table 13 is attached as Table B-1.

The reader will note that the right-hand column of Rating Table 13 shows the difference in river discharge, Q, per foot of gauge height. If the river sides were vertical, the difference would remain effectively the same regardless of gauge height; each additional 1,000 cubic feet per second, for example, would raise the river height the same amount. Because rivers in cross section are generally shaped like a broad letter "V," however, the higher the water level, the more room there is to contain water. This is why Rating Table 13 indicates that an increase in gauge height from 1 foot to 2 feet adds only 732 cubic feet per second of discharge whereas an increase from 21 feet to 22 feet adds 17,500 cubic feet per second.

The USGS also publishes annual summaries of streamflow data for each gauging station. Attached, as Table B-2, is the water year[1] 1997 discharge data for Altamaha River Gauging Station 02225000. For example, the table indicates that on January 20, 1997, the river discharge was 22,500 cubic feet per second. Referring to Rating Table 13 (Table B-1), this value corresponds to the gauge height of 13 feet, the approximate gauge reading on that day.

In addition to annual discharge data, Table B-2 presents statistical analyses of annual and multi-year data. The table indicates that, based on 49 years of data (1949 – 1997), 11,580 cubic feet per second is the river's annual mean discharge, that March is the month that has the highest mean discharge (24,570 cubic feet per second) and maximum discharge (47,260 cubic feet per second), and that September is the month that has the lowest mean discharge (4,907 cubic feet per second) and minimum discharge (1,864 cubic feet per second). The annual discharge table for fiscal year 1990, attached as Table B-3, also indicates that the historical lowest daily mean was 1,620 cubic feet on July 21, 1986.

The equations use data presented in attached ratings and annual discharge tables in calculating information presented in Section 3.1.2.1.

EQUATION B.1 – ANNUAL FLOW RATE

Calculate the Altamaha River annual flow rate in cubic feet per year by converting average mean discharge of 11,580 cubic feet per second from Table B-2:

> 11,580 cubic feet per second $\times$ 3,600 seconds per hour $\times$ 24 hours per day $\times$ 365 days per year = 365,186,880,000 or 3.65 $\times$ 1011 cubic feet per year

1. A water year runs from October 1 through September 30.

EQUATION B.2 – IMPACT ON AVERAGE FLOW

Calculate the percent that HNP cooling water consumptive use by evaporation, 32.6 million gallons per day (Section 2.1.4), reduces Altamaha River the annual mean discharge of 11,580 cubic feet per second (cfs) (Table B-1). First, convert consumptive loss units to same as discharge units:

$$\frac{32{,}600{,}000 \text{ gallons per day} \times 0.1336719 \text{ cubic feet per gallon}}{3600 \text{ seconds per hour} \times 24 \text{ hours per day}} = 50.44 \text{ cubic feet per second}$$

Second, determine percentage represented by consumptive loss:

$$\frac{50.44 \text{ cubic feet per second}}{11{,}580 \text{ cubic feet per second}} \text{x}100 = 0.44 \text{ percent}$$

EQUATION B.3 – IMPACT ON MINIMUM FLOW

Calculate the percent that HNP cooling water consumptive use by evaporation, 50.44 cubic feet per second (Equation B-2), would have reduced the Altamaha River historic lowest daily mean discharge of 1,620 cubic feet per second (Table B-3):

$$\frac{50.44 \text{ cubic feet per second}}{1{,}620 \text{ cubic feet per second}} \text{x}100 = 3.1 \text{percent}$$

EQUATION B.4 – IMPACT ON AVERAGE ELEVATION

Calculate the amount that HNP cooling water consumptive use by evaporation, 50.44 cubic feet per second (Equation B.2), reduces the Altamaha River elevation at the time of the annual mean discharge of 11,580 cubic feet per second.

Table B-1 is the USGS rating table for the referenced gauging station. It provides flow rates for gage height increments of 0.1 feet. For all practical purposes, there is a straight line relationship between gage height and flow rate between these small increments of gage height.

The average flow rate of 11,580 cfs is between the following points on the rating table.

Flow rate (cfs)	Gage height (feet)
11,520	8.7
11,720	8.8

A straight line between these points is:

$$\text{gage height (ft)} = 8.7 + \frac{8.8 - 8.7}{11{,}720 - 11{,}520} \times (\text{flow rate} - 11{,}520)$$

therefore, 11,580 cfs occurs at a gage height of

$$8.7 + \frac{0.1}{200}(11{,}580 - 11{,}520) = 8.73 \text{ ft}$$

subtraction of the consumptive withdrawal reduces the flow rate to

11,580 – 50.44 = 11,529.6 cfs

This is also between the two reference points, therefore gage height would be

$$8.7 + \frac{.1}{200} \times (11{,}529.6 - 11{,}520) = 8.70 \text{ ft}$$

The difference in gage height (0.03 ft) is negligible.

EQUATION B.5 – IMPACT ON MINIMUM ELEVATION

Calculate the amount that HNP cooling water consumptive use by evaporation, 50.44 cubic feet per second (Equation B.2) would have reduced the Altamaha River historic lowest daily mean discharge of 1,620 cubic feet per second (Table B-3):

The lowest flow rate of record (1,620 cfs) is between the following points on the rating table:

Flow rate (cfs)	Gage height (feet)
1,553	1.1
1,621	1.2

A straight line between these points is:

$$\text{gage height (ft)} = \quad 1.1 + \frac{1.2 - 1.1}{1{,}621 - 1{,}553}(\text{flow rate} - 1{,}553)$$

therefore, 1,620 cfs occurs at a gage height of:

$$1.1 + \frac{0.1}{68} \text{ x } (1{,}620 - 1{,}553) = 1.20 \text{ ft}$$

subtraction of the consumptive withdrawal reduces the flow rate to

1,620 – 50.44 = 1,569.6

This is also between the two reference points, therefore gage height would be

$$1.1 + \frac{0.1}{68} \text{ x } (1{,}569.6 - 1{,}553) = 1.12 \text{ ft}$$

The difference in gage height (0.08 ft) is negligible.

Table B-1. USGS Expanded Rating Table, Altamaha River Station 02225000, Rating No. 13.0.

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION PAGE 1
EXPANDED RATING TABLE TYPE: LOG
02225000 DATE PROCESSED: 12-22-1998 @ 11:35 BY wrstokes
ALTAMAHA RIVER NEAR BAXLEY, GA. DD: 3 TYPE: 001 RATING NO: 13.0
OFFSET: -4.0 START DATE/TIME: 10-01-1997 (0001)

BASED ON _______ DISCHARGE MEASUREMENTS, NOS ________, AND ________, AND IS ______ WELL DEFINED BETWEEN ______ AND ______ CFS
COMP BY _____ DATE ________ CHK. BY _____ DATE ________
SAME AS RATING NO 12 BELOW 20 FEET.

GAGE HEIGHT (FEET)	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF IN Q PER FOOT
	DISCHARGE IN CUBIC FEET PER SECOND					(EXPANDED PRECISION)					
.0						1180*	1238	1298	1360	1423	614.0
1.0	1487	1553	1621	1690	1761	1833	1907	1983	2060	2139	732.0
2.0	2219	2301	2385	2470	2557	2646	2736	2828	2922	3017	895.0
3.0	3114	3212	3312	3414	3518	3623	3730	3838	3949	4061	1061
4.0	4175	4290	4407	4526	4647	4769	4893	5019	5146	5276	1232
5.0	5407	5540	5674	5810	5948	6088	6230	6373	6519	6665	1407
6.0	6814	6965	7117	7271	7427	7585	7744	7906	8069	8234	1587
7.0	8401	8569	8740	8912	9086	9262	9440	9619	9801	9984	1769
8.0	10170	10360	10550	10740	10930	11120	11320	11520	11720	11920	1950
9.0	12120	12330	12540	12750	12960	13170	13390	13600	13820	14040	2150
10.0	14270	14490	14720	14950	15180	15410	15640	15880	16120	16360	2330
11.0	16600*	16870	17140	17410	17690	17970	18250	18530	18820	19110	2800
12.0	19400*	19700	20000	20300	20610	20920	21230	21540	21860	22180	3100
13.0	22500*	22880	23270	23660	24050	24450	24850	25260	25670	26080	4000
14.0	26500*	26990	27490	27990	28500	29020	29540	30070	30610	31150	5200
15.0	31700*	32290	32900	33500	34120	34750	35380	36020	36670	37330	6300
16.0	38000*	38680	39370	40070	40780	41500*	42280	43070	43870	44680	7500
17.0	45500*	46370	47260	48160	49070	50000*	50910	51840	52780	53730	9200
18.0	54700*	55650	56600	57570	58560	59550	60560	61570	62610	63650	10010
19.0	64710	65780	66860	67960	69060	70190	71320	72470	73630	74810	11290
20.0	76000*	77250	78510	79790	81090	82400	83720	85060	86420	87790	13180
21.0	89180	90590	92010	93450	94910	96380	97870	99380	100900	102400	14820
22.0	104000*	105700	107300	109000	110700	112500	114200	116000	117800	119600	17500
23.0	121500	123300	125200	127100	129100	131000	133000	135000	137000	139000	19600
24.0	141100	143200	145300	147400	149600	151700	153900	156200	158400	160700	21900*
25.0	163000*										

Table B-2. USGS Discharge Table for the Altamaha River Water Year October 1996 to September 1997 (Station 02225000).

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - GEORGIA INSTALLATION 12/22/1998

STATION NUMBER 02225000 ALTAMAHA RIVER NEAR BAXLEY, GA. STREAM SOURCE AGENCY USGS
LATITUDE 315620 LONGITUDE 0822113 DRAINAGE AREA 11600.00 DATUM 61.51 STATE 13 COUNTY 001

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1996 TO SEPTEMBER 1997
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3350	2790	3730	6300	17700	49900	7920	11600	6220	5320	8750	2430
2	3340	2730	4070	6160	17400	47500	7960	12800	6710	5610	6790	2380
3	3980	2680	4670	6500	16300	43800	7880	14000	6920	6360	6530	2330
4	4780	2700	5960	6660	15400	39400	7540	15200	7090	6060	6990	2270
5	5190	2800	7800	6790	14600	34800	7190	16100	6990	5680	7220	2220
6	5510	2880	9170	6880	13800	31200	6960	17000	6790	5680	6960	2150
7	5320	2890	10200	6930	13200	28800	6630	17800	6580	5660	6600	2080
8	5520	2890	10200	7230	12600	27900	6200	18600	6490	5040	6280	2040
9	6420	3010	8690	8470	12200	29200	5890	19200	6430	4640	5720	1990
10	7070	3380	7530	10400	11600	32900	5820	19700	6310	4200	5230	1950
11	7300	3860	7100	12300	11300	36900	6190	19500	6130	3880	4900	1920
12	6960	4680	7150	13600	11400	40100	6260	17800	5860	3810	4480	1860
13	6690	4920	7040	14800	11300	41300	6100	14800	5380	3720	3920	1840
14	6340	5000	6550	15900	12400	39400	5980	12000	4840	3600	3560	1820
15	5720	5110	6210	17100	17100	35500	5720	10200	4430	3510	3360	1820
16	4960	5250	6200	18500	22900	31900	5390	9300	4250	3480	3230	1840
17	4350	5350	6120	19900	26500	27700	5110	8880	4390	3400	3190	1850
18	3980	4930	6060	21100	28700	23800	5050	8180	5000	3300	3280	1850
19	3660	4490	6630	22000	29600	20700	5490	7000	6560	3210	3250	1840
20	3450	4230	7880	22500	30000	18200	5820	6070	7600	3240	3200	1820
21	3420	3810	9150	22300	30700	16000	5710	5230	8310	3370	3260	1810
22	3350	3510	9460	20800	33100	14500	5370	4700	9070	3790	3470	1830
23	3220	3330	9030	19200	38600	13600	5180	4380	9820	4070	3450	1820
24	3090	3380	8120	18400	44700	12900	4820	4280	10300	4360	3230	1820
25	2990	3670	7090	17600	48600	12100	4530	4530	9330	4250	3020	1800
26	2900	3800	6310	16500	50600	11100	4470	4670	7690	3990	2860	1820
27	2820	3820	6070	16000	50900	10200	4850	4500	6640	5310	2710	1900
28	2800	3800	5870	15500	50800	9220	6720	4340	6310	6970	2630	2310
29	2780	3680	5530	15000	---	8520	9140	4490	6140	8220	2590	4660
30	2800	3640	5830	15200	---	8110	10700	4840	5590	9380	2530	6770
31	2820	---	6630	16400	---	8030	---	5530	---	10100	2490	---
TOTAL	136880	113010	218050	442920	694000	805180	188590	327220	200170	153210	135680	66840
MEAN	4415	3767	7034	14290	24790	25970	6286	10560	6672	4942	4377	2228
MAX	7300	5350	10200	22500	50900	49900	10700	19700	10300	10100	8750	6770
MIN	2780	2680	3730	6160	11300	8030	4470	4280	4250	3210	2490	1800
CFSM	.38	.32	.61	1.23	2.14	2.24	.54	.91	.58	.43	.38	.19
IN.	.44	.36	.70	1.42	2.23	2.58	.60	1.05	.64	.49	.44	.21

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1949 - 1997, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	5577	5729	10060	16030	22410	24570	19080	9903	7057	6506	6351	4907
MAX	24560	14480	29870	36550	41600	47260	41730	20630	19380	32470	19600	13860
(WY)	1995	1996	1993	1993	1973	1975	1975	1975	1973	1994	1994	1949
MIN	1864	2115	2763	3395	4803	9112	5635	2576	2302	1796	1902	2228
(WY)	1982	1982	1988	1981	1989	1985	1986	1986	1988	1988	1988	1997

SUMMARY STATISTICS	FOR 1996 CALENDAR YEAR		FOR 1997 WATER YEAR		WATER YEARS 1949 - 1997	
ANNUAL TOTAL	4023250		3481750			
ANNUAL MEAN	10990		9539		11580	
HIGHEST ANNUAL MEAN					17720	1975
LOWEST ANNUAL MEAN					5210	1988
HIGHEST DAILY MEAN	57800	Feb 12	50900	Feb 27	97900	Jul 16 1994
LOWEST DAILY MEAN	2650	Sep 22	1800	Sep 25		
ANNUAL SEVEN-DAY MINIMUM	2760	Oct 29	1820	Sep 20	1660	Jul 17 1986
INSTANTANEOUS PEAK FLOW			51300	Feb 27	98800	Jul 16 1994
INSTANTANEOUS PEAK STAGE			17.64	Feb 27	22.70	Mar 12 1971
ANNUAL RUNOFF (CFSM)	.95		.82		1.00	
ANNUAL RUNOFF (INCHES)	12.90		11.17		13.56	
10 PERCENT EXCEEDS	27500		20700		25500	
50 PERCENT EXCEEDS	6410		6160		7190	
90 PERCENT EXCEEDS	3140		2760		2720	

STATISTICS COMPUTED BY: rogermc DATE: 04/21/1998 AT: 07:48:32

Table B-3. USGS Water Discharge Record Water Year October 1990 to September 1991, Altamaha River Station 02225000.

ALTAMAHA RIVER BASIN

02225000 ALTAMAHA RIVER NEAR BAXLEY, GA.

LOCATION.--Lat 31°56'20", long 82°21'13", Appling-Toombs County line, Hydrologic Unit 03070106, on right bank 400 ft downstream from bridge on U.S. Highway 1, 2.2 mi upstream from Bay Creek, 8 mi downstream from Bullards Creek, and 12 mi north of Baxley.
DRAINAGE AREA.--11,600 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1949 to June 1951, October 1970 to current year.
GAGE.--Water-stage recorder. Datum of gage is 61.51 ft above National Geodetic Vertical Datum of 1929. Aug. 13, 1949, to June 30, 1 nonrecording gage at site 400 ft upstream at same datum.
REMARKS.--No estimated daily discharges. Records good.
AVERAGE DISCHARGE.--22 years (water years 1950, 1971-91), 11,190 ft^3/s, 13.10 in/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 97,500 ft^3/s, Mar. 12, 1971, gage height, 22.7 ft; minimum daily discharge, 1,620 ft^3/s, July 21, 1986.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Dec. 10, 1948, reached a stage of 25.1 ft, from floodmark, discharge, 130,000 ft^3/s. Flood of January 1925 reached a stage of 30.0 ft, from information furnished by Georgia Department of Transportation.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 25,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Feb. 7	2100	50,500	17.75	Apr. 10	2000	28,100	14.78
Mar. 10	1100	*62,500	*19.04				

Minimum daily discharge, 2,330 ft^3/s, Oct. 9.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2450	6030	3590	5230	31000	14400	14900	16200	10600	9300	13300	17100
2	2420	5580	4070	5430	33900	16000	16200	16200	10800	9600	17900	17200
3	2380	4850	4250	5800	37000	21800	17300	16100	10900	9830	20600	16000
4	2350	4650	3890	5960	42000	30800	18500	16100	10700	9640	21100	12800
5	2350	5180	3690	6050	47400	41900	20400	16400	11200	9750	19900	10000
6	2380	5190	3710	6200	49800	51100	23100	17100	11900	9640	17700	8860
7	2420	4470	4430	6470	50100	57300	25100	17900	12700	9860	15500	8140
8	2370	4260	4980	6650	50200	60200	26600	18800	12700	10300	13300	7880
9	2330	5510	5260	6330	49400	61300	27600	19200	11400	10800	11100	7690
10	2480	6870	5520	5940	47800	62000	28000	19000	10200	10700	9070	7320
11	2700	8190	5190	6110	45400	61400	27900	18800	9100	10500	7940	6660
12	3140	9110	4700	8260	42200	59200	27500	19300	7900	10500	8440	5910
13	4050	9590	4590	10600	37300	55900	26600	19600	6540	9740	10200	5190
14	6660	9340	4710	12300	30600	51800	25300	19700	5700	9200	9940	4670
15	8680	8450	4880	13700	25900	46900	23700	20100	5460	9360	10000	4340
16	9620	7300	4860	14500	22400	40700	22400	20700	5470	10200	11000	4180
17	8940	6280	4800	14700	20100	33400	21700	21700	5630	11900	12000	3930
18	6820	5720	4360	15100	18100	28300	21200	22900	5980	13300	12700	3640
19	5380	5450	4220	15600	16100	25600	19800	24000	6330	14700	13300	3490
20	4550	5210	4570	17300	14500	23600	18300	24300	6400	15900	13500	3630
21	4110	4560	5310	19400	13100	21600	16300	22700	6490	16400	12600	3740
22	4170	4130	5550	20800	12300	19900	15500	20600	7280	16700	12000	3650
23	4220	3910	5470	21600	11800	18600	15400	19200	7720	16800	11900	3530
24	4160	3800	5580	22100	11400	17000	15600	18000	7960	16300	11200	3450
25	4630	3870	5740	23100	11500	15400	15800	16700	8430	15000	9980	3360
26	6280	3950	5980	24200	12100	14200	16100	15300	8870	14000	10600	3260
27	8120	3880	6350	24700	12900	12900	16400	13900	8600	13400	12500	3220
28	9150	3730	6060	25300	13700	12000	16300	12800	8380	13000	13400	3320
29	9110	3580	5640	25800	—	11900	16600	11900	8500	12500	13800	3210
30	8240	3490	5380	27500	—	12600	16400	11200	8890	12000	15000	3110
31	6650	—	5270	29300	—	13400	—	10900	—	12000	16300	—
TOTAL	153510	166130	152380	451930	810000	1013300	612400	557300	258750	373020	407770	192480
MEAN	4952	5538	4915	14580	28930	32690	20410	17980	8625	12030	13150	6418
MAX	9620	9590	6350	29300	50200	62000	28000	24300	12700	16800	21100	17200
MIN	2330	3490	3590	5230	11400	11900	14900	10900	5470	9200	7940	3110
CFSM	.43	.48	.42	1.26	2.49	2.82	1.76	1.55	.74	1.04	1.13	.55
IN.	.49	.53	.49	1.45	2.60	3.25	1.96	1.79	.83	1.20	1.31	.62

CAL YR 1990	TOTAL 3905730	MEAN 10700	MAX 65000	MIN 1840	CFSM .92	IN. 12.53
WTR YR 1991	TOTAL 5140970	MEAN 14110	MAX 62000	MIN 2330	CFSM 1.22	IN. 16.51

ATTACHMENT C. SPECIAL-STATUS SPECIES CONSULTATIONS

Attachment C presents letters Southern Nuclear Operating Company submitted to the Georgia Department of Natural Resources requesting information on state-listed species in the project area and to the U.S. Fish and Wildlife Service and National Marine Fisheries Service requesting information on Federally-listed that might be present and that could be affected by the proposed action.

5131 Maner Road
Smyrna, Georgia 30080
Tel 404 799.2100
Fax 404 799.2141

GEORGIA POWER
A SOUTHERN COMPANY

December 16, 1997

Georgia Department of Natural Resources
Wildlife Resources Division
Natural Heritage Program
2117 U. S. Hwy.278
Social Circle, Georgia 30279

Attention: Mr. Greg Krakow, Data Manager

Re: Request for
Threatened & Endangered
Species Information

Dear Mr. Krakow:

Southern Nuclear is in the process of preparing an application for a license extension for Plant Hatch near Baxley, Georgia. We anticipate the need for an endangered species survey for the site as a part of this application. We are requesting that you conduct a search of your data base for known locations of Threatened & and Endangered Species within and around the immediate project site. I have a copy of the most resent lists for Threatened and Endangered Species for Appling and Toombs counties from the U.S. Fish and Wildlife Service. The approximate location of the Plant site is indicated on the attached photo-copy of the Baxley NE, Ga. 7.5 Minute Topographic Quadrangle.

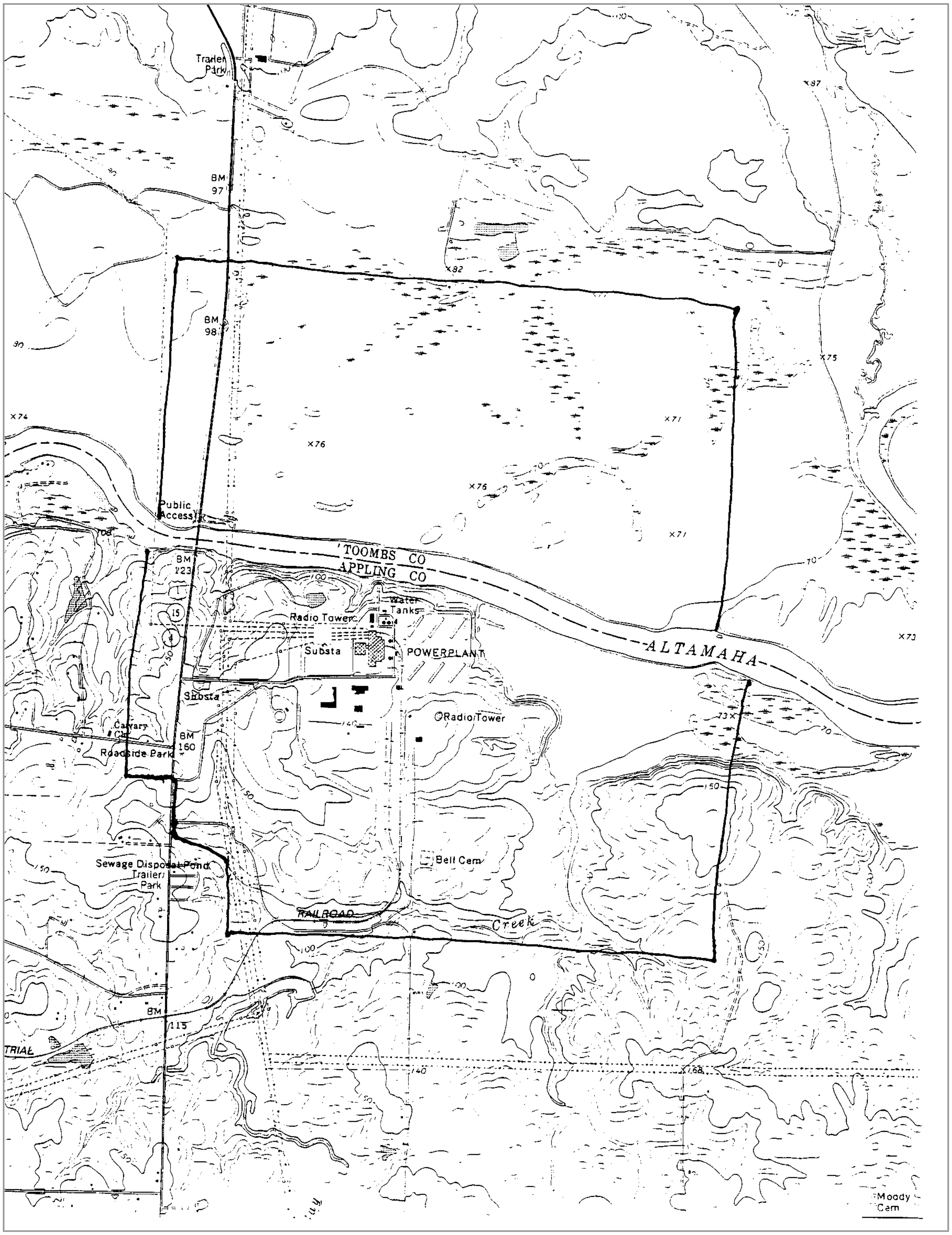
Southern Nuclear and Georgia Power Company appreciates your attention to processing this data request. If you need additional information, please contact me at 404-799-2151.

Sincerely,

William J. Candler

William J. Candler
Environmental Supervisor

Letter C-1. Georgia Department of Natural Resources letter (page 1 of 2).



Letter C-1. Georgia Department of Natural Resources letter (page 2 of 2).

Georgia Department of Natural Resources

Wildlife Resources Division

LONICE C. BARRETT, COMMISSIONER
DAVID WALLER, DIVISION DIRECTOR

Georgia Natural Heritage Program
2117 U.S. Hwy. 278 S.E., Social Circle, Georgia 30025-4714
(770) 918-6411, (706) 557-3032

February 27, 1998

William J. Candler
5131 Maner Road
Smyrna, Georgia 30080

Subject: **Known or Potential Occurrences of Special Concern Plant and Animal Species for Plant Hatch Extension, Bailey, Georgia**

Dear Mr. Candler;

This is in response to your request of February 6, 1998. According to our records, within a three mile radius of the project site, there are occurrences of the following:

Within the Project Area (Includes map location numbers. All locations are exact except *Alasmidonta arcula* which is within 1.5 miles of the location indicated on the map.)

Alasmidonta arcula (Altamaha arc-mussel), #5
Elliptio spinosa (Georgia spiny mussel), #4
Sideroxylon sp. 1 (Ohoopee bumelia), #1
Agrimonia incisa (Cutleaf agrimony), #2 & #3

1 Mile East of Project Area

Elliptio shepardiana (Altamaha lance)
Elliptio spinosa (Georgia spiney mussel)

1 Mile Southeast of Project Area

Picoides borealis (Red-cockaded woodpecker)
Aimophilia aestivalis (Bachman's sparrow)
Gopherus polyphemus (Gopher tortoise)
Krameria lanceolata (Sandbur)

3 Miles East of Project Area

Elliptio spinosa (Georgia spiny mussel)
Alasmidonta arcula (Altamaha arc-mussel)

Letter C-2. Georgia Department of Natural Resources letter (page 1 of 9).

Mr. William J. Candler
Page 2
February 11, 1998

Enclosed are potential animal and plant lists for Toombs County that should aid in assessing the potential for rare species occurrences within the area of concern.

Please keep in mind the limitations of our database. The data collected by the Georgia Natural Heritage Program comes from a variety of sources, including museum and herbarium records, literature, and reports from individuals and organizations, as well as field surveys by our staff biologists. In most cases the information is not the result of a recent on-site survey by our staff. Many areas of Georgia have never been surveyed thoroughly. Therefore, the Georgia Natural Heritage Program can only occasionally provide definitive information on the presence or absence of rare species on a given site. Our files are updated constantly as new information is received. Thus, information provided by our program represents the existing data in our files at the time of the request and should not be considered a final statement on the species or area under consideration.

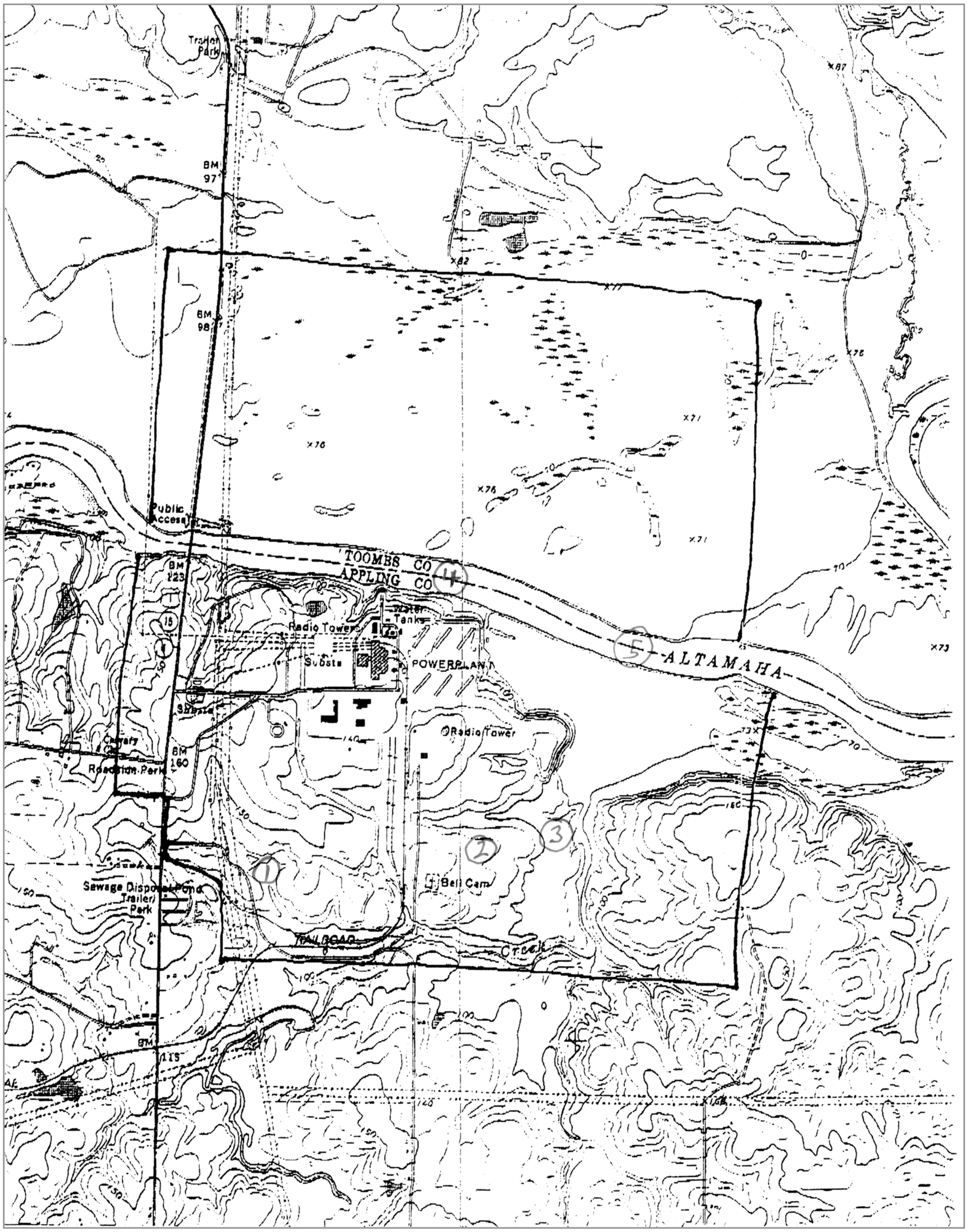
If I can be of further assistance, please let me know.

Sincerely,

Greg Krakow
Data Manager

GK/gk
enclosures

Letter C-2. Georgia Department of Natural Resources letter (page 2 of 9).



Letter C-2. Georgia Department of Natural Resources letter (page 3 of 9).

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Special Concern Animals Potentially Occurring in Toombs County

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Acantharchus pomotis MUD SUNFISH	G5	S3			Blackwater streams; bays; cypress/gum ponds
Acipenser brevirostrum SHORTNOSE STURGEON	G3	S2	LE	E	Brownwater rivers; tidal rivers; estuaries
Aimophila aestivalis BACHMAN'S SPARROW	G3	S3		R	Open pine or oak woods; old fields; brushy areas
Alasmidonta arcula ALTAMAHA ARC-MUSSEL	G1G2	S3			Altamaha River
Alosa alabamae ALABAMA SHAD	G4	S1		U	Brownwater & blackwater streams
Ambystoma cingulatum FLATWOODS SALAMANDER	G2G3	S3		R	Pine flatwoods; moist savannas; cypress/gum ponds
Ammodramus henslowii HENSLOW'S SPARROW	G3G4	S3			Fields; meadows
Anodonta couperiana BARREL FLOATER	G3G4	S?			Habitat data is not available
Anodonta gibbosa INFLATED FLOATER	G1G3	S3?			Habitat data is not available
Catharus fuscescens VEERY	G5	S4			Moist deciduous woods; streamside thickets
Cordulegaster sayi SAY'S SPIKETAIL	G1G2	S2			Habitat data is not available
Cyprinella callisema OCMULGEE SHINER	G3	S3			Blackwater & brownwater streams
Cyprinella leedsi BANNERFIN SHINER	G3	S3S4			Blackwater & brownwater streams
Drymarchon corais couperi EASTERN INDIGO SNAKE	G4T3	S3	LT	T	Sandhills; pine flatwoods; dry hammocks
Elanoides forficatus AMERICAN SWALLOW-TAILED KITE	G5	S2		R	River swamps; marshes
Elliptio dariensis GEORGIA ELEPHANT-EAR	G3	S3			Habitat data is not available
Elliptio hopetonensis ALTAMAHA SLABSHELL	G3	S4			Habitat data is not available
Elliptio shepardiana ALTAMAHA LANCE	G2	S4			Brownwater rivers
Elliptio spinosa GEORGIA SPINY MUSSEL	G1	S2			Altamaha River
Enneacanthus chaetodon BLACKBANDED SUNFISH	G5	S1S2		R	Blackwater streams; bays; cypress/gum ponds
Etheostoma parvipinne GOLDSTRIPE DARTER	G4G5	S2		R	Blackwater & brownwater streams; springs
Etheostoma serriferum SAWCHEEK DARTER	G5	S3			Blackwater & brownwater streams; lakes

Letter C-2. Georgia Department of Natural Resources letter (page 4 of 9).

Page Number 2 of 3 Report Generated 27 February 1998

Special Concern Animals Potentially Occurring in Toombs County

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Eumeces egregius MOLE SKINK	G4	S3			Coastal dunes; longleaf pine-turkey oak woods; dry hammocks
Eurycea longicauda LONGTAIL SALAMANDER	G5	S2			Moist woods near streams or springs; cave entrances
Falco peregrinus PEREGRINE FALCON	G4	S1	E(S/A)	E	Rocky cliffs & ledges; seacoasts
Falco sparverius paulus SOUTHEASTERN AMERICAN KESTREL	G5T3T4	S3			Pine forests; pine savannas
Farancia erytrogramma RAINBOW SNAKE	G5	S3			River swamps; springs; sandy fields near water
Fundulus chrysotus GOLDEN TOPMINNOW	G5	S3			Blackwater streams; ponds; bays; brackish streams
Gopherus polyphemus GOPHER TORTOISE	G3	S3		T	Sandhills; dry hammocks; longleaf pine-turkey oak woods
Haliaeetus leucocephalus BALD EAGLE	G4	S2	LTNL	E	Edges of lakes & large rivers; seacoasts
Heterodon simus SOUTHERN HOGNOSE SNAKE	G4G5	S3			Open, sandy woods; fields; floodplains
Hybognathus regius EASTERN SILVERY MINNOW	G5	S3?			Blackwater & brownwater streams
Kinosternon baurii STRIPED MUD TURTLE	G5	S3			River swamps; sloughs; ponds; marshes
Lampropeltis triangulum MILK SNAKE	G5	S2			Open woods; fields; forests
Lampsilis dolabraeformis ALTAMAHA POCKETBOOK	G2	S2?			Habitat data is not available
Lampsilis splendida RAYED PINK FATMUCKET	G3	S3?			Habitat data is not available
Lasiurus intermedius NORTHERN YELLOW BAT	G4G5	S2S3			Wooded areas near open water or fields
Limnothlypis swainsonii SWAINSON'S WARBLER	G4	S3S4			Habitat data is not available
Micrurus fulvius EASTERN CORAL SNAKE	G5	S3			Hardwood forests; pine flatwoods; dry hammocks; marshes
Mycteria americana heronry WOOD STORK	G4	S2	LENL	E	Cypress/gum ponds; marshes; river swamps; bays
Necturus punctatus DWARF WATERDOG	G4	S2			Blackwater streams
Notophthalmus perstriatus STRIPED NEWT	G2G3	S2		R	Pine flatwoods; ponds; ditches
Notropis harperi REDEYE CHUB	G4	S1		R	Springs & small streams
Nyctanassa violacea YELLOW-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds

Letter C-2. Georgia Department of Natural Resources letter (page 5 of 9).

Page Number 3 of 3 Report Generated 27 February 1998

Special Concern Animals Potentially Occurring in Toombs County

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Nycticorax nycticorax BLACK-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds
Ophisaurus attenuatus SLENDER GLASS LIZARD	G5	S3			Open woods; savannas; old fields; edges of streams & ponds; sandhills
Ophisaurus mimicus MIMIC GLASS LIZARD	G3	S2			Pine flatwoods
Pandion haliaetus OSPREY	G5	S3			Lakes; rivers; seacoasts
Picoides borealis RED-COCKADED WOODPECKER	G3	S2	LE	E	Open pine woods; pine savannas
Pituophis melanoleucus mugitus FLORIDA PINE SNAKE	G5T3?	S3			Upland forests; grasslands; floodplains; old field
Pseudotriton montanus MUD SALAMANDER	G5	S4			Swamps; muddy seeps; springs
Pteronotropis hypselopterus SAILFIN SHINER	G5	S3			Blackwater & brownwater streams
Rana capito GOPHER FROG	G4	S?	C		Floodplains; wet meadows; pastures; ponds
Sciurus niger shermani SHERMAN'S FOX SQUIRREL	G5T2	S?			Pine forests; pine savannas
Toxolasma pullus SAVANNAH LILLIPUT	G3	S2			Altamaha River; Savannah River
Villosa delumbis EASTERN CREEKSHELL	G3G4	S?			Habitat data is not available

Letter C-2. Georgia Department of Natural Resources letter (page 6 of 9).

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Special Concern Plants Potentially Occurring in Toombs County — 65 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Agalinis aphylla SCALE-LEAF PURPLE FOXGLOVE	G3G4	S2S3?			Longleaf pine-wiregrass savannas; pine flatwoods
Agalinis filicaulis SPINDLY PURPLE FOXGLOVE	G3G4	S2?			Seasonally wet, longleaf pine-wiregrass savannas; grassy pine barrens
Agrimonia incisa CUTLEAF AGRIMONY; CUTLEAF HARVEST LICE	G3	S3			Mixed oak-hickory forests, pine savannas, mesic hardwood forests
Amorpha georgiana var. georgiana GEORGIA INDIGO-BUSH	G3T2	S1			Fluvial terraces: pine-shrub-wiregrass terraces along rivers and major streams
Amphicarpum muehlenbergianum BLUE MAIDENCANE, FLORIDA GOOBER GRASS	G4	S3?			Pine flatwoods
Andropogon mohrii BOG BLUESTEM	G4?	S2?			Longleaf pine-wiregrass savannas; pine-cypress savannas
Apteria aphylla NODDING NIXIE	G4	S3			Mesic hardwoods or magnolia-beech bluff forests
Aristida condensata SANDHILL THREE-AWN GRASS	G4?	S3?			Sandridges
Astragalus michauxii SANDHILL MILKVETCH	G3	S2			Longleaf pine-wiregrass savannas; turkey oak scrub
Balduina atropurpurea PURPLE HONEYCOMB HEAD	G2G3	S2		R	Wet savannas, pitcherplant bogs
Calamintha ashei OHOOPEE DUNES WILD BASIL	G3	S2		T	Ohoopee dunes
Carex dasycarpa VELVET SEDGE	G4?	S3		R	Evergreen hammocks; mesic hardwood forests
Carex decomposita CYPRESS-KNEE SEDGE	G4	S2?			Swamps and lake margins on floating logs
Ceratiola ericoides ROSEMARY	G4	S2		T	Ohoopee Dunes; deep sandridges
Chrysoma pauciflosculosa WOODY GOLDENROD	G4G5	S3			Ohoopee dunes; sandridges
Delphinium carolinianum CAROLINA LARKSPUR	G5	S3			Granite outcrops; rocky, calcareous oak forests; Altamaha Grit outcrops
Elliottia racemosa GEORGIA PLUME	G2G3	S2S3		T	Scrub forests; Altamaha Grit outcrops; open forests over ultramafic rock
Epidendrum conopseum GREEN-FLY ORCHID	G3G4	S3		U	Epiphytic in bottomland hardwoods and magnolia-beech bluff forests, also Altamaha Grit outcrops
Evolvulus sericeus var. sericeus CREEPING MORNING-GLORY	G5T?	S1		E	Altamaha Grit outcrops; open calcareous uplands
Fothergilla gardenii DWARF WITCH-ALDER	G4	S2		T	Openings in low woods; swamps

Letter C-2. Georgia Department of Natural Resources letter (page 7 of 9).

Page Number 2 of 3 Report Generated 14 January 1998

Special Concern Plants Potentially Occurring in Toombs County 65 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Habenaria quinqueseta var. quinqueseta MICHAUX ORCHID	G4G5T?	S1			Moist shade, Altamaha Grit outcrops; open pine woods
Ilex amelanchier SERVICEBERRY HOLLY	G4	S2			Wet, sandy thickets; cypress-gum swamps
Ipomopsis rubra STANDING CYPRESS	G4G5	S3			Granite outcrops; sandridges
Isoetes melanopoda BLACK-FOOTED QUILLWORT	G5	S1?			Clayey soils in low woods; sandstone or granite outcrop seeps
Krameria lanceolata SANDBUR	G5	S3?			Longleaf pine-wiregrass sandridges
Lachnocaulon beyrichianum SOUTHERN BOG-BUTTON	G2G3	S1			Flatwoods
Lechea deckertii DECKERT PINWEED	G4G5	S1?			Scrub
Lechea torreyi TORREY PINWEED	G4G5	SU			Flatwoods; pond margins; scrub
Liatris pauciflora FEW-FLOWER GAY-FEATHER	G4G5	S2?			Sandridge scrub
Lindera melissifolia PONDBERRY	G2	S1	LE	E	Pond margins and wet savannas
Listera australis SOUTHERN TWAYBLADE	G4	S2			Poorly drained circumneutral soils
Litsea aestivalis PONDSPICE	G3	S2		T	Cypress ponds; swamp margins
Macranthera flammea FLAME FLOWER	G3	S2?			Wet, sandy thickets; pitcherplant bogs
Marshallia ramosa PINELAND MARSHALLIA	G2	S2		R	Altamaha Grit outcrops; open forests over ultramafic rock
Matelea flavidula YELLOW MILKVINE	G3	SU			Open bluff forests; floodplain forests
Matelea pubiflora TRAILING MILKVINE	G3G4	S2		R	Exposed sandy soils; sandridges
Nestronia umbellula INDIAN OLIVE	G4	S2		T	Oak-hickory-pine woods with heath understory; rocky or sandy woods;
Oxypolis ternata TERNATE COWBANE	G3	S2			Wet pine savannas and bogs
Penstemon dissectus GRIT BEARDTONGUE	G2?	S2		R	Altamaha Grit outcrops and adjacent pine savannas; rarely sandridges
Phaseolus polystachios var. sinuatus TRAILING BEAN-VINE	G4T3	S2?			Sandhills; dry pinelands and hammocks
Pieris phillyreifolia CLIMBING HEATH	G3?	S3			Cypress ponds; epiphytic on cypress bark
Platanthera integra YELLOW FRINGELESS ORCHID	G4	S2			Wet savannas, pitcherplant bogs
Platanthera nivea SNOWY ORCHID	G5	S3			Wet savannas, pitcherplant bogs

Letter C-2. Georgia Department of Natural Resources letter (page 8 of 9).

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Special Concern Plants Potentially Occurring in Toombs County 65 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Polanisia tenuifolia SLENDERLEAF CLAMMY-WEED	G5	S3			Sandridges; scrub
Polygala leptostachys GEORGIA MILKWORT	G2G4	S1			Oak-pine scrub
Quercus austrina BLUFF WHITE OAK	G5	S3?			Bluff forests; floodplain hammocks
Rhynchospora culixa GEORGIA BEAKRUSH	G1	SH			Pine savannas; flatwoods
Rhynchospora punctata PINELAND BEAKRUSH	G1?	S1?			Wet savannas, pitcherplant bogs
Rudbeckia nitida var. nitida YELLOW CONEFLOWER	G3?T1T3	S3?			Wet savannas, pitcherplant bogs; cypress ponds
Sarracenia flava YELLOW FLYTRAP	G4G5	S3S4		U	Wet savannas, pitcherplant bogs
Sarracenia minor HOODED PITCHERPLANT	G4	S4		U	Wet savannas, pitcherplant bogs
Sarracenia psittacina PARROT PITCHERPLANT	G4	S2S3		T	Wet savannas, pitcherplant bogs
Sarracenia purpurea PURPLE PITCHERPLANT	G5	S1		E	Swamps, wet rhododendron thickets
Sarracenia rubra SWEET PITCHERPLANT	G3	S2		E	Atlantic white cedar swamps; wet meadows
Schizachyrium stoloniferum BLUESTEM	G3G4Q	S2?			Longleaf pine-wiregrass savannas
Scutellaria mellichampii SKULLCAP	G?	S1?			Sandy deciduous woods
Sideroxylon sp. 1 OHOOPEE BUMELIA	G2Q	S3?			Dry longleaf pine woods with oak understory
Silene caroliniana CAROLINA PINK	G5	S2?			Granite outcrops and sandhills near the Ogeechee and Savannah Rivers
Sium suave WATER-PARSNIP	G5	S2			Swamps
Sporobolus teretifolius WIRE-LEAF DROPSEED	G1G2	S2?			Longleaf pine-wiregrass savannas, pitcherplant bogs
Stewartia malacodendron SILKY CAMELLIA	G4	S2		R	Steepheads, bayheads; edges of swamps
Stylisma pickeringii var. pickeringii PICKERING MORNING-GLORY	G4?T2T3	S2		T	Open, dry, oak scrub of sandhills
Uvularia floridana FLORIDA BELLWORT	G3?	S3?			Mixed oak-hickory forests; mesic hardwoods or magnolia-beech bluff forests
Warea cuneifolia SANDHILL-CRESS	G4	S3			Sandhills scrub
Zigadenus leimanthoides DEATH-CAMUS	G4Q	S1			Sandhill bogs; pine flatwoods

Letter C-2. Georgia Department of Natural Resources letter (page 9 of 9).

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

September 15, 1999 LRS-99-001

U.S. Fish and Wildlife Service
Ecological Services Field Office
247 South Milledge Avenue
Athens, Georgia 30605

Attn: Ms. Sandra Tucker, Field Supervisor

Re: Request for "no effect" determination regarding License Renewal Activity.

Southern Nuclear Operating Company ("SNC") is preparing an application to renew the Edwin I. Hatch ("HNP") Nuclear Power Plant operating licenses consistent with the U.S. Nuclear Regulatory Commission ("NRC") regulations. This application would provide for an additional 20 years of operation beyond the current license term. As part of the license renewal process, the NRC requires applicants to identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities.

HNP Unit 1 began commercial operation December 31, 1974 and is licensed to operate through August 5, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed through June 13, 2018. The Plant is in Appling County, Georgia, approximately 11 miles north of the town of Baxley. HNP's six transmission lines cross 17 counties in the Coastal Plain of Georgia (see attached figure for details).

SNC recently conducted surveys of the HNP site and associated transmission line rights-of-way. No federally listed species were found on the plant site property, but several listed species were observed (or evidence of these species was found) in or adjacent to existing transmission line corridors. A report detailing the findings of the threatened and endangered species surveys is enclosed.

Page 1 of 3

Letter C-3. U.S. Fish and Wildlife Services letter (page 1 of 4).

LR-99-001
Re: Request for "no effect" determination regarding License Renewal Activity.
Page 2 of 3

Two federally-listed species not recorded in the 1998-1999 surveys, the threatened bald eagle and endangered wood stork, have been observed by Georgia Power Company biologists and natural resources managers in the general area of the Plant, but neither species is believed to nest in the vicinity of the Plant. Bald eagles have been seen foraging along the Altamaha River upstream and downstream of HNP. Wood storks have been observed in a beaver pond wetland just east of the HNP cooling towers.

In addition to the surveys of terrestrial plants and animals, SNC conducted a freshwater mussel survey in a 12-mile reach of the Altamaha River up and downstream of HNP in September 1998. Collections were dominated by species that are endemic to the Altamaha River system and species that are considered "Species of Concern" by the USFWS and Georgia DNR because the status of their populations is not known. None of the mussel species collected were state or federally-listed. A copy of the *Freshwater Mussel Survey: Altamaha River/Appling and Toombs Counties, Georgia* is enclosed. Note that a copy of this survey has already been sent to Mr. Greg Masson of your Brunswick office.

SNC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed species. Thus, SNC has no plans to alter current operations for the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. The license renewal would not constitute a "major construction activity" because no expansion of existing facilities is planned, and no additional land disturbance is anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that a renewed license would have no effect on listed or proposed endangered or threatened species and that formal consultation is not necessary.

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by October 22, 1999 to enable us to meet our application preparation schedule.

Sincerely,

C. R. Pierce
License Renewal Services Manager

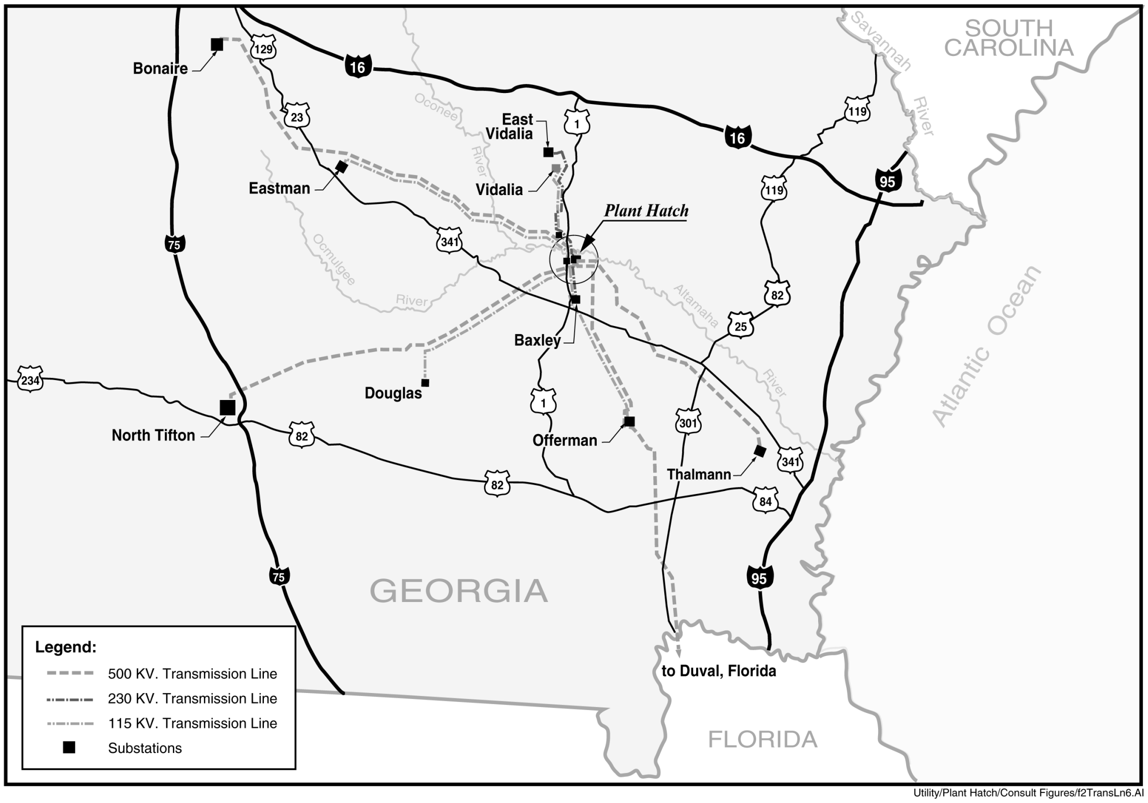
CRP/JTD
Attachment

Letter C-3. U.S. Fish and Wildlife Services letter (page 2 of 4).

LR-99-001
Re: Request for "no effect" determination regarding License Renewal Activity.
Page 3 of 3

CC: Greg Masson, USFWS – Brunswick
Mark Bowers, USFWS – Piedmont NWR
P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter C-3. U.S. Fish and Wildlife Services letter (page 3 of 4).



Edwin I. Hatch Nuclear Plant Transmission Lines.

Letter C-3. U.S. Fish and Wildlife Services letter (page 4 of 4).

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World SM

September 15, 1999 LRS-99-002

National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702

Attn: Mr. Charles Oravetz, Chief, Protected Species Branch

Re: Request for "no effect" determination regarding License Renewal Activity.

Southern Nuclear Operating Company ("SNC") is preparing an application to renew the Edwin I. Hatch ("HNP") Nuclear Power Plant operating licenses consistent with the U.S. Nuclear Regulatory Commission ("NRC") regulations. This application would provide for an additional 20 years of operation beyond the current license term. As part of the license renewal process, the NRC requires applicants to identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities.

NRC guidance directs license applicants to consult with the appropriate agency to determine whether threatened or endangered species are present and whether they would be adversely affected by the proposed action.

HNP Unit 1 began commercial operation December 31, 1974, and is licensed to operate through August 6, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed through June 13, 2018. The Plant is in Appling County, Georgia, approximately 11 miles north of the town of Baxley. Generating facilities for HNP lie on the south bank of the Altamaha River, just east of U.S. Highway 1 (see attached figures). The Altamaha River is approximately 500 feet wide and as deep as 30 feet in the area of HNP, and is bordered by a mature floodplain forest.

Page 1 of 3

Letter C-4. National Marine Fisheries Service letter (page 1 of 5).

LR-99-002
RE: Request for "no effect" determination regarding License Renewal Activity.
Page 2 of 3

One Federally listed aquatic species, the anadromous shortnose sturgeon (*Acipenser brevirostrum*) is known to occur in the Altamaha River in the vicinity of Plant Hatch. The *Final Environmental Statement* (FES) *Related to Operation of Edwin I. Hatch Nuclear Plant Unit No. 2* (NRC 1978) reported that one adult shortnose sturgeon and three larval sturgeon were collected during three years (1972-1975) of pre- and post-operational monitoring in the Altamaha River near the Plant. The NRC concluded in the FES that losses of adult fish (due to impingement) and ichthyoplankton (due to entrainment) as a result of operation of both units of HNP would not be significant. The NRC also concluded that the thermal (discharge) plume would not present a barrier to migrating fish, including the shortnose sturgeon because the thermal plume would be small and restricted to a surface layer.

Additional studies conducted by Georgia Power in 1974, 1975, 1976, 1979, and 1980 (summarized in the Plant Hatch 316(b) Demonstration, dated March 1981) confirmed that the operation of two nuclear units at HNP has minimal impact on fish populations in the Altamaha River. No shortnose sturgeons were collected in these impingement and entrainment studies. Annual impingement rate estimates ranged from 146 fish per year to 438 fish per year. The hogchoker, *Trinectes maculatus*, was the species most often impinged and the only species collected every year in impingement samples. Estimated entrainment losses of fish, larvae, and eggs were less than one percent of the total number present in 1974, 1975, 1976, 1979, and 1980 spawning seasons, with the exceptions of three months (July, August, and September) in 1980. This was a period when a severe drought dramatically reduced river flows. It should be noted that all of the anadromous fish species that are found in the Altamaha including the shortnose sturgeon would have completed their spawning runs by late summer and would not normally be affected by these low river conditions. Catostomids, cyprinids, and centrarchids dominated the entrainment samples.

SNC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed species, including the shortnose sturgeon. SNC has no plans to alter current patterns of operation over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no major structural modifications are anticipated in support of license renewal. We therefore request your concurrence with our determination that the license renewal would have no effect on listed or proposed endangered or threatened species and that formal consultation is not necessary.

Letter C-4. National Marine Fisheries Service letter (page 2 of 5).

LR-99-002
RE: Request for "no effect" determination regarding License Renewal Activity.
Page 3 of 3

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by October 22, 1999, to enable us to meet our application preparation schedule. SNC will include a copy of this letter and your response in the Environmental Report that will be submitted as part of the HNP license renewal application should we decide to request renewal.

Sincerely,

C R Pierce

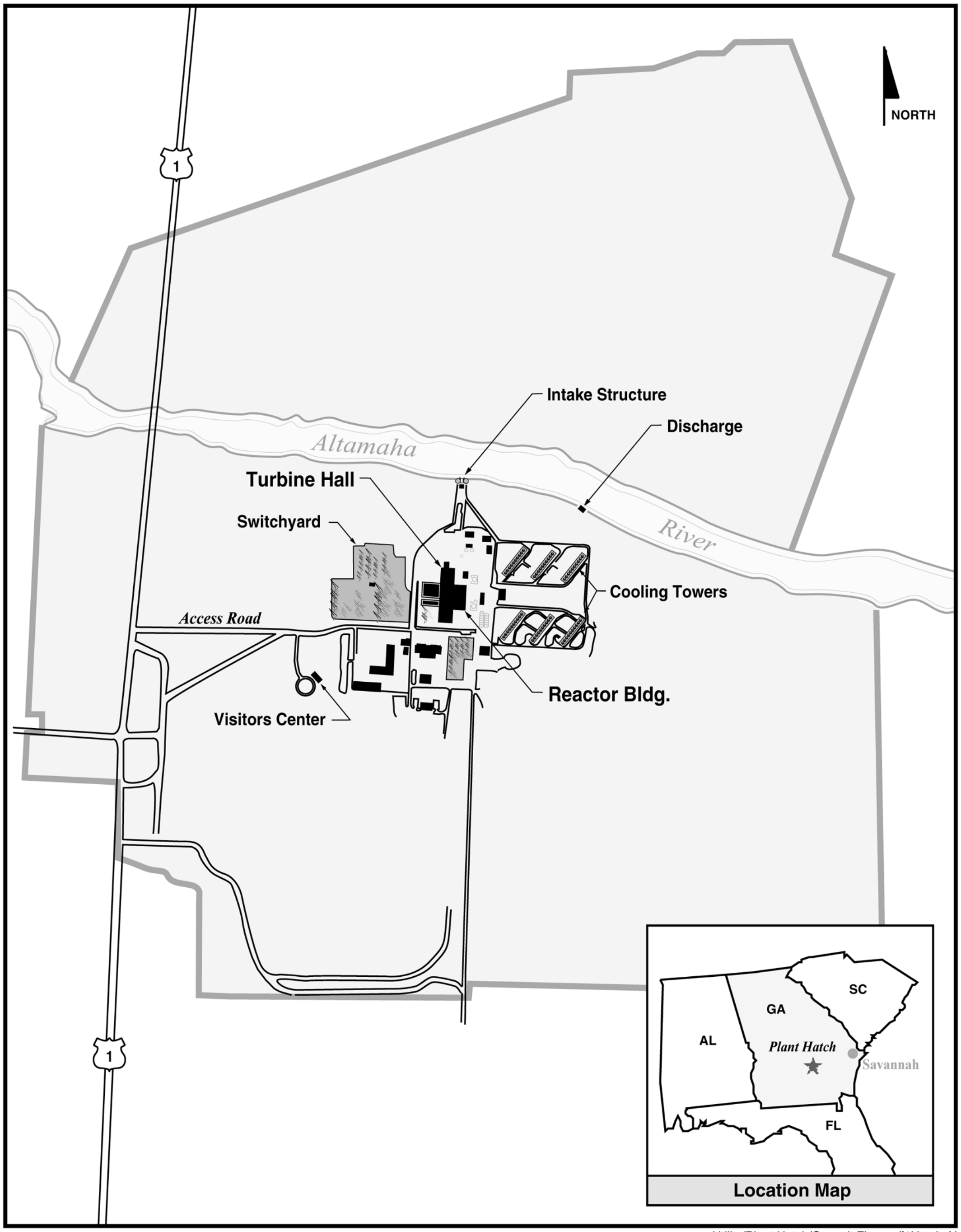
C. R. Pierce
License Renewal Services Manager

CRP/JTD

Attachment

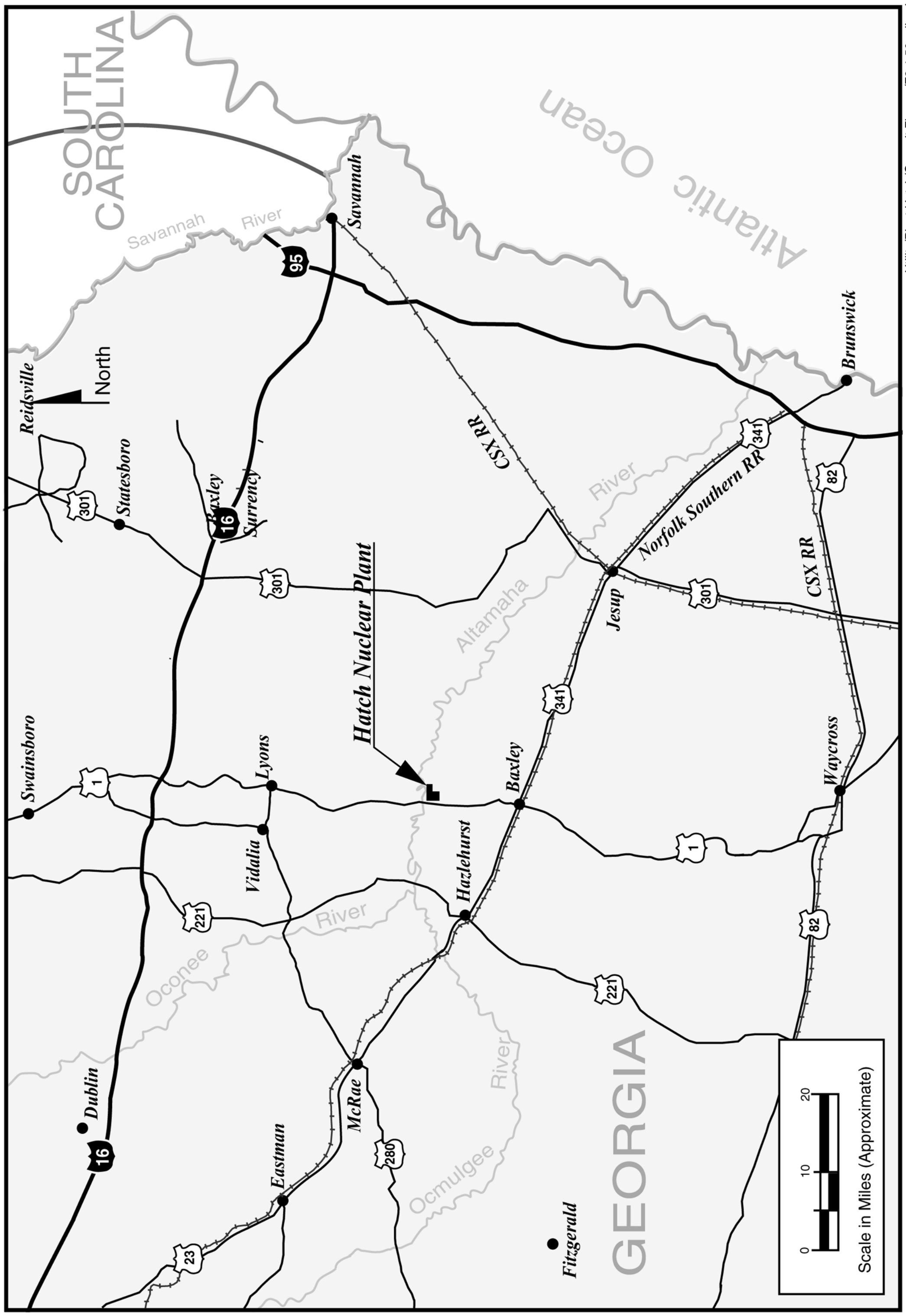
cc: P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter C-4. National Marine Fisheries Service letter (page 3 of 5).



Edwin I. Hatch Nuclear Plant Site.

Letter C-4. National Marine Fisheries Service letter (page 4 of 5).



Utility/Plant Hatch/Consult Figures/F2-1 50-mile.ai

Edwin I. Hatch Nuclear Plant , 50-mile region.

Letter C-4. National Marine Fisheries Service letter (page 5 of 5).

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
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September 15, 1999 LR-99-005

Wildlife Resources Division
Georgia Department of Natural Resources
2070 U.S. Highway 278 SE
Social Circle, Georgia 30025

Attn: Mr. David Waller, Director

Re: E.I. Hatch Nuclear Plant Threatened and Endangered Species Surveys

Southern Nuclear Operating Company ("SNC") is preparing an application to renew the Edwin I. Hatch ("HNP") Nuclear Power Plant operating licenses consistent with the U.S. Nuclear Regulatory Commission ("NRC") regulations. This application would provide for an additional 20 years of operation beyond the current license term. As part of the license renewal process, the NRC requires applicants to identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities.

HNP Unit 1 began commercial operation December 31, 1974, and is licensed to operate through August 5, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed through June 13, 2018. The Plant is in Appling County, Georgia, approximately 11 miles north of the town of Baxley. HNP's six transmission lines cross 17 counties in the Coastal Plain of Georgia (see attached figures for details).

SNC recently conducted surveys of the HNP site and associated transmission line rights-of-way. These surveys were conducted in accordance with the *Edwin I. Hatch Nuclear Plant Environmental Field Survey Plan*, a copy of which was submitted to your organization for comment in September 1998. No federally-listed species were found on the plant site property, but several state and federally-listed species were observed (or evidence of these species was found) in or adjacent to existing transmission line corridors. A report detailing the findings of the threatened and endangered species surveys is enclosed.

Page 1 of 3

Letter C-5. Wildlife Resources Division letter (page 1 of 5).

LR-99-005
RE: E.I. Hatch Nuclear Plant Threatened and Endangered Species Surveys
Page 2 of 3

Two federally-listed species not recorded in the 1998-1999 surveys, the threatened bald eagle and endangered wood stork, have been observed by Georgia Power Company biologists and natural resources managers in the general area of the Plant, but neither species is believed to nest in the vicinity of the Plant. Bald eagles have been seen foraging along the Altamaha River upstream and downstream of HNP. Wood storks have been observed in a beaver pond wetland just east of the HNP cooling towers.

In addition to the surveys of terrestrial plants and animals, SNC conducted a freshwater mussel survey in a 12-mile reach of the Altamaha River up and downstream of HNP in September 1998. Collections were dominated by species that are endemic to the Altamaha River system and species that are considered "Species of Concern" by the USFWS and Georgia DNR because the status of their populations in not known. None of the mussel species collected were state or federally-listed. A copy of the *Freshwater Mussel Survey: Altamaha River/Appling and Toombs Counties, Georgia* is enclosed. Note that a copy to this survey has already been sent to Mr. Bert Deener of your Waycross office.

SNC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed species. SNC has no plans to alter current operations for the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously-disturbed areas. The license renewal would not constitute a "major construction activity" because no expansion of existing facilities is planned, and no additional land disturbance is anticipated in support of license renewal. Accordingly, we ask that you provide comments on the survey reports and concurrence with our determination that license renewal is not likely to have an adverse impact on threatened and endangered species.

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by October 22, 1999, to enable us to meet our application preparation schedule.

Sincerely,

C. R. Pierce

C. R. Pierce
License Renewal Services Manager

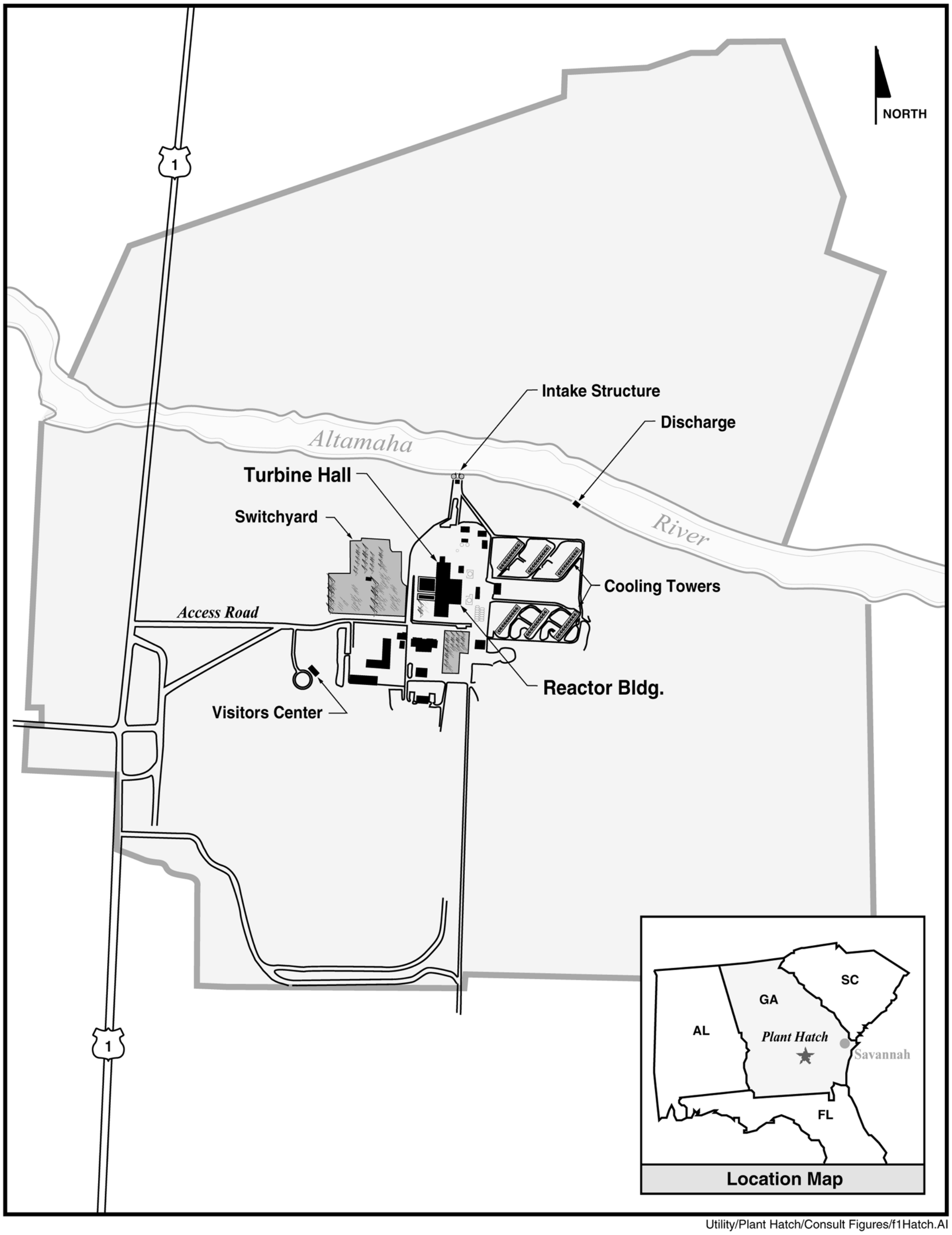
CRP/JTD
Enclosure

Letter C-5. Wildlife Resources Division letter (page 2 of 5) .

LR-99-005
RE: E.I. Hatch Nuclear Plant Threatened and Endangered Species Surveys
Page 3 of 3

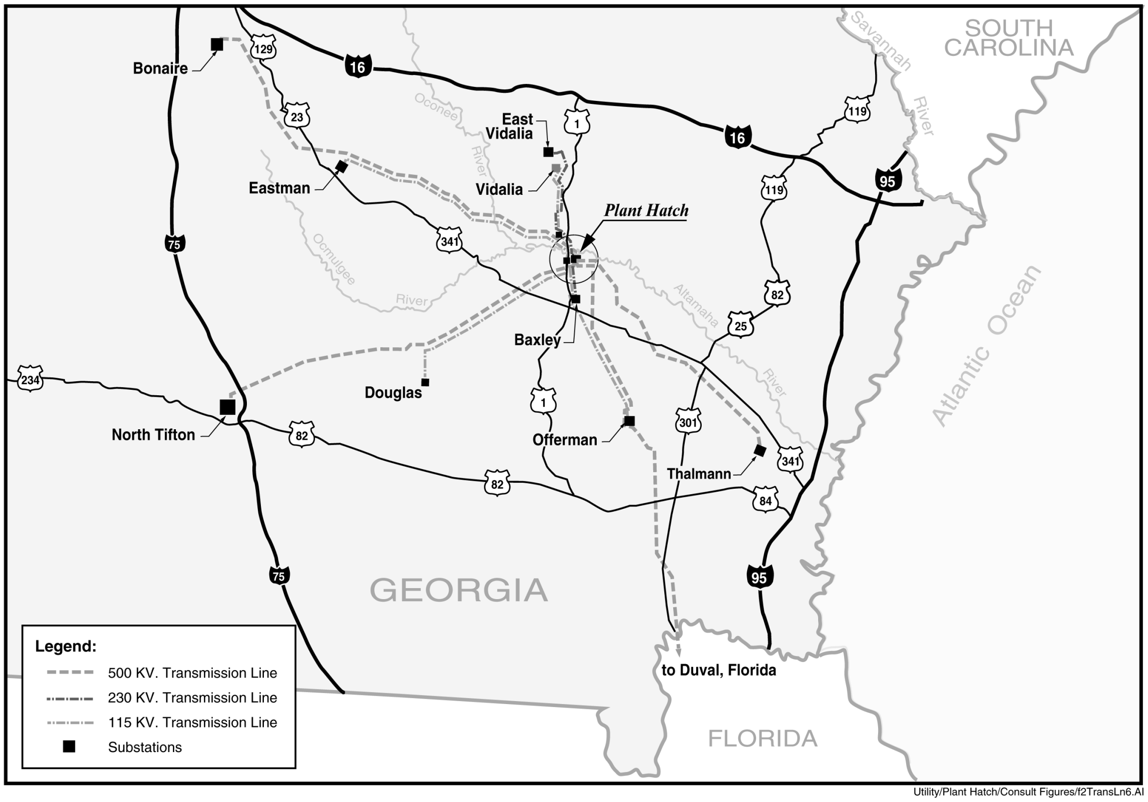
Cc: Bert Deener, Georgia DNR
P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter C-5. Wildlife Resources Division letter (page 3 of 5) .



Edwin I. Hatch Nuclear Plant Site.

Letter C-5. Wildlife Resources Division letter (page 4 of 5) .



Edwin I. Hatch Nuclear Plant Transmission Lines.

Letter C-5. Wildlife Resources Division letter (page 5 of 5) .

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
247 South Milledge Avenue
Athens, Georgia 30605

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

November 8, 1999

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

C.R. Pierce,
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201
Attn: Mr. Jim Davis

Re: FWS Log No. 99-0887

Dear Mr. Pierce:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter dated September 15, 1999, requesting concurrence with Southern Nuclear Operating Company's "no effect" determination with regard to potential impacts to threatened and endangered species associated with license renewal at the Edwin I. Hatch Nuclear Power Plant (Plant Hatch) located on the Altamaha River near the town of Baxley, Appling County, Georgia. Additional information requested by our office during discussions with Mr. Mike Nichols of Georgia Power Company was provided to our office by letter dated October 8, 1999, and included the following supporting materials: U.S. Nuclear Regulatory Commission (NRC) Draft Regulatory Guidance (DG-4005, July, 1998), request for threatened and endangered species information (December 16, 1997), completed threatened and endangered species surveys for Plant Hatch Extension (February 27, 1998), and Sections 2 and 5 of the Environmental Statement for Operation of Plant Hatch (March, 1978). We provide the following comments in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

We are unable to concur with Souther Nuclear Operating Company's determination of "no effect" regarding license renewal. In order to adequately evaluate natural resource impacts associated with the operation of Plant Hatch, we recommend that the NRC and Southern Nuclear evaluate additional relative information must be reviewed including; (1) any reports concerning actual operations at the facility since initial licensing, (2) any operations that may differ from those described in the initial license, (3) any operations that may differ from those described in the initial environmental reviews, (4) proposed or anticipated plant modifications or operational changes, (5) any Notices of Violation (NOV's) concerning operations, maintenance, releases of hazardous materials or exeedences in regulated discharges. In addition, any recorded data concerning actual intake velocities, discharge rates, chemical constituents in the actual discharges, accidents or spills, and any spill contingency plans should be provided. Thermal

1

Letter C-6. USFWS Letter, November 8, 1999 (page 1 of 3) .

discharges should also be characterized and evaluated since the initial reviews in the 1970's relied heavily on modeled predictions and not actual measurements.

The Service is concerned about the potential entrainment of anadromous species and sensitive aquatic species at plant intake structures located in the Altamaha River, and recommends that effective methods to reduce entrainment of fishery resources at the project be evaluated. Entrainment reduction may include incorporation of the best scientifically developed technology available. However, some evaluation of the actual entrainment occurring at the project may also be necessary to quantify impacts to fishery resources due to the unique characteristics of the intake structures.

Many changes in water quality and quantity have occurred since the initial licensing of Plant Hatch. The Service is concerned that excessive thermal discharges may have adverse impacts on water quality and the aquatic environments of the Altamaha River. Of particular concern are high water temperatures and low dissolved oxygen concentrations due to increased Biological Oxygen Demand (BOD) resulting from significantly increased wastewater discharges.

We would encourage Souther Nuclear to further investigate the potential occurrence of the federally threatened flatwoods salamander, (Ambystoma cingulatum), in the vicinity of Plant Hatch and associated transmission line corridors. The flatwoods salamander is known from areas geographically close to Plant Hatch and the Service believes that suitable habitat may exist on the main facility property or within the transmission line corridors. Additionally, information concerning methods used to maintain transmission line corridors (mechanical and chemical) should be discussed and evaluated.

Concurrent to our discussions of potential impacts to natural resources under federal purview, we would strongly encourage Southern Nuclear to coordinate closely with the Georgia Department of Natural Resources, Wildlife Resources Division concerning impacts to aquatic resources of the Altamaha River. Additionally, Section 7 consultation should be initiated with the National Marine Fisheries Service, Protected Species Branch concerning potential impacts to the federally endangered shortnose sturgeon, (Acipencer brevirostrum).

We appreciate the opportunity to be involved in early planning stages of the license renewal process for the Edwin I. Hatch Nuclear Power Plant. While recognizing our statutory obligations to protect federal trust resources, we look forward to working with you in developing a timely license application that reflects Southern Nuclear's committment to protecting the environment. If you should have any questions or require addtitional information, please contact Mr. Mark D. Bowers of my staff at (912) 986-3066.

Sincerely,

Sandra S. Tucker

Sandra S. Tucker
Field Supervisor

2

Letter C-6. USFWS Letter, November 8, 1999 (page 2 of 3) .

cc:
U.S. EPA, Atlanta, GA
GADNR-EPD, Atlanta, GA
GADNR-WRD, Social Circle, GA
NMFS, Charleston, SC
NMFS, Panama City, FL
FWS, GA ES, Brunswick, GA
Altamaha River Keeper
The Nature Conservancy, Darien, GA

3

Letter C-6. USFWS Letter, November 8, 1999 (page 3 of 3) .

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

December 7, 1999 LRS-99-008

U.S. Fish and Wildlife Service
Ecological Services Field Office
247 South Milledge Avenue
Athens, Georgia 30605

Attn: Ms. Sandra Tucker, Field Supervisor

Re: FWS Log No. 99-0887

Southern Nuclear Operating Company (SNC) is preparing an application to renew the Edwin I. Hatch Nuclear Plant operating licenses in accordance with Nuclear Regulatory Commission (NRC) regulations. As part of this process, the NRC requires applicants to identify adverse impacts to threatened and endangered species resulting from the continued operation of the facility.

By letters dated September 15, 1999 and October 4, 1999, respectively, SNC provided U.S. Fish and Wildlife Service (USFWS) with reports and other pertinent information assessing the potential impacts of license renewal on threatened and endangered species for review. The information concluded that license renewal would have no significant effect on listed or proposed endangered or threatened species and that formal consultation under Section 7 of the Endangered Species Act was not necessary. USFWS responded by letter dated November 2, 1999, that USFWS could not concur based on the information provided by SNC without clarification of certain issues that were noted in the referenced correspondence.

SNC met with Mr. Mark Bowers of your staff on November 30, 1999, in order to clarify the issues noted in the November 2, 1999 letter, and develop a thorough understanding of the information necessary for USFWS to complete an assessment of the potential impacts to threatened and endangered species associated with license renewal. Based on discussions with Mr. Bowers, the following additional information is provided in response to the issues outlined in your November 2, 1999 letter.

Letter C-7. SNC Letter to USFWS, December 7, 1999 (page 1 of 10) .

LRS-99-008
Page 2 of 3

The USFWS November 2, 1999 letter recommended that specific information be evaluated relative to the relicensing of Plant Hatch including: (1) reports concerning actual operation of the facility since initial licensing; (2) operations differing from those described in the initial licensing, and environmental reviews; (3) proposed or anticipated plant modifications or operational changes; (4) notice of violations (NOVs) associated with environmental permits and regulations; and (5) recorded data concerning intake velocities, discharge rates, chemical constituents of discharges, spills, and spill contingency plans. USFWS also recommended that thermal discharges be carefully evaluated.

This information is provided to NRC on an ongoing basis. Most of it is provided in accordance with the requirements of Appendix B of the current NRC operating license, known as the Environmental Protection Plan (EPP). The EPP requires the licensee to evaluate changes in plant design or operation with potential for impact to the environment, and inform the NRC of incidents such as spills or permit exceedances that result in significant environmental impact. 10 CFR Section 51.53(c) identifies the environmental information that must be submitted with the license renewal application in the form of an environmental report. The NRC will review the environmental report and relevant historical information in development of the Final Environmental Impact Statement for license renewal.

Thermal discharge information for two-unit operation was provided to Mr. Bowers and discussed in detail in the November 30, 1999 meeting. The "Thermal Plume Model Verification" (Attachment B) documents the field study that was performed to verify the accuracy of the model predicted plume described in the Environmental Impact Statement. The model and field verification demonstrate that thermal discharge to the river does not create thermal blockage or result in significant elevation of water temperature in the Altamaha River.

In the November 2, 1999 letter, USFWS, also indicated a concern with potential impingement and entrainment of sensitive aquatic species by the plant intake structure. This issue was discussed in detail with Mr. Bowers. Accordingly SNC provided copies of the 316(b) demonstration study (Attachment C) which includes five years of impingement data and three years of entrainment data. The study conclusively demonstrates that impingement and entrainment of sensitive aquatic species is not an issue for the Plant Hatch intake structure. SNC has determined that continued operation of Edwin I. Hatch Nuclear Plant is "not likely to adversely affect" sensitive aquatic species from entrainment or impingement.

In the November 2, 1999 letter, USFWS also expressed a concern related to the need for further investigation of the potential occurrence of the federally threatened flatwoods salamander (Ambystoma cingulatum) in the vicinity of Plant Hatch. The flatwoods salamander habitat and occurrence were evaluated in the Threatened and Endangered Species Survey provided in previous correspondence. The conclusion of this survey report has been revised to note that flatwoods salamander habitat can possibly occur

Letter C-7. SNC Letter to USFWS, December 7, 1999 (page 2 of 10) .

adjacent to or within the transmission corridors. The "Biological Information Update, Edwin I. Hatch Nuclear Plant, License Renewal" (Attachment A) discusses the flatwoods salamander habitat and the impact of maintenance activities within the transmission corridors. SNC has determined that continued operation of Edwin I. Hatch Nuclear Plant is "not likely to adversely affect" the flatwoods salamander.

Lastly, USFWS encouraged SNC to consult with Georgia Department of Natural Resources, Wildlife Services Division, and National Marine Fisheries Service (NMFS), Protected Species Branch relative to the potential impacts from license renewal on the shortnose sturgeon (Acipenser brevirostrum). SNC has formally contacted both agencies and is currently engaged in discussions relative to impact of license renewal on the shortnose sturgeon with NMFS. A copy of the "Biological Information Update, Edwin I. Hatch Nuclear Plant, License Renewal" developed by SNC discusses the shortnose sturgeon and is provided for your information as Attachment A.

We appreciate your efforts in developing the information necessary to analyze threatened and endangered species issues associated with Plant Hatch license renewal. SNC request, that USFWS provide concurrence letter upon the completion of your review of this additional material.

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by December 17, 1999 to enable us to meet our application preparation schedule.

Sincerely,

C. R. Pierce
License Renewal Services Manager

CRP/JTD
Attachments

CC: Greg Masson, USFWS – Brunswick
Mark Bowers, USFWS – Piedmont NWR
David Bernhart, NMFS – St. Petersburg
P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter C-7. SNC Letter to USFWS, December 7, 1999 (page 3 of 10) .

Biological Information Update
Edwin I Hatch Nuclear Plant
License Renewal

Letter C-7. Attachment (page 4 of 10) .

Table of Contents

Letter C-7. Attachment (page 5 of 10) .

I. INTRODUCTION

The purpose of this report is to provide additional information concerning Edwin I. Hatch Nuclear Plant to address questions raised by U. S. Fish and Wildlife Services concerning the Flatwoods Salamander and the Shortnose Sturgeon. The report summarizes plant information and existing data related to the Flatwoods Salamander and the Shortnose Sturgeon.

II. PROPOSED ACTION

The proposed action is the renewal of existing NRC operating licenses NPF-5 and DPR-57 for Edwin I. Hatch Nuclear Plant Units 1 and 2 respectively. HNP Unit 1 began commercial operation December 31, 1974, and is licensed to operate through August 6, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed to operate through June 13, 2018. NRC regulations (10 CFR Part 54) allow license renewal for periods of up to 20 years, which would extend the operation of Unit 1 to August 6, 2034 and extend the operation of Unit 2 to June 13, 2038.

III. SITE DESCRIPTION

The Edwin I. Hatch Nuclear Plant (HNP) is a steam-electric generating facility operated by Southern Nuclear Operating Company (SNC). HNP is located in Appling County, Georgia southeast of where U.S. Highway 1 crosses the Altamaha River. It is approximately 11 miles north of Baxley, Georgia; 98 miles southeast of Macon, Georgia; 73 miles northwest of Brunswick, Georgia; and 67 miles southwest of Savannah, Georgia. The Universal Transverse Mercator coordinates of the Unit 2 reactor (to the nearest 100 meters) are Zone 17R LF 3,533,700 meters North and 372,900 meters East. These coordinates correspond to latitude 31 degrees, 56 minutes, and 4 seconds North and longitude 82 degrees, 20 minutes, and 39 seconds West.

HNP is a two-unit plant. Each unit is equipped with a General Electric Nuclear Steam Supply System that utilizes a boiling-water reactor with a Mark I containment design. Both units were originally rated at 2,436 megawatt-thermal and designed for a power level corresponding to approximately 2,537 megawatt-thermal. Both units are now licensed for 2,763 megawatt-thermal (63 FR 53473-53478, October 5, 1998). The Plant withdraws water for cooling from the Altamaha River via shoreline intake and discharges via offshore discharge structures. Main Condenser cooling is provided by closed loop mechanical draft cooling towers. Descriptions of HNP can be found in documentation submitted to U.S. Nuclear Regulatory Commission (NRC) for the original operating license and subsequent license amendments. Georgia Power Company (GPC) submitted environmental reports for the construction stage and operating license stage for HNP in 1971 and 1976, respectively (References 1 and 2). In 1972, the Atomic Energy Commission (AEC)[1] issued a Final Environmental Statement (FES) for Units 1 and 2 (Reference 3), and in 1978 issued a FES for Unit 2 (Reference 4). The FES evaluates the environmental impacts from plant construction and operation in accordance with the National Environmental Policy Act (NEPA).

The excess heat produced by HNP's two nuclear units is absorbed by cooling water flowing through the condensers and the service water system. As stated above, main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating water system is a closed-loop cooling system that utilizes three (3) cross-flow mechanical-draft cooling towers and one (shared) counter-flow mechanical-draft cooling tower for dissipating waste heat to the atmosphere.

Letter C-7. Attachment (page 6 of 10) .

1. Predecessor agency to NRC.

SNC is permitted by Georgia DNR (GADNR Permit 001-0690-01) to withdraw surface water for cooling and other uses. For both Units, cooling water is withdrawn from the Altamaha River through a single intake structure. The intake structure is located along the southern shoreline of the Altamaha River and is positioned so that water is available to the plant at both minimum flow and probable flood conditions. The main river channel is located closer to the northern shoreline. The intake is approximately 150 feet long, 60 feet wide, and approximately 60 feet above normal river level. The water passage entrance is about 27 feet wide and extends from 16 feet below to 33 feet above normal water levels. Large debris is removed by trash racks, while small debris is removed by vertical traveling screens with a 3/8-inch mesh. As a condition of its permit, SNC is required to monitor and report withdrawals. HNP withdraws an annual average of 57.18 million gallons per day (88 cfs).

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 42-inch lines extending approximately 120 feet out from the shore at an elevation of 54 feet mean sea level. The point of discharge is approximately 1,260 feet down-river from the intake structure and approximately 4 feet below the surface when the river is at its lowest level. The U. S. Nuclear Regulatory Commission developed a model which predicted the average expected thermal conditions and extreme thermal conditions under conservative assumptions in the E. I. Hatch Unit 1 and 2 Environmental Impact Statement. They independently noted the small size of the thermal plume even under conservative assumptions, and the lack of the possibility of thermal blockage in the Altamaha River from the plant discharge (Reference 3). The predictive thermal plume model was field-verified during 1980 following commencement of Unit 2 operation (Reference 7).

The National Pollutant Discharge Elimination System (NPDES) Permit for HNP (GA0004120) issued by the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GA DNR) in 1997 requires weekly monitoring of discharge temperatures. The permit does not contain temperature limits.

GPC built six transmission lines for the specific purpose of connecting HNP to the transmission system. In total, for the specific purpose of connecting HNP to the transmission system, HNP has approximately 340 miles of transmission line corridors that occupy approximately 7,200 acres. GPC plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely.

HNP transmission line corridors pass through land that primarily is a mixture of cultivated land, grazing land, and managed timberlands (paper and pulp stock). Georgia Power Company controls vegetation in transmission corridors to keep vegetation heights low enough to prevent interference with the transmission lines. Corridors in timberlands and in the vicinity of road crossings are maintained on a 3-year cycle by mowing. The current practice may use mowers on dry ground, approved herbicides on low-lying wet areas and stream crossings where mowers cannot be operated, and hand clearing in sensitive wetland areas. In areas inaccessible to mowers, the preferred method of controlling woody plants is to apply herbicide labeled for use in wetlands, such as Accord, with a backpack sprayer. The normal practice for these corridors is to use non-restricted herbicides applied to specific woody vegetation on a three-year schedule. Some portions of the transmission corridors are cultivated by local farmers, and therefore require no additional vegetation maintenance. Private interests, who have agreed to handle vegetation maintenance, are maintaining other portions of the transmission corridors for wildlife enhancement.

Letter C-7. Attachment (page 7 of 10) .

IV. SPECIES EVALUATION

A. Flatwoods Salamander

The historical range of the flatwoods salamander included parts of the States of Alabama, Florida, Georgia, and South Carolina that are in the lower Coastal Plain of the southeastern United States. There are no records of known occurrence of this species for Appling and Toombs County. Surveys of sensitive species have been conducted at the HNP site in the past; the most recent being the "Significant Species Survey" prepared by The Nature Conservancy of Georgia in 1995. An additional set of surveys covering transmission corridors and undeveloped areas of the site were conducted in 1998-1999 (TetraTech/Nus, 1999, Reference 9). The transmission corridors, because of their size, were surveyed by concentrating efforts in areas offering the greatest potential for harboring listed species (e.g. unusual communities such as sandhill seepage bogs). Resources such as aerial photographs, topographic maps, soil surveys, and National Wetlands Inventory maps were used as tools to locate these areas. The survey of the HNP site was accomplished by systematic walkover within all natural habitats. Biologists walked parallel overlapping transects through various natural habitats so that each habitat type was thoroughly searched. Similar surveys were conducted along transmission line corridors. Surveys were conducted in the spring from March 29 through April 14, 1999, and during the summer from May 24 through June 1 and on June 13, 1999. Flatwoods salamanders were not located during these surveys or the earlier "Significant Species Survey". Adults of this species are not expected to occur within the transmission corridors, but may occur in restored long-leaf pine/ wiregrass communities adjacent to suitable breeding habitat. Breeding sites consisting of shallow, ephemeral cypress or swamp tupelo ponds were not found on the HNP site adjacent to suitable adult habitat.

Georgia Power Company's goal is to re-establish the longleaf pine-wiregrass communities that were historically found in the sandhills and Coastal Plain of South Georgia. Several hundred acres of pines, including native longleaf pine, have been planted in formerly agricultural upland areas of the site. Transmission lines may be adjacent to potential breeding sites and cross areas subject to temporary flooding which may be suitable for breeding, but it is not known if suitable habitat for adults is adjacent to these locations and within the range of individuals of this species. Transmission line vegetation control normally consists of herbicide application (Accord) to specific woody vegetation using backpack sprayers. This practice is used to limit the growth of trees and other woody vegetation in the transmission corridors. This method is also used to control woody vegetation in wetland areas. Control of trees and woody vegetation supports the open canopy necessary for breeding of the flatwoods salamander. Vegetation control is conducted on a three-year cycle.

Glyphosate, the active ingredient in Accord, works on the plant, not in the soil. Studies firmly show that Accord will not bioaccumulate and proper use of this product will not result in toxicity in the flatwoods salamander.

There are no modifications proposed for license renewal; therefore no land will be disturbed in a habitat that the flatwoods salamander might be found. Current land management activities in the transmission corridors are protective of the wetland areas and foster habitats favorable to reproduction of flatwoods salamanders. Continued transmission line maintenance associated with license renewal "is not likely to adversely affect" the flatwoods salamander.

Letter C-7. Attachment (page 8 of 10) .

B. Shortnose Sturgeon

Entrainment samples at Plant Edwin I. Hatch were collected for the years 1975, 1976, and 1980. Samples were collected weekly during 1975 and 1976, and monthly in 1980. The results of these surveys are summarized in Plant Edwin I. Hatch 316(b) demonstration on the Altamaha River in Appling County, Georgia (Reference 6). Additional ichthyological drift data are available for 1974 (weekly collection) and 1979 (monthly collection), but were not used in summarizing entrainment rates. Impingement data are available for five years, including 1975, 1976, 1977, 1979, and 1980. Impingement samples include weekly samples in 1975, 1976, and 1977 and monthly samples for 1979 and 1980. Each sample represents impingement for at least a 24-hour period.

Monthly entrainment data for each taxa for 1975, 1976 represent entrainment estimates for Unit 1 operation. The 1980 data includes entrainment estimates for Unit 1 and Unit 2 operation. There was no increase in fish eggs and larvae entrainment. The differences in numbers of fish eggs and larvae are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year.

It was noted in the Edwin I. Hatch Nuclear Plant Annual Environmental Surveillance Report No. 3, January 1 - December 31, 1976, (Georgia Power Company, 1977) that densities of fish and fish eggs during the spawning seasons in 1975 and 1976 fluctuated directly with spawning intensity and inversely with river flow. The same conditions occurred in the 1979 and 1980 studies. Relative abundance of fish families varied during the five years of study, but the Catostomidae and Cyprinidae were the most abundant taxa each year. Clupeidae comprised only a small percentage of the total fish collected with 1980 being the highest (10.9%). The density of most fish groups was greater in night samples than in similar day samples. Shortnose sturgeon larvae where not found in any entrainment samples.

The entrainment estimates assume a uniform distribution of fish eggs and larvae, while the cross section measurements suggest that the greater densities would occur in the channel furthest from the intake (Reference 6, Figure 9). Under normal flow and pumping conditions, the intake velocity is 1.9 feet per second. The measured range of intake velocities was from 0.3 feet per second to 2.7 feet per second. Estimated percent of river flow entrained in Plant Edwin I. Hatch cooling water has remained less than one percent with the exception of the months of July, August, and September, 1980. The increase in estimated percent flow entrained during this period was due to extremely low river elevations resulting from the lack of rainfall.

Five years, 1975, 1976, 1977, 1979, and 1980, of impingement samples were also collected at Plant Edwin I. Hatch. A total of 165 fish representing 22 species were collected. The highest annual number of fish collected in impingement samples was 61 fish in 1975, while the lowest, 14 fish, was in 1980. The data indicates low impingement estimates per day and per year. The 1975 estimates are 1.2 fish per day and 438 per year; 1976 estimates are 0.4 fish per day and 146 per year; 1977 estimates are 1.1 fish per day and 401.5 per year; 1979 estimates are 1.3 fish per day and 474.5 per year; and 1980 estimates are 1.2 fish per day and 438 per year. The hogchoker, Trinectes maculatus, was the most abundant and the only species collected consistently each year. No shortnose sturgeon was collected in impingement samples.

Letter C-7. Attachment (page 9 of 10) .

Biological factors affecting impingement include the resident fish population, daily and seasonal movements to deeper water, feeding behavior, and movement associated with breeding behavior. Physical factors that affect impingement losses include river elevation, intake velocities, and intake location relative to the river cross section. Elevated river levels resulted in a reduction in intake velocities.

It is believed that shortnose sturgeon ages one year and older aggregate in the Altamaha River at or just upstream of the fresh/saltwater interface during the summer. These fish appear to move downstream into more saline water at the end of summer. During late fall and early winter, movement to less saline water occurs and some adults may move upstream toward spawning areas. Spawning is thought to occur during February through March. Some spawning fish move downstream immediately, while other remain upstream (Reference 9).

No spawning aggregation has been identified in the immediate vicinity of E. I Hatch Nuclear Plant. The main channel of the river is located near the northern bank and Plant Hatch's intake structure is located on the southern bank. Entrainment of eggs is unlikely because the shortnose sturgeon eggs are demersal, adhesive, and negatively buoyant. Entrainment of larval fish has been assessed and entrainment rates found to be low. Impingement of healthy juvenile and adult shortnose sturgeon is unlikely considering their strong swimming ability. Five years of data collected for the intake structure has not identified any entrainment or impingement of shortnose sturgeon.

There are no construction modifications of the intake structure, effluent pipes, or changes in operation proposed for the license renewal period. Existing data for impingement and entrainment (Reference 6) and the thermal plume characteristics (Reference 7) demonstrate that renewal of E. I. Hatch Nuclear Plant operating license "is not likely to adversely affect" the shortnose sturgeon.

V. REFERENCES

1. HNP Environmental Report Construction Stage, 1971.
2. HNP Environmental Report Operating License Stage, 1975.
3. Final Environmental Statement for the Edwin I. Hatch Nuclear Plant Unit 1 and Unit 2; Georgia Power Company; Docket Nos. 50-321 and 50-366, Atomic Energy Commission, October 1972.
4. NUREG-0147, Final Environmental Statement for the Edwin I. Hatch Nuclear Plant Unit 2; Georgia Power Company; Docket Nos. 50-366, Atomic Energy Commission, March 1978.
5. NPDES Discharge Monitoring Reports January 1997 – September 1998.
6. Wiltz, J. W., 1981. Plant Edwin I. Hatch 316(b) demonstration on the Altamaha River in Appling County, Georgia. Georgia Power Environmental Affairs Center, March, 1981.
7. Nichols, M. C., and S. D. Holder, 1981. Plant Edwin I Hatch Units 1 and 2 Thermal Plume Model Verification, Georgia Power Company, Environmental Affairs Center, March, 1981.
8. Rogers, S.G, and W. Weber. 1995. Movements of shortnose sturgeon in the Altamaha River system, Georgia. Contribution Series No. 57. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Georgia. 78 pp.
9. Tetra Tech, 1999. Threatened and Endangered Species Survey: E. I. Hatch Nuclear Plant and Associated Transmission Line Corridors (1998-1999). July 9, 1999.

Letter C-7. Attachment (page 10 of 10) .

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE

247 South Milledge Avenue
Athens, Georgia 30605

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

13 JAN 2000

C.R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201
Attn: Mr. Jim Davis

Re: FWS Log No. 99-0887

The U.S. Fish and Wildlife Service (Service) has reviewed your letter of December 13, 1999, concerning potential impacts to threatened and endangered species associated with license renewal at the Edwin I. Hatch Nuclear Power Plant (Plant Hatch) located on the Altamaha River near the town of Baxley, Appling County, Georgia. We have also reviewed the additional information requested in our letter dated November 2, 1999. We provide the following comments in accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, (16 U.S.C. 1531 et seq.).

Based on the information provided, and in coordination with the Georgia Department of Natural Resources, we concur that the relicensing of Plant Hatch would not adversely affect federally threatened or endangered species under purview of the U.S. Fish and Wildlife Service. Consultation under Section 7 (a)(2) of the Endangered Species Act must be re-initiated if any of the following incidents occur: (1) new information reveals impacts of this identified action that may affect listed species in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this assessment; or (3) a new species is listed or critical habitat determined that may be affected by the identified action. As you proceed with consultation on the federally endangered shortnose sturgeon with the National Marine Fisheries Service, we ask that you copy our office so that we may maintain a complete administrative record for the relicensing of Plant Hatch.

We appreciate the opportunity to be involved in early planning stages of the license renewal process for the Edwin I. Hatch Nuclear Power Plant. If you should have any questions or require additional information, please contact Mr. Mark D. Bowers of my staff at (912) 986-3066.

Sincerely,

Sandra S. Tucker

Sandra S. Tucker
Field Supervisor

Letter C-8. USFWS Letter, January 13, 2000 (page 1 of 2) .

cc:
Keith Parsons, GADNR-EPD, Atlanta, GA
Russ England, GADNR-WRD, Social Circle, GA
Prescott Brownell, NMFS, Charleston, SC

Letter C-8. USFWS Letter, January 13, 2000 (page 2 of 2) .

Lonice C. Barrett, Commissioner
David Waller, Director

Georgia Department of Natural Resources
Wildlife Resources Division

2070 U.S. Highway 278, S.E., Social Circle, Georgia 30025
(770) 918-6400

October 13, 1999

Mr. C.R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

Dear Mr. Pierce:

Thank you for your letter of 15 September requesting comments on the rare species surveys conducted as part of an environmental assessment for the proposed license renewal for E.I. Hatch Nuclear Power Plant near Baxley, Georgia. My staff has reviewed the freshwater mussel survey report developed by Law Engineering and Environmental Services, Inc., as well as the terrestrial species survey report submitted by Tetra Tech, Inc. Based on this review, we find the surveys to be adequate for the purpose of assessing potential effects of the license renewal on state-listed and federally-listed species. We concur with your determination that license renewal is not likely to have an adverse impact on threatened and endangered species in the vicinity of the nuclear plant or its transmission corridors.

We appreciate the commitment of Georgia Power Company to protect and enhance rare species habitats within the boundaries of its power plant properties and transmission corridors. In particular, we applaud the stated management goal of restoring and enhancing longleaf pine-wiregrass habitats on the Hatch Nuclear Power Plant property, as well as maintaining species-rich seeps and other wetlands within the powerline corrdors. Once again, thank you for the opportunity to review these rare species survey reports and comment on this project.

Sincerely,

David Waller

David J. Waller

DW/jpa

cc: Jon Ambrose
Mike Harris

Letter C-9. GADNR Wildlife Resource Division Letter, October 13, 1999 (page 1 of 1) .

5131 Maner Road
Smyrna, Georgia 30080
Tel 404.799.2100
Fax 404.799.2141

GEORGIA POWER
A SOUTHERN COMPANY

October 18, 1999

Mr. David Bernhart
National Marine Fisheries Service
9721 Executive Center Drive North
St. Petersburg, Florida 33702

Dear Mr. Bernhart:

Enclosed are copies of additional information requested by Jim Davis for your review. This information is provided as part of the informal consultation for license renewal of E. I. Hatch Nuclear Plant and includes:

> Sections 2 and 5 of the Environmental Statement related to operation of E. I Hatch Nuclear Plant Unit 2 (March 1978).
>
> Plant Edwin I. Hatch 316(b) demonstration on the Altamaha River in Appling County, Georgia (March 1981).

Sections 2 and 5 of the Environmental Statement provide details of the plant site and the environmental assessment conducted by the NRC. The Plant Edwin I. Hatch 316(b) presents five years of entrainment and impingement data collected for this facility.

Please let me know if you need any additional information or have any questions regarding these reports.

Sincerely,

M C Nichols

M. C. Nichols
Environmental Laboratory Manager

cc:

- J. T. Davis, Southern Nuclear
- C. R. Pierce, Southern Nuclear
- C. M. Hobson, Georgia Power

Letter C-10. National Marine Fisheries Letter (page 1 of 1) .

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702
(727)570-5312, FAX 570-5517

OCT - 8 1999

F/SER3:DMB

Mr. C. R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company
P.O. Box 1295
Birmingham, Alabama 35201-1295

Dear Mr. Pierce:

This is in response to your September 15, 1999 letter regarding your application to the Nuclear Regulatory Commission (NRC) to extend the current operating licenses for the Edwin I. Hatch Nuclear Power Plant for an additional twenty years. The plant's Unit 1 began operations in 1974, and Unit 2 began operations in 1979. The proposed application would extend the Units' operations to 2034 and 2038. The Plant is sited in Appling County, Georgia on the south bank of the Altamaha River. The plant has cooling water intake and discharge from and into the river.

The Federally endangered shortnose sturgeon (*Acipenser brevirostrum*) inhabits the Altamaha River and would likely use the areas in the vicinity of the plant during its spawning migration and juvenile development. Little recent data is available on the shortnose sturgeon's status and habitats in the Altamaha; however, population estimates based on tag-recapture work estimated the population at 2,862 in 1988, 798 in 1990, and 468 in 1993. There is concern that the shortnose sturgeon populations in the three major rivers to the south -- the Satilla, St. Mary's, and St. John's -- may have been recently extirpated, as the result of declining water quality. Any adverse effects on shortnose sturgeon through entrainment or impingement at the plant or through decreased water quality could have potentially serious impacts on the Altamaha population and the species as a whole.

Based on the information provided in your letter and the status of the Altamaha River population of shortnose sturgeon, we cannot concur with your determination that Plant operations through 2038 would have no effect on endangered species under National Marine Fisheries Service purview. We recommend that Southern Nuclear and the NRC prepare a more thorough biological assessment of potential effects of plant operation on shortnose sturgeon as required by section 7 of the Endangered Species Act, using the best available data. We appreciate your early notification to us on this issue, and we look forward to working with you and the NRC to ensure that plant operations do not adversely affect listed species.

Letter C-11. NMFS Letter, October 8, 1999 (page 1 of 2) .

If you have any questions, please contact David Bernhart, Fishery Biologist, at (727)570-5312.

Sincerely yours,

Charles A. Oravetz

for William T. Hogarth
Regional Administrator

cc: NRC - Leigh
F/PR3
F/SER45 - Rackley

Letter C-11. NMFS Letter, October 8, 1999 (page 2 of 2) .

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

February 2, 2000 LRS-00-001

National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702

Attn: Mr. Charles Oravetz, Chief, Protected Species Branch

Re: Request for Concurrence Regarding License Renewal Activity.

Southern Nuclear Operating Company (SNC) is preparing an application to renew the Edwin I. Hatch Nuclear Plant operating licenses in accordance with Nuclear Regulatory Commission (NRC) regulations. As part of this process, the NRC requires applicants to identify adverse impacts to threatened and endangered species resulting from the continued operation of the facility.

By letters dated September 15, 1999 and October 18, 1999, respectively, SNC provided National Marine Fisheries Service (NMFS) with reports and other pertinent information assessing the potential impacts of license renewal on threatened and endangered species for review. The information concluded that license renewal would have no significant effect on listed or proposed endangered or threatened species and that formal consultation under Section 7 of the Endangered Species Act was not necessary. NMFS responded by letter dated October 8, 1999, that NMFS could not concur based on the information provided by SNC and recommended a more thorough biological assessment of the potential effects of plant operations on shortnose sturgeon.

SNC met with Mr. David Bernhart of your staff on December 20, 1999, in order to clarify the scope of information necessary to complete the assessment recommended in the October 8, 1999 letter and any other pertinent information that would support the NMFS review. The goal of this meeting was to develop a thorough understanding of the information necessary for NMFS to complete an assessment of the potential impacts to the shortnose sturgeon associated with license renewal.

Letter C-12. SNC Letter to NMFS, February 2, 2000 (page 1 of 73)

LRS-00-001
Page 2 of 3

Based on discussions with Mr. Bernhart during the December 20, 1999, meeting, NMFS recommended that specific additional information be evaluated relative to the relicensing of Plant Hatch including:

- Clarification of referenced larval sturgeon data
- Additional comparative data for impingement of shortnose sturgeon
- Early life history of shortnose sturgeon as it applies to potential effects

Additional information has been developed as requested, including the items identified above, and is attached for your review. The information in the following attachment (Biological Information Update – NMFS) includes a description of the plant operations, a brief description of shortnose sturgeon life history, existing monitoring data, an evaluation of the potential for HNP operations to impact shortnose sturgeon, and a comparison to data collected from facilities on the Hudson River.

SNC has determined that continued operation of Edwin I. Hatch Nuclear Plant is "not likely to adversely affect" the shortnose sturgeon for the following reasons.

- No spawning aggregation has been located in the immediate vicinity of E. I. Hatch Nuclear Plant based on studies of the Altamaha River population.
- Data collected for the intake structure over a significant period of time did not identified any entrainment of larval shortnose sturgeon.
- Impingement of healthy juvenile and adult shortnose sturgeon is unlikely considering their strong swimming ability and the design of the intake structure. Data collected over a five-year period did not identify any impingement of shortnose sturgeon.

SNC requests, that NMFS provide a concurrence letter upon the completion of your review of this additional material. We appreciate your efforts in helping us develop the information necessary to analyze threatened and endangered species issues associated with Plant Hatch license renewal.

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by February 15, 2000 to enable us to meet our application preparation schedule.

Sincerely,

C R Pierce

C. R. Pierce
License Renewal Services Manager

CRP/JTD
Attachments

Letter C-12. SNC Letter to NMFS, February 2, 2000 (page 2 of 73)

LRS-00-001
Page 3 of 3

CC: Sandra Tucker, USFWS – Athens
Mark Bowers, USFWS – Piedmont NWR
David Bernhart, NMFS – St. Petersburg
P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter C-12. SNC Letter to NMFS, February 2, 2000 (page 3 of 73)

Biological Information Update for NMFS
Edwin I Hatch Nuclear Plant
License Renewal

Prepared by:

J. T. Davis, Southern Nuclear

M. C. Nichols, Georgia Power

A. S. Hendricks, Georgia Power

T. C. Moorer, Southern Nuclear

January 24, 2000

Letter C-12. Attachment (page 4 of 73)

Table of Contents

Letter C-12. Attachment (page 5 of 73)

I. INTRODUCTION

The purpose of this report is to provide additional information concerning Edwin I. Hatch Nuclear Plant and to address questions raised by U. S. National Marine Fisheries Service concerning the impacts of continued operation in relation to the shortnose sturgeon (*Acipenser brevirostrum*). The report summarizes plant information and existing data and discusses the consequences of the proposed action for the shortnose sturgeon.

II. PROPOSED ACTION

The proposed action is the renewal of existing NRC operating licenses for Edwin I. Hatch Nuclear Plant Units 1 and 2, which are operated in accordance with NRC operating licenses NPF-5 and DPR-57, respectively. HNP Unit 1 began commercial operation December 31, 1975, and is currently licensed to operate through August 6, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is currently licensed to operate through June 13, 2018. NRC regulations (10 CFR Part 54) allow license renewal for periods of up to 20 years, which would extend the operation of Unit 1 through August 6, 2034, and extend the operation of Unit 2 through June 13, 2038.

III. SITE DESCRIPTION

A. General Plant Information

The Edwin I. Hatch Nuclear Plant (HNP) is a steam-electric generating facility operated by Southern Nuclear Operating Company (SNC) (Reference 1). HNP is located in Appling County, Georgia, at river kilometer (rkm) 180, slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. It is approximately 11 miles north of Baxley, Georgia; 98 miles southeast of Macon, Georgia; 73 miles northwest of Brunswick, Georgia; and 67 miles southwest of Savannah, Georgia. The Universal Transverse Mercator coordinates of the Unit 2 reactor (to the nearest 100 meters) are Zone 17R LF 3,533,700 meters North and 372,900 meters East. These coordinates correspond to latitude 31 degrees, 56 minutes, and 4 seconds North and longitude 82 degrees, 20 minutes, and 39 seconds West. Figures VI-1 and VI-2 illustrate the HNP location.

HNP is a two-unit plant. Each unit is equipped with a General Electric Nuclear Steam Supply System that utilizes a boiling-water reactor with a Mark I containment design. Both units were originally rated at 2,436 megawatt-thermal and designed for a power level corresponding to approximately 2,537 megawatt-thermal. Both units are now licensed for 2,763 megawatt-thermal (63 FR 53473-53478, October 5, 1998). HNP uses a closed-loop system for main condenser cooling that withdraws from and discharges to the Altamaha River via shoreline intake and offshore discharge structures. Descriptions of HNP can be found in documentation submitted to U.S. Nuclear Regulatory Commission (NRC) for the original operating license and subsequent license amendments. Georgia Power Company (GPC) submitted environmental reports for the construction stage and operating license stage for HNP in 1971 and 1975, respectively (References 2 and 3). In 1972, the Atomic Energy Commission (AEC)1 issued a Final Environmental Statement (FES) for Units 1 and 2 (Reference 4), and in 1978 issued a FES for Unit 2 (Reference 5). The FESs evaluate the environmental impacts from plant construction and operation in accordance with the National Environmental Policy Act (NEPA).

Letter C-12. Attachment (page 6 of 73)

[1]. Predecessor agency to NRC.

The property at the HNP site totals approximately 2,240 acres and is characterized by low, rolling sandy hills that are predominantly forested. A property plan is shown in Figure VI-3. Figure VII-4 provides a more detailed site plan. The property includes approximately 900 acres north of the Altamaha River in Toombs County and approximately 1,340 acres south of the River in Appling County. All industrial facilities associated with the site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling tower area and associated facilities, is approximately 300 acres (Figure VI-4). Approximately 1,600 acres are managed for timber production and wildlife habitat.

B. Heat Dissipation System

The excess heat produced by HNP's two nuclear units is absorbed by cooling water flowing through the condensers and the service water system. Main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating water system is a closed-loop cooling system that utilizes three (Reference 3) cross-flow and one counter-flow mechanical-draft cooling towers for dissipating waste heat to the atmosphere.

For both Units 1 and 2, cooling tower makeup water is withdrawn from the Altamaha River through a single intake structure. The intake structure is located along the southern shoreline of the Altamaha River (Figure VI-3) and is positioned so that water is available to the plant at both minimum flow and probable flood conditions. The main river channel is located closer to the northern shoreline. The intake is approximately 150 feet long, 60 feet wide, and the roof is approximately 60 feet above the water surface at normal river level. The water passage entrance is about 27 feet wide and extends from 16 feet below to 33 feet above normal water levels. Large debris is removed by trash racks, while small debris is removed by vertical traveling screens with a 3/8 inch mesh. Water velocity through the intake screens is 1.9 feet per second (fps) at normal river elevations and decreases at higher river flows.

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 42-inch lines extending approximately 120 feet out from the shore at an elevation of 54 feet mean sea level. The point of discharge is approximately 1,260 feet down-river from the intake structure and approximately 4 feet below the surface when the river is at its lowest level (Figure VI-3).

The National Pollutant Discharge Elimination System (NPDES) Permit for HNP (GA0004120) issued by the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GA DNR) in 1997 requires weekly monitoring of discharge temperatures, but does not stipulate a maximum discharge temperature or maximum temperature rise across the condenser. Maximum discharge temperatures measured at the mixing box, which are reported to EPD on a quarterly basis, range from 62 °F in winter to 94 °F in summer (see Table V-1).

C. Surface Water Use

The Altamaha River is the major source of water for the plant. Water is withdrawn from the River to provide cooling for certain once-through loads and makeup water to the cooling towers. SNC is permitted (GADNR Permit 001-0690-01) to withdraw a monthly average of up to 85 million gallons per day with a maximum 24-hour rate of up to 103.6 million gallons. As a condition of this permit, SNC is required to monitor and report withdrawals. Table V-2 provides the annual average daily withdrawal and the maximum daily withdrawal for the years 1989 through 1997. As shown in Table V-2, HNP withdraws an annual average of 57.18 million gallons per day (88 cubic feet per second (cfs)).

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The evaluation of surface water use in the FES concluded that the consumptive losses would be approximately 46 percent of the total water withdrawn from the River. In NRC's environmental assessment for an extended power uprate (Volume 63 Number 192 FR pages 53473-53478, at page 53474), NRC concluded that the necessary increase in makeup water to support the higher heat load would be insignificant and that cooling tower blowdown would decrease by approximately 626 gallons per minute (1.4 cfs). As evaluated by NRC, consumptive water use for the plant operating at the extended power level is expected to be 57 percent of the total withdrawal (Reference 7).

The thermal discharge plume has been modeled using the Motz-Benedict model for horizontal jet discharges. The predictive thermal plume model was field verified during 1980 following commencement of Unit 2 operation (Reference 10). Twelve thermal plume monitoring surveys were conducted during 1980 and compared to model predictions. During each of the twelve surveys, temperatures were taken at depths of one foot, three feet, and five feet. All temperatures measurements were made from a boat moving along a pre-selected transects in the river using a temperature probe and continuous recorder. Monitoring equipment was calibrated in the laboratory before each survey and rechecked in the field before and after each survey. The average projected fully mixed excess temperature under average summer conditions (average river flow of 3000 cfs, ΔT of 4.7 °F) is 0.09 °F (Reference 3). During the 1980 field surveys, the period of lowest river flow and greatest cooling tower heat rejection (3220 cfs, and ΔT of 4.5 °F, respectively) resulted in a fully mixed excess temperature of 0.05 °F. The NRC modeled average expected thermal conditions and extreme thermal conditions under conservative assumptions in the E. I. Hatch Unit 2 Final Environmental Impact Statement. The NRC independently noted the small size of the thermal plume even under the conservative assumptions, and concluded thermal blockage in the Altamaha River from the plant discharge was not possible (Reference 5).

To control biofouling of cooling system components such as condenser tubes and cooling towers, an oxidizing biocide (typically sodium hypochlorite or sodium bromide) is injected into the system as needed to maintain a concentration of free oxidant sufficient to kill most microbial organisms and algae. When the system is being treated, blowdown is secured to prevent the discharge of residual oxidant into the river. After biocide addition, water is recirculated within the system until residual oxidant levels are below discharge limits specified in the NPDES permit (GA0004120).

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IV. STATUS REVIEW OF SHORTNOSE STURGEON

A. Life History

The shortnose sturgeon Acipenser brevirostrum is a member of the family Acipenseridae, a long-lived group of ancient anadromous and freshwater fishes. The species is currently known by at least 19 distinct population segments inhabiting Atlantic coast rivers from New Brunswick, Canada to northern Florida (Reference 15). Most shortnose sturgeon populations have their greatest abundance in the estuary of their respective river (Reference 14). The species is protected throughout its range.

The distribution of shortnose sturgeon strongly overlaps that of the Atlantic sturgeon, but life histories differ greatly between the two species. The Atlantic sturgeon is truly anadromous with adults and older juveniles spending large portions of their lives at sea. Shortnose sturgeon, however, are restricted to their natal streams. Shortnose sturgeon are not known to move among or between different river drainages (References 13 and 15).

Seasonal migration patterns and some aspects of spawning may be partially dependent on latitude. In northern rivers, shortnose sturgeon move to estuaries in summer months. In southern rivers, movement to estuaries usually occurs in winter (Reference 15). Shortnose sturgeon spawn in freshwater like the Atlantic sturgeon, but then return to the estuaries and spend much of their lives near the fresh/salt water interface. Fresh tidewaters and oligohaline areas serve as nurseries for shortnose sturgeon (Reference 11). Availability of spawning and rearing habitats may be limited throughout the range of shortnose sturgeon (Reference 14).

Shortnose sturgeon exhibit faster growth in southern rivers, but will reach larger adult size in northern rivers (Reference 15). Thus, shortnose sturgeon will reach sexual maturity (45-55 cm FL, (Reference 14)) at a younger age in southern rivers. Spawning by individual fish may only occur at intervals with frequencies of a few to several years. Dadswell et al. (Reference 16) composed a detailed summary of the known biology of shortnose sturgeon.

Rivers of the deep south are on the edge of the natural range of the shortnose sturgeon and present somewhat unique problems for the species. The majority of southern rivers and estuaries regularly reach temperatures unfavorable to shortnose sturgeon. Intolerant of saline environments and limited to riverine habitats, shortnose sturgeon must seek thermal refuges during most summers in the south. The refuges are found in lower river reaches and consist usually of a few deep holes, possibly cooled by springs or seeps. The fish concentrated in a few of these thermal refuges quickly exhaust local food supplies and appear to just be surviving the summer (Reference 11). A life history that restricts the species to individual drainages, combined with seasonally restricted use of habitats, may be directly related to the species' current endangered status. Sturgeons have long been commercially important species, which may be a leading cause in their rapid decline worldwide. For more than a century, Atlantic and shortnose sturgeon populations were subjected to extensive fishing, likely contributing to the massive population declines along the east coast (Reference 15). Prior to 1900, sturgeon catches were averaging over 3.0 million kg per annum, but this harvest was sustained for less than a decade. Prior to the closure of most east coast fisheries during the 1980s, catches had decreased to less than 1% of historical levels (References 12).

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Although the shortnose sturgeon was severely overharvested in the past, the greatest threats to survival presently include barriers to its spawning grounds created by dams, loss of habitat for other life history stages, poor water quality, and incidental capture in gill net and trawl fisheries targeting other species (Reference 13 and 16). Shortnose sturgeon was listed as endangered in 1967 by the U.S. Fish and Wildlife Service. In 1974, the National Marine Fisheries Service reconfirmed this decision under the Endangered Species Act of 1973 (Reference 13 and 15).

B. Status in Altamaha River

The Altamaha River is large, with the largest watershed east of the Mississippi River. The Altamaha River is located entirely within the state of Georgia. It flows over 800 km from its headwaters to the Atlantic Ocean. The main body of the Altamaha is formed by the confluence of the Oconee and Ocmulgee rivers in the central coastal plain at Altamaha rkm 212 (Reference 13).

The incidences of catch and overharvest of sturgeons from Georgia rivers paralleled the trends of other states. From 1888 through 1892, sturgeon catches in Georgia averaged 71,000 kg per annum (Reference 18). "As recently as 49 years ago, a dealer in Savannah (GA) was shipping 4,500 kg of carcasses per week (6,500 kg in the round) during the peak three to five weeks of the spring run"(Reference 18). Similar harvests were recorded from the Altamaha River (Reference 11).

Catch rate data for sturgeons in Georgia is just as startling. In 1880, and average seasonal catch was 100 fish per net. During a 20-year period from the late 1950s through the late 1970s, net fishermen in the lower Altamaha River caught just 1.1 to 3.2 fish per net per season (Reference 20 as presented in Reference 11). This data indicates a 97-99% decline in the sturgeon fishery (Reference 11).

There is a continuing high demand for sturgeon roe and flesh. From 1962 to 1994 the source of the majority of sturgeon catches has shifted among the Savannah, Ogeechee, and Altamaha rivers. The Altamaha River has been the focus of a "much-throttled" fishery from 1982 to present. Certain recent events have kept prices for sturgeon products high or rising, fueling commercial fisheries and some poaching (Reference 12). Some of these events were an increasing US domestic demand for all seafood products, decreased supplies of sturgeon products as fisheries closed in the US, and sturgeon stocks worldwide were becoming more depleted by overharvest and habitat degradation, particularly in the republics of the old Soviet Union (Reference 12).

The Altamaha River population of shortnose sturgeon has been the focus of much recent research to assess abundance and distribution, determine migration patterns, and describe habitat utilization. Some authors suggested the Altamaha River population of shortnose sturgeon was in better shape than the population in the Savannah River, Georgia-South Carolina (Reference 12). Another study indicated shortnose sturgeon in the Altamaha River may be experiencing lower juvenile mortality rates than in the Ogeechee River, Georgia (Reference 14). The Shortnose Sturgeon Recovery Team indicated that the Altamaha River population was the largest and most viable population south of Cape Hatteras, North Carolina (Reference 15). Relative abundance data from one sampling station during 1986-1991 appears to demonstrate a relatively stable population with little trend in the abundance of juveniles (Reference 11).

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Telemetry studies have revealed much information about the seasonal migrations of shortnose sturgeon in the Altamaha River and the importance of certain habitats. During summer in the Altamaha River, most fish ages 1+ and older are concentrated at or just upstream of the fresh/salt water interface in physiological refugia. Cooling water temperatures in the fall spur a movement of all sizes of fish to generally more saline waters. Some adult and most large juvenile fish move back to fresh tidewater near the end of autumn to overwinter with little movement or activity. In preparation for spawning in late winter-early spring, some adults will move upstream to locations near spawning sites. The majority of adults and a few large juveniles remain in oligohaline waters near the fresh/salt water interface and may be very active (Reference 13).

Several suspected spawning sites for shortnose sturgeon have been located within the Altamaha River system. Much of the spawning activity occurs in a 70 kilometer section of the Altamaha River centered about Doctortown, Georgia. Spawning is also suspected in the lower Ocmulgee River (Ocm rkm 4-16), which is several kilometers upstream of the shoals marking the transition to the upper coastal plain (Reference 13). This reach is about 40 rkm upstream of Plant Hatch.

Suspected spawning areas in the Altamaha River system were often adjacent to river bluffs with gravel, cobble, or hard rock substrate (Reference 12). Shortnose sturgeon eggs are demersal and adhesive after fertilization, sinking quickly and adhering to sticks, stones, gravel, and rubble on the stream bottom.

Shortnose sturgeon, especially juveniles, appear severely restricted to certain habitats near the fresh/salt water interface of the lower Altamaha River. During summers when the water temperature exceeds 28 °C, the fish are further restricted to a few deep holes near the interface. Recaptures of tagged fish indicate that the fish move little and lose weight during this time, which indicates the oversummering habitat is very important, and that food resources may be quickly exhausted (Reference 11). Flournoy et al (Reference 11) proposed that shortnose sturgeon were using a few deep holes in the lower Altamaha as physiological refuges, and that these holes may constitute critical habitat. They further hypothesized that the Altamaha River population of shortnose sturgeon existed only because the physiological refugia were available.

The Shortnose Sturgeon Recovery Team has identified numerous factors that may affect the continued survival and potential recovery of the species. Some of these factors may be habitat degradation or loss from dams, bridge construction, channel dredging, and pollutant discharges, as well as mortality from cooling water intake systems, dredging, and incidental capture in other fisheries (Reference 15). Recent evidence of illegal directed take of shortnose sturgeon in South Carolina indicate that poaching may also be a significant source of mortality (Reference 14).

All of the above factors may contribute to mortality in shortnose sturgeon populations, and the significance of each may vary with latitude and individual circumstances. However, the prevailing evidence seems to indicate, at least for the Altamaha River, that the primary threats to the population are commercial harvest and limited oversummering habitat. Dahlberg and Scott (Reference 17) recognized that shortnose sturgeon were often caught in gill nets by shad fishermen in the Altamaha River. The threat of bycatch remains real as many of the individual shortnose sturgeon used in recent studies were captured or recaptured with shad fishing gear. Rogers et al (Reference 12) stated that at least one of their tagged fish released in the estuary was captured in commercial shad gear, and six of

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the 36 individuals telemetered were initially collected with shad gear. Even if the fish are recognized as protected shortnose sturgeon and returned to the river, the capture may result in abandonment of spawning activity (Reference 14).

Several authors suggested the Altamaha River population of shortnose sturgeon may be healthier than the Savannah River population. In comparing the two rivers, (Reference 13) found that both rivers have discharges of similar magnitude and neither is dammed below the fall line. Both the Savannah and Altamaha are moderately industrialized, including paper mills and nuclear generating stations along their reaches from the fall line to the coast. Only the Savannah, however, is heavily altered and industrialized in its estuarine zone (Reference 12).

Previous research has shown shortnose sturgeon ages one year and older aggregate in the Altamaha River at or just upstream of the fresh/saltwater interface during the summer. These fish appear to move downstream into more saline water at the end of summer. During late fall and early winter, movement to less saline water occurs and some adults may move upstream toward spawning areas. Spawning is thought to occur during February through March. Some spawning fish move downstream immediately, while other remain upstream (Reference 13).

C. Low Potential for Plant Hatch to effect Shortnose Sturgeon

Biological, hydraulic, and physical factors affect the rates of impingement and entrainment. Southern Nuclear believes the shortnose sturgeon's known behavior and use of the Altamaha River indicates a low potential for impingement or entrainment with the cooling water for Plant Hatch. Southern Nuclear also believes the low potential for impingement or entrainment is further reduced by siting, design, and operational characteristics of Plant Hatch. This section presents information specific to this argument.

Available literature suggests there is little opportunity for shortnose sturgeon eggs or larvae to encounter the cooling water intakes at Plant Hatch. Much of the available spawning habitat for shortnose sturgeon in the Altamaha River is well downstream of Plant Hatch. Eggs and larvae from these spawning locations are not available for entrainment by Plant Hatch.

There is a suspected spawning area in the lower Ocmulgee River about 40 rkm upstream from Plant Hatch, but entrainment of eggs or larvae of from this site is also unlikely. Fertilized shortnose sturgeon eggs sink quickly and adhere tightly to rough substrates, even under high flow conditions. Shortnose sturgeon larvae seek bottom cover quickly upon hatching and seldom stray from cover (Reference 21). The larvae grow quickly and are able to maintain bottom contact without being swept downstream (Reference 21), and may linger near the spawning area for the first year of life (Reference 15). Some authors, after attempting to capture shortnose sturgeon larvae, speculated the larvae of shortnose sturgeon, contrary to larvae of Atlantic sturgeon, do not spend much time in the drift (References 22 and 23). These early life history behaviors suggest a very low potential for entrainment effects at Plant Hatch.

The location of the cooling water intake at Plant Hatch should further reduce the potential for entrainment and impingement. The intake structure was constructed flush with the shallow, southern shoreline of the Altamaha River. The deep river channel hugs the northern bank opposite of the intake structure. Literature indicates that shortnose sturgeon

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migrate along the bottom of river channels, often seeking the deepest water available. This behavior and the cooling water intake location on the shoreline opposite the river channel should minimize the probability of shortnose sturgeon encountering the intake structure.

Entrainment and impingement effects are also a function of withdrawal rates, which are reduced for facilities with closed cycle cooling systems in comparison to once through cooling systems. Plant Hatch is operated using 3 mechanical draft cooling towers per unit as described in section III B. Cooling towers have been suggested as mitigative measures to reduce known or predicted entrainment and impingement losses (see, for example, Reference 25). EPA has endorsed closed cycle cooling towers as the "best available technology" for minimizing entrainment and impingement mortality (Reference 26). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low entrainment, impingement, and discharge effects. Studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant (Reference 9).

D. Existing Monitoring Data for Plant Hatch

This section briefly describes the methods and results of previous studies conducted at Plant Hatch. Initial preoperational surveys were conducted at Plant Hatch as required by the Unit 1 and 2 Final Environmental Statement (Reference 4) to "perform preoperational measurements of aquatic species to establish base-line data". During these surveys, one adult shortnose sturgeon was collected by gill net on March 13, 1974, in the vicinity of Plant Hatch. Three additional specimens of Acipenser sp., two juveniles and one larva were collected but could not be identified to species (Reference 5). No adult, juvenile, or larval shortnose sturgeon were collected during subsequent impingement and entrainment sampling conducted following startup of either Unit 1 or Unit 2.

Preoperational drift surveys where conducted weekly from February through May in 1973, and every 6 weeks June through December 1973. Samples were collected at four quadrates for transect above and below the plant intake and two locations close to the plant intake. Typical sample sets consisted of 14 individual samples from 15-minute collections. Drifting organisms were collected with a one-meter diameter 000-mesh nylon plankton net, set 6-12 inches above the river bottom. Samples were washed into a quart container and preserved with formalin.

Cataostomids, cyprindis, and centrarchids were the dominant ichthyoplanton families collected. Commercially important fish in these collections included Alosa sapidissima eggs, with mean densities approaching 0.3 per 1000 m3 in March. Alosa sapidissima larvae were present in drift samples from May through June, with the density never exceeding 0.03 individuals per 1000 m3. A sturgeon larva was collected during this sampling and sent to Dr. Donald Scott for identification of species, but could not be identified beyond the genus Acipenser. This is the only record of larval sturgeon found in the vicinity of Plant Hatch.

Entrainment samples at Plant Edwin I. Hatch were collected for the years 1975, 1976, and 1980 following unit startup. Samples were collected weekly during 1975 and 1976, and monthly in 1980. The results of these surveys are summarized in Reference 8, included as Appendix A in this document. Additional ichthyological drift data are available for 1974 (weekly collection) and 1979 (monthly collection), but were not used in summarizing entrainment rates. Monthly entrainment data for each taxa for 1975, 1976 represent

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entrainment estimates for Unit 1 operation. The 1980 data includes entrainment estimates for Unit 1 and Unit 2 operation. There was no increase in fish eggs and larvae entrainment. The differences in numbers of fish eggs and larvae are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year. No sturgeon larvae were found in any entrainment samples collected during operational monitoring.

The entrainment estimates assume a uniform distribution of fish eggs and larvae, while the cross section measurements suggest that the greater densities would occur in the channel furthest from the intake (See Appendix A, Figure 9). Under normal flow and pumping conditions, the intake velocity is 1.9 fps. The measured range of intake velocities was from 0.3 fps to 2.7 fps. Estimated percent of river flow entrained in Plant Edwin I. Hatch cooling water has remained less than one percent with the exception of the months of July, August, and September, 1980. The increase in estimated percent flow entrained during this period was due to extremely low river elevations resulting from the lack of rainfall.

Impingement data are available for five years, including 1975, 1976, 1977, 1979, and 1980. Impingement samples include weekly samples in 1975, 1976, and 1977 and monthly samples for 1979 and 1980. Each sample represents impingement for at least a 24-hour period. A total of 165 fish representing 22 species were collected. The highest number impinged per year, 61 fish, was in 1975, while the lowest, 14 fish, was in 1980. The data indicates low impingement estimates per day and per year. The 1975 estimates are 1.2 fish per day and 438 per year; 1976 estimates are 0.4 fish per day and 146 per year; 1977 estimates are 1.1 fish per day and 401.5 per year; 1979 estimates are 1.3 fish per day and 474.5 per year; and 1980 estimates are 1.2 fish per day and 438 per year. The hogchoker, Trinectes maculatus, was the most abundant and the only species collected consistently each year. Most species were collected only once during the five years. No sturgeon were collected in impingement samples during five years of sampling. In addition, no adult sturgeon has been reported impinged by the intake structure during the operation of the plant.

E. Comparison with other power generation facilities

For general comparison, the Hudson River, New York supports a large sturgeon population including both shortnose and Atlantic species. There are six fossil-fueled and one nuclear electricity generating plants located along the Hudson River, and much research has been conducted to address impingement and entrainment concerns. Results for entrainment and impingement at the power generation facilities Bowline, Indian Point, and Roseton are recently summarized for the period from 1972 through 1998 (Reference 23). These three facilities withdraw 62% of the maximum permitted water withdrawal from this reach of the Hudson River. Bowline Units 1 and 2 are two fossil fuel steam electric plants with combined capacity of 1200 MWe and utilize an intake structure located on an embayment off of the Hudson River. The maximum pumping rate is 384,000 gpm. Indian Point Units 2 and 3 are separate pressurized water reactors with combined capacity of 2042 MWe utilizing two separate shoreline intake structures. Predicted condenser cooling water flow rates are 840,000 gpm and 870,000 gpm for Indian Point Units 2 and 3, respectively. Roseton is a two-unit fossil-fueled steam electric plant with combined capacity of 1248 MWe and utilizes a shoreline intake structure. Maximum pumping rate is 641,000 gpm. Unlike Plant Hatch, all three of these facilities use once-through cooling. For comparison, the maximum pumping rate for Plant Hatch is 72,000 gpm. The USNRC notes that "Water withdrawal from adjacent bodies of water for plants with closed-cycle cooling systems is 5

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to 10 percent of that for plants with once-through cooling systems, with much of this water being used for makeup of water by evaporation."(Reference 9). The operation of the Plant Hatch cooling system is consistent with this description.

One of the environmental impacts identified for these three facilities on the Hudson River is entrainment and impingement of aquatic organisms, including striped bass, white perch, Atlantic tomcod, American shad, bay anchovy, alewife, blueback herring, and spottail shiner. Other species were considered, including Atlantic sturgeon (Acipenser oxyrhynchus) and shortnose sturgeon. No shortnose sturgeon eggs or larvae were collected in entrainment samples for these facilities over periods ranging from 5 to 14 years. As a result, entrainment effects on shortnose sturgeon are believed to be negligible.

Adult shortnose sturgeon, however, were collected in impingement samples at these facilities. Indian Point Unit 2 reported shortnose sturgeon in impingement samples for 10 of 19 years reported (ranging from 1 to 6 individuals per year). Indian Point Unit 3 reported shortnose sturgeon in impingement samples for 7 of 15 years reported (ranging from 1 to 3 individuals per year). The size of impinged shortnose sturgeon ranged from 12 to 18 inches. The low rate of impingement and the return of impinged fish to the Hudson River alive lead to the conclusion that impingement effects were negligible (Reference 23). Even though sampling has documented large numbers of affected fish at intakes along the Hudson River, and a large resident population of sturgeon exists, shortnose sturgeon are a very small component of the impingement and entrainment numbers (Reference 23). In fact, some recent research suggests that the shortnose sturgeon population in the Hudson River has increased during the last ten years and is now more numerous than the commercially exploited Atlantic sturgeon (Reference 24).

The use of closed cycle cooling minimizes water withdrawals from the Altamaha River. As a result, SNC believes that the probability is much lower of impinging shortnose sturgeon, particularly when compared to similarly situated facilities using once-through cooling systems. In addition, the existing monitoring data supports the finding that no impacts are known to occur to shortnose sturgeon from entrainment and impingement at Plant Hatch.

F. Consequences of Proposed Action

There are no construction modifications of the intake structure, effluent pipes, or changes in operation proposed for the license renewal period for Plant Hatch. Based on the life history characteristics of shortnose sturgeon, siting and operational characteristics of the plant, existing data for impingement and entrainment, and the known thermal plume characteristics there are no adverse impacts to shortnose sturgeon expected from E. I. Hatch Nuclear Plant during the license renewal period.

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V. TABLES

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Table V-1. Weekly discharge temperatures, Edwin I. Hatch Nuclear Plant, 1997-1998.

Month/Year		Unit 1 Average discharge temperature (°F)	Unit 1 Maximum discharge temperature (°F)	Unit 2 Average discharge temperature (°F)	Unit 2 Maximum discharge temperature (°F)
January	1997	63.0	68.0	63.8	67.0
February	1997	68.8	71.0	66.0	68.0
March	1997	71.6	79.0	70.0	80.0
April	1997	77.5	82.0	76.0	84.0
May	1997	78.3	85.0	78.3	86.0
June	1997	82.2	86.0	83.0	86.0
July	1997	88.0	91.0	87.5	90.0
August	1997	84.3	86.0	88.0	93.0
September	1997	84.6	88.0	86.6	86.6
October	1997	76.5	84.0	77.5	77.5
November	1997	62.3	68.0	62.0	62.0
December	1997	67.6	75.0	68.4	73.0
January	1998	61.8	69.0	62.7	69.0
February	1998	67.8	77.0	67.8	77.0
March	1998	71.4	77.0	71.0	77.0
April	1998	74.5	75.0	74.5	75.0
May	1998	83.8	89.0	81.8	86.0
June	1998	87.0	91.0	87.6	91.0
July	1998	89.8	92.0	90.3	92.0
August	1998	90.0	94.0	90.4	94.0
September	1998	87.5	89.0	85.0	91.0

Source: Reference 6.

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Table V-2. HNP surface water use.

Year	Average Daily Withdrawal (MGD)[a]	Maximum Daily Withdrawal (MGD)[a]	Average Daily Loss From Evaporation (MGD)[b]
1989	55.48	70.43	31.62
1990	56.88	80.50	32.42
1991	56.94	81.40	32.46
1992	58.02	82.73	33.07
1993	58.74	85.31	33.48
1994	57.30	83.61	32.66
1995	59.29	78.23	33.80
1996	57.07	78.03	32.53
1997	54.93	75.02	31.31
Average	57.18		32.59

MGD = million gallons per day.

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VI. FIGURES

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Figure VI-1. HNP Edwin I. Hatch Nuclear Plant, 50 mile region

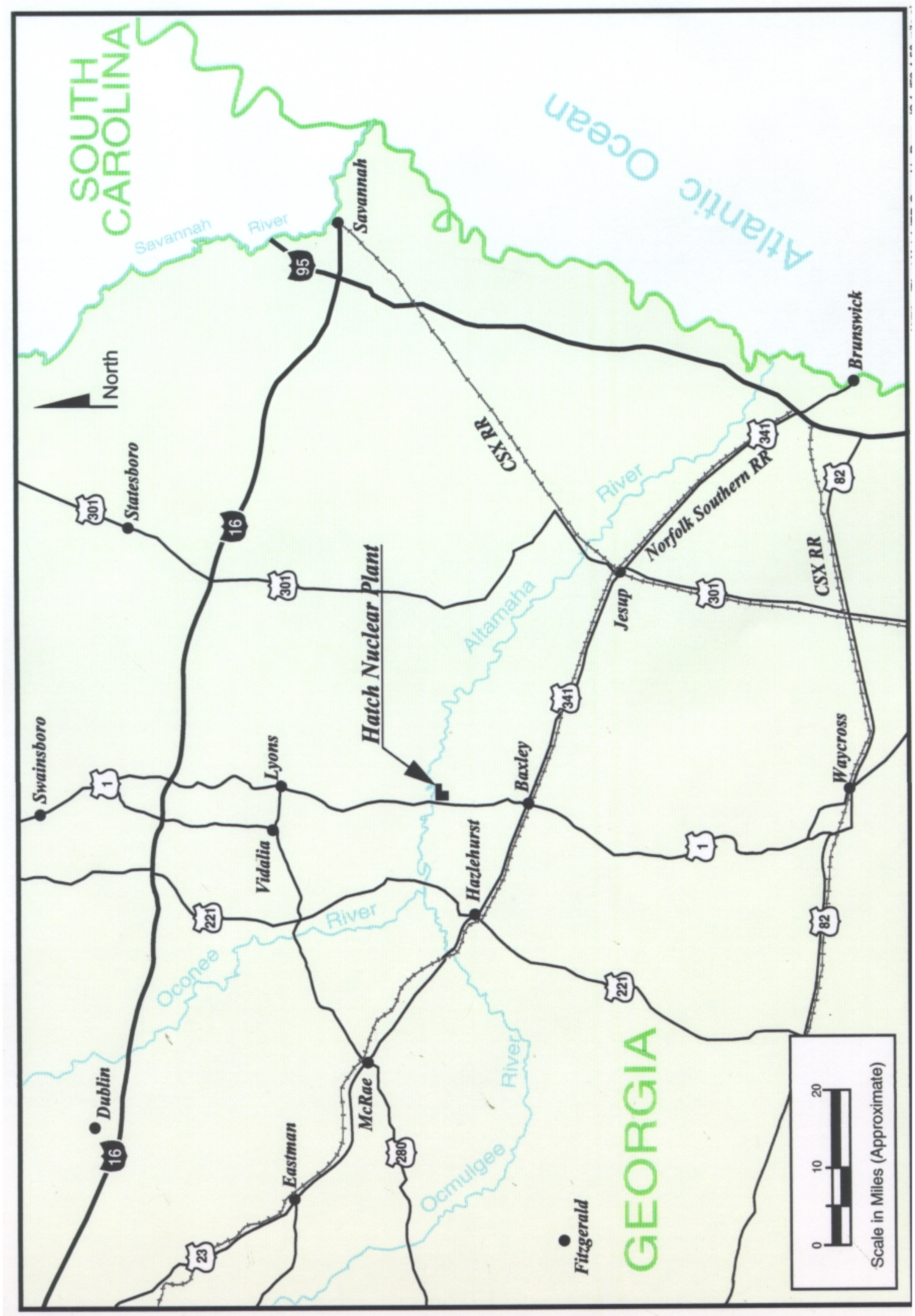

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Figure VI-2. HNP Edwin I. Hatch Nuclear Plant, 10 mile region

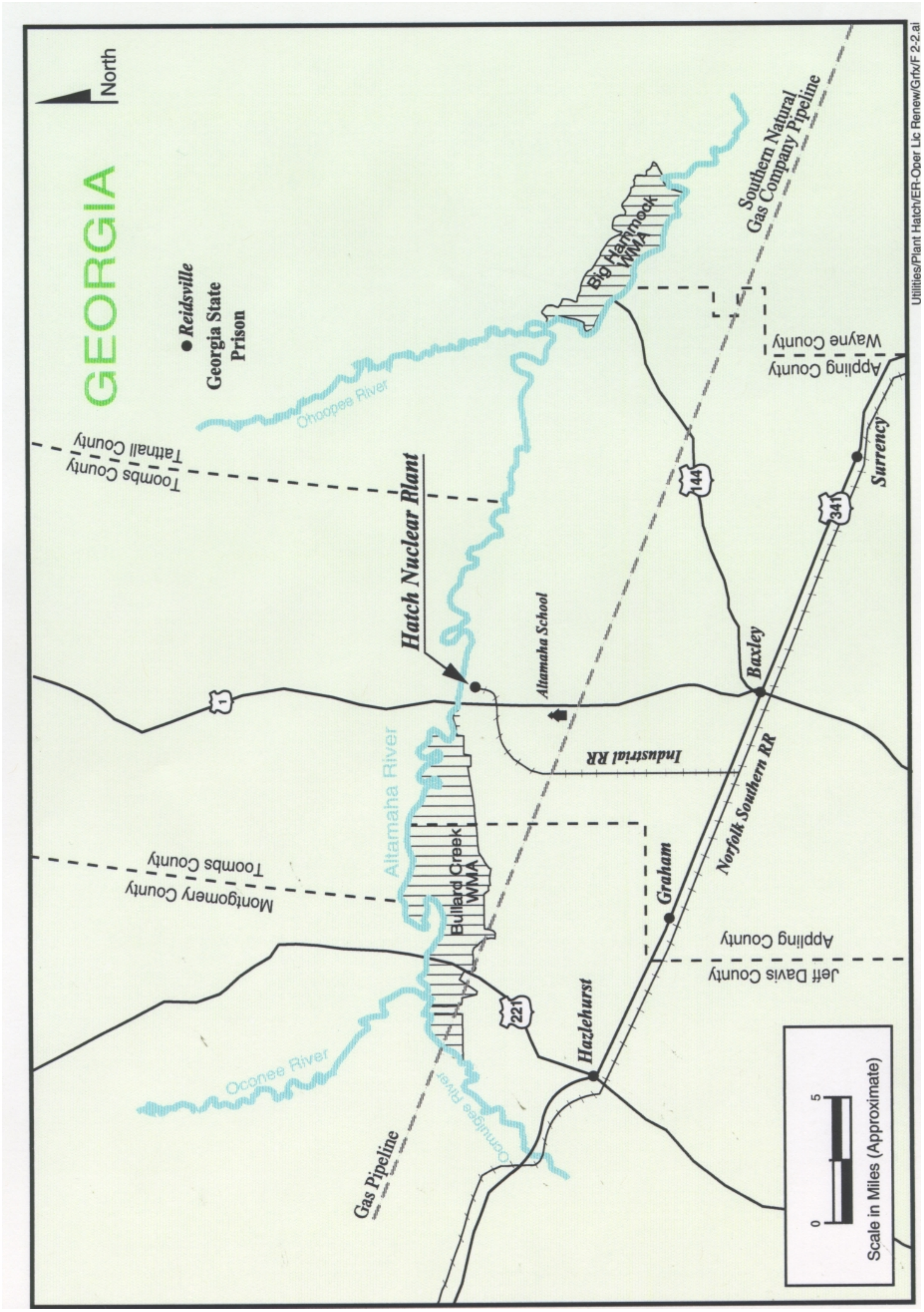

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Figure VI-3. HNP Edwin I. Hatch Nuclear Plant property plan

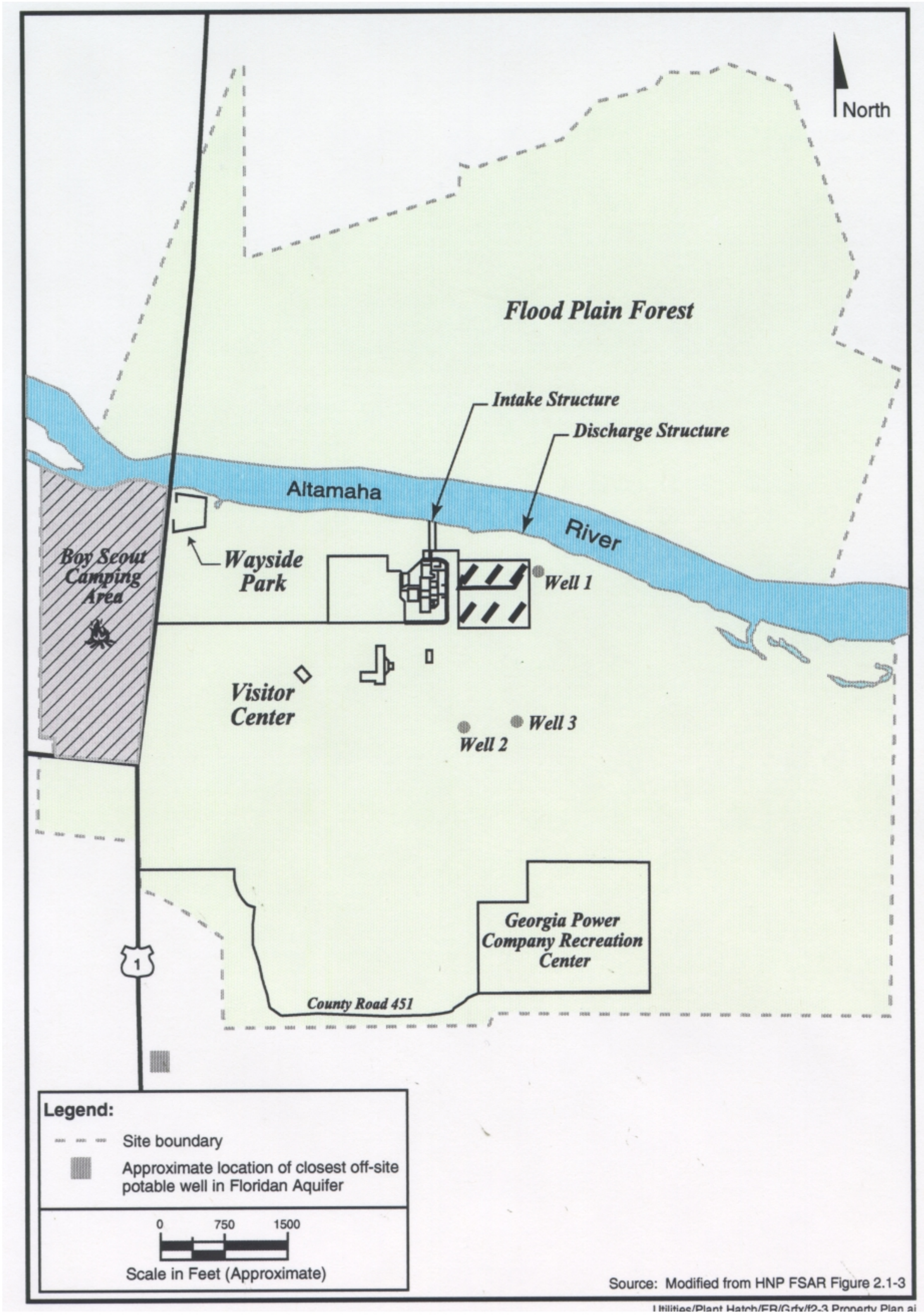

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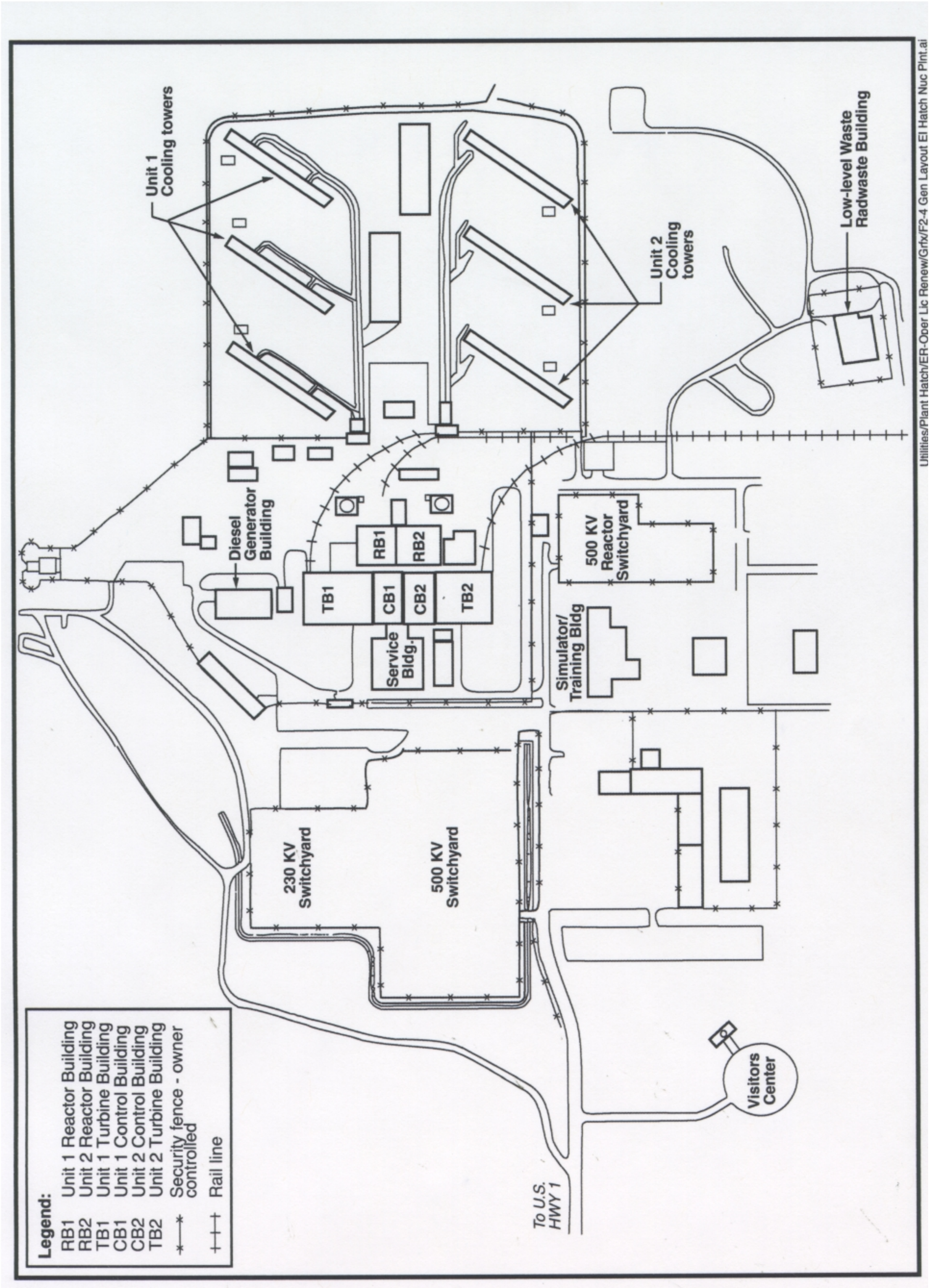
Figure VI-4. HNP Edwin I. Hatch Nuclear Plant site plan



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VII. REFERENCES

1. Nuclear Operating Agreement between SNC and GPC, 1997
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VIII. APPENDIX A PLANT EDWIN I. HATCH 316(B) DEMONSTRATION ON THE ALTAMAHA RIVER IN APPLING COUNTY, GEORGIA

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PLANT EDWIN I. HATCH 316(b) DEMONSTRATION
ON THE ALTAMAHA RIVER IN APPLING COUNTY, GEORGIA

GEORGIA POWER COMPANY
ENVIRONMENTAL AFFAIRS CENTER

JOHN W. WILTZ, PRINCIPAL INVESTIGATOR

March, 1981

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ACKNOWLEDGMENTS

I wish to acknowledge the following Georgia Power Company employees: Mike C. Nichols for assistance in calculating fish and fish egg densities and James A. Gardner for proposing Part 3 Hydrodynamics in the Entrainment Results, and Randy Ott for procuring impingement samples. Gary A. Breece, Ben L. Maulsby, and Mike C. Nichols reviewed the manuscript. I also wish to acknowledge the biologists and engineers who assisted in procuring and sorting of samples.

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Conclusions

1. Fish egg and fish densities generally fluctuated directly with spawning intensity and inversely with river flow.

2. Relative abundance of fish families varied during the five years of study, but the Catostomidae and Cyprinidae were the most abundant taxa each year.

3. The density of most fish groups was greater in night samples than in similar day samples.

4. Estimated entrainment of fish and fish eggs into the cooling water has remained less than one percent of the total population during five successive spawning periods with the exception of the months of July, August, and September, 1980. The increase in estimated percent entrained during these months was due to extremely low river elevations resulting from the lack of rainfall.

5. The percent of river discharge entrained is dependent on the number of intake pumps operating and river discharge. An increase in river discharge decreases the percent entrained.

6. An increase in entrained fish eggs and larvae is not apparent for 1980 compared to 1975 and 1976. The differences in numbers of fish eggs and larvae are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year.

7. Based on the five years of study, estimated entrainment at Plant Edwin I. Hatch does not constitute a significant reduction in the fish population.

8. The hogchoker, Trinectes maculatus, was the most abundant and the only species collected consistently each year in the impingement sample.

9. Because of the very low number of fish impinged for the five years of study, an accurate correlation between river elevation and the number of fish impinged cannot be made.

10. The increased velocity at the bottom of the intake structure (caused by the intake pumps) may, to some degree, explain why the majority of the fish impinged were Trinectes maculatus, a bottom dweller.

11. Low intake velocities and site location are probably the primary factors resulting in low numbers of impinged fish.

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12. The impingement data for the five years indicates that impingement losses at Plant Edwin I. Hatch are extremely low and that the plant does not create a significant environmental effect.

13. The results of this investigation fulfill the requirements set forth in NPDES Permit No. GA-0004120, Part 1-B-3.

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Introduction

As required by the National Pollution Discharge Elimination System (NPDES), Permit No. Ga. 0004120, for Plant Hatch, a 316(b) demonstration was completed by Georgia Power Company. The 316 (b) demonstration proposal was submitted to the Georgia Environmental Protection Division in June, 1977, and approved in August, 1977.

Plant Hatch, owned jointly by Oglethorpe Power Corporation (30.0%), Municipal Electric Authority of Georgia (17.7%), City of Dalton (2.2%), and Georgia Power Company (50.1%), is located approximately 17.7 kilometers (11 miles) north of Baxley in Appling County in southeast Georgia. The site is on the south bank of the Altamaha River, east of U. S. Highway 1. The site, Figures 1 and 1A, consists of approximately 908.1 hectares (2,244 acres). The area is characterized by flat-to-gently-rolling terrain.

The plant consists of two nuclear units. Unit 1 has a generating capacity of 810 megawatts, while Unit 2 has a generating capacity of 820 megawatts. Unit 1 and Unit 2 went into commercial operation on December 31, 1975, and September 5, 1979, respectively.

A cooling water flow diagram for Plant Hatch Unit 2 is presented in Figure 2. (Note: The cooling water system for Unit 1 is identical to Unit 2). Figure 2A presents the plant intake structure. Cooling water for the plant circulating water system is furnished by the Altamaha River. A single intake structure housing two service water pumps per unit are required withdrawing approximately 1.5 m3/sec (22,550 gpm) of water under normal operation. The intake structure also houses four residual heat removal service water pumps. The pumps have a combined capacity of 1.0 m3/sec (16,000 gpm) and operate when the reactor is shut down. Normally, two pumps are used when the system is operating withdrawing .52 m3/sec (8000 gpm) from the river.

The intake structure is approximately 45.7 meters (m) (150 feet) long, 18.3 m (60 feet) wide, and located 18.3 m (60 feet) above normal river level. The water passage entrance is about 8.2 m (27 feet) wide and extends 4.9 m (16 feet) below to 10.1 m (33 feet) above normal water level. Large debris is removed by trash racks, while small debris is removed by vertical traveling screens with a 9.5mm (3/8-inch mesh). Water velocity through the intake screens is 57.9 cm/sec (1.9 fps) at normal river elevations and decreases at higher river flows.

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PART I ENTRAINMENT

Materials And Methods

Two sampling stations (I1 and I2) were used to collect the diel entrainment samples. The stations were located in front of the intake structure (Il) and across the river (I2) as presented in Figure 3.

The study began in February 1980, and ended in September 1980, with samples taken monthly.

Samples were collected using a Wildco No. 25 twin 0.5 m diameter plankton net with a mesh size of 760 μ. Sample duration was determined by measuring the river velocity with a General Oceanics Digital Flowmeter, Model 2030 MKII, and with a calibrated curve, a time factor was obtained allowing for the filtering of approximately 500 cubic meters of water through the net. The volume of water filtered through the net was determined with the use of a permanently fixed General Oceanics, Model 2030 R2 flowmeter in the net. Samples were preserved in a 10% formalin solution and taken to the Environmental Affairs Center in Decatur, Georgia, for identification. Physicochemical data were taken at the beginning of the day sample and at the end of the night sample. Dissolved oxygen concentration and air and water temperature were measured with a Yellow Springs Instrument Company oxygen meter, Model 57. Specific conductance was measured with a Yellow Springs Instrument Company S-C-T meter, Model 33, and pH was measured with an Orion Research Ionalyzer, Model 399A.

Densities for each fish taxa collected were calculated as follows. The total number of individuals in each taxa was divided by the volume of river water filtered during day and night sampling to obtain the densities for each sample. The estimated densities for each month were obtained by averaging the densities for all samples taken during the month. Estimates of total numbers of fish eggs and fish in the vicinity of the plant were obtained by multiplying average monthly densities by total monthly river discharge using USGS data for the Altamaha River near Baxley. The percent of river discharge entrained was calculated using total monthly discharge and the total volume of water pumped each month. The estimated number of each taxa entrained was calculated by multiplying densities by the number of individuals in the vicinity of the plant by the percent of river discharge entrained.

The hydrodynamic effects of the Hatch river intake structure upon the Altamaha River were determined at river elevations 19.7 m (64.6 ft.) and estimated for 21.5 m (70.6 ft.). Velocity profiles (at river elevation 19.7 m) were measured in seven 26 m sections of the river at 0.2, 0.6, and 0.8 of the depth in each section.

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Results

Part 1 Biological

A total of 25 fish eggs and 442 fish (includes larval juveniles and adults) were collected in the eight month study. Specimens were not collected in the February samples. Most specimens, 24 eggs and 380 fish, were collected at night.

The scientific and common names of the species collected are presented in Table 1. The family Cyprinidae (includes the cyprinids, Hybognathus nuchalis, Notropis chalybaeus, and Notropis petersoni were the most abundant with 128 fish comprising 29% of the total number of fish collected (Table 2). The next most abundant families were the Catostomidae with 101 fish (22.9%) and the Centrarchidae with 78 fish (17.6%). The least abundant family was the Soleidae with one fish (.2%). The family Clupeidae was represented by 48 fish (10.9%) of which Alosa sapidissima comprised 10.4% (46 fish). Eleven Alosa sapidissima eggs were collected (44% of the total number of eggs collected).

The mean and range (in parenthesis) of total lengths for the species and the month in which they were collected are presented in Table 3.

Monthly densities for each family for the month they were collected, the estimated number of fish eggs and fish entrained by the plant, the estimated number found in the river in the vicinity of the plant, and the estimated percent entrained are given for 1980 in Table 4. The highest estimated number of fish entrained was for the family Centrarchidae at 4920.9 individuals in June. This estimate assumes a homogenous dispersal of fish in the-water (so the actual number entrained will vary). The lowest estimates were for the family Esocidae at 61.1 individuals in April. The month of September had the highest percent entrainment of 3.52% with the months of March and April the lowest at .21%.

Part 2 Physicochemical

Air temperatures recorded during the study are presented in Figure 4. The highest temperature was for the day sample in August at 32.4 C, and the lowest was the night sample in February at 12.0 C. Water temperatures are presented in Figure 5. A high of 31.0 C was recorded for the night sample in August, and a low of 7.5 C for the night sample in February. Dissolved oxygen concentration was lowest for the night sample in February and the day sample in September with a measurement of 5.2 mg/l (Figure 6). The highest recorded was 9.1 mg/l for the day sample in February. Because of meter malfunction, air and water temperature and dissolved oxygen concentration were not taken in July. pH values are given in Figure 7. Values for pH were below 6.0 for the day and night samples in February and March and the night sample in April. The highest pH recorded was 6.7 for the June, July, and August samples. pH values are not presented for September because of meter malfunction. Specific conductance is presented in Figure 8. The highest recorded was 138 microhms/cm for the night sample in September, and the lowest was 35 microhms/cm for the night sample in March.

Part 3 Hydrodynamics

Plant Hatch river pumping data for January, 1980, through October, 1980, and the percent river entrained for each month are presented in Table 5. In addition, Table 5 presents the average monthly discharge for the Altamaha River. Percent river entrained by the plant was at or above 1.0% for the months of June through October (1.0, 1.5, 3.2, 3.5, and 2.9%, respectively). The lowest percent entrained was 0.2% occurring in March and April.

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Velocity profiles were measured in seven 26 m sections of the river and are presented in Figures 9 and 10. At elevations 19.7 m and 21.5 m, average depths of each layer were 0.5 m and 1.4 m, respectively. It should be noted that the deepest section is on the north bank. Velocities of the upper and lower layers in the section of the river nearest the Hatch intake indicated that approximately 57% of the intake flow would be drawn from the upper layer, and approximately 43% would be drawn from the lower layer. With one pump operating, a maximum of 0.54 m3/sec will be withdrawn from the Altamaha River. This represents 0.6% of the discharge at river elevation of 19.7 m. A maximum of 4.8% of the flow would be diverted with two pumps operating per unit.

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Discussion

The State of Georgia has specific criteria for water quality control concerning dissolved oxygen concentration, water temperature, and pH (Georgia Environmental Protection Division, 1974).

Dissolved oxygen concentration for warm waters is a daily average of 5.0 mg/l and no less than 4.0 mg/l. Concentrations were lowest, 5.2 mg/l, for the night survey in February and the day survey in September.

Water temperatures for the state are not to exceed 32.2 C (90.0 F). Temperatures during the study did not exceed this limit with the highest, 31.0 C, recorded for the August night survey.

The pH range for the State of Georgia is 6.0 to 8.5. Values were below 6.0 for the day survey in February and March and the night survey for February, March, and April. The lowest recorded was 5.6 for the night survey in February and the day survey in March. Since the samples were collected upstream from our discharge and no industry is located upstream in the vicinity of the plant, this should indicate a normal occurrence.

The range for specific conductance for a diverse fish fauna in freshwater is between 150 and 500 microhms/cm. (Ellis et al. 1946). The highest recorded was 138 microhms/cm for the September night survey while the lowest was 35 microhms/cm for the March night survey.

Table 5 compares the Altamaha River discharge, Plant Hatch river pumping data, and the percent of river discharge entrained by the plant for 1975, 1976, and 1980. The Plant Hatch river pumping data for 1975 and 1976 assumes a constant pumping rate at 36.5 x 106 gallons/day. The 1980 pumping data is actual pumping rates obtained from plant records. The data in Table 5 shows that the percent of river discharge entrained is dependent on the number of intake pumps operating and river discharge. An increase in river discharge decreases the percent entrained. This is best illustrated for the months of June through October, 1980, a drought year for the state of Georgia.

Entrainment samples at Plant Edwin I. Hatch were collected for the years 1974, 1975, 1976, 1979, and 1980. Samples were collected weekly from 1974 through 1976 and monthly in 1979 and 1980. Table 6 presents the percent composition of the fish egg and fish for the five-year study. The differences in total number of fish eggs and fish collected are the results of the changes in sampling frequency. For the years 1975, 1979, and 1980, the most abundant fish were in the family Cyprinidae. The family Catostomidae was the most abundant for the years 1974 and 1976. The family Esocidae was the lowest for the years 1975, 1976, and 1977. The family Soleidae (an adult) was the lowest in 1980 while in 1974, the lowest was grouped as Other taxa. This group consisted of families represented by very low numbers, such as the Atherinidae and Belonidae. The commercially important Alosa sapidissima was highest in 1980 and lowest in 1979. The eggs of Alosa sapidissima were the most abundant in 1974, 1975, and 1976. No Alosa sapidissima eggs were collected in 1979 while in 1980, eggs from other species were more abundant.

An interesting note in Table 6 is though the data are not comprehensive, it does indicate a fluctuation in percent composition for each family from one year to another. For some families, this is more pronounced, as in the family Catostomidae; while in the family Esocidae, the percent composition was always very low.

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Monthly entrainment data for each taxa for 1975, 1976, and 1980 are presented in Table 7. The 1975 and 1976 data represents entrainment estimates for Unit 1. The 1980 data represents entrainment estimates for Unit 1 and Unit 2. With the addition of the Unit 2 intake pumps, an increase in fish eggs and larvae entrainment is expected. This may not be the case as shown by the data. An increase in entrained fish eggs and larvae is not apparent for 1980 compared to 1975 and 1976. The differences in numbers of fish eggs and larvae are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year.

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Summary

It was noted in the Edwin I. Hatch Nuclear Plant Annual Environmental Surveillance Report No. 3, January 1 - December 31, 1976, (Georgia Power Company, 1977) that densities of fish and fish eggs during the spawning seasons in 1974, 1975, and 1976 generally fluctuated directly with spawning intensity and inversely with river flow. The same conditions occurred in the 1979 and 1980 studies. Relative abundance of fish families varied during the five years of study, but the Catostomidae and Cyprinidae were the most abundant taxa each year. Clupeidae comprised only a small percentage of the total fish collected with 1980 being the highest (10.9%). The density of most fish groups was greater in night samples than in similar day samples.

Estimated entrainment of fish and fish eggs into Plant Edwin I. Hatch cooling water has remained less than one percent of the total population during five successive spawning periods with the exception of the months of July, August, and September, 1980. The increase in estimated percent entrained was due to extremely low river elevations resulting from the lack of rainfall. Based on the five years of study, estimated entrainment at the plant does not constitute a significant reduction in the fish population.

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PART II IMPINGEMENT

Materials And Methods

One sampling station located in the intake structure was used to collect the impingement samples (Figure 2A).

The study began in January, 1980, and ended in December, 1980, with samples taken monthly.

Samples were collected by inserting a wire basket with a 3/8 inch mesh size into the screen backwash sluiceway (Figure 11). Each sample lasted approximately 24 hours with the exception of the April and July surveys, which lasted approximately 48 hours. Samples were preserved in a 10% formalin solution and taken to the Environmental Affairs Center in Decatur, Georgia, to be identified, enumerated, weighted, and measured.

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Results

Part 1 Biological

Fourteen fish were impinged (Table 8) representing six species and one damaged ictalurid, which could not be identified to species. The most abundant species was Trinectes maculatus with six individuals impinged. Amia calva was represented by three individuals; while the remaining taxa, Aphredoderus sayanus, Ictalurus spp., Ictalurus puntatus. Lepomis auritus, and Percina nigrofasciata were represented by one individual each. The weight (grams) and length (millimeters) of each is presented in Table 8.

Part 2 Physicochemical

Water temperatures taken at the beginning and end of each survey are presented in Figures 12 and 13. The highest temperature recorded was 30.0 0 C on July 15 and 17, 1980; while the lowest was 8.9 0 C on February 15 and 16, 1980.

River elevations are presented in Figures 14 and 15. The highest, 81.9 feet, was recorded on March 19, 1980; while the lowest, 63.7 feet, was recorded on September 16 and 17, 1980. Data for Figures 14-15 are from unpublished primary computation of gage heights and discharge for the Altamaha River for 1980 at station 02225000 located near the U.S. Highway 1 bridge. Data for November and December were not available during the writing of this report.

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Discussion

Five years, 1975, 1976, 1977, 1979, and 1980, of impingement samples were collected at Plant Edwin I. Hatch. A total of 165 fish (Table 9) representing 22 species were collected. The highest number impinged, 61 fish, was in 1975, while the lowest, 14 fish, was in 1980. The data indicates low impingement estimates per day and per year. The 1975 estimates are 1.2 fish per day and 438 per year; 1976 estimates are .4 fish per day and 146 per ear; 1977 estimates are 1.1 fish per day and 401.5 per year; 1979 estimates are 1.3 fish per day and 474.5 per year; and 1980 estimates are 1.2 fish per day and 438 per year.

The hogchoker, Trinectes maculatus, was the most abundant and the only species collected consistently each year. Most species were collected only once during the five years.

Biological factors affecting impingement are: the resident fish population, daily and seasonal movements to deeper water, feeding behavior, and movement associated with breeding behavior. Other factors which determine impingement losses are: river elevation, intake velocities, and site location. Elevated river levels resulted in a reduction in intake velocities. In addition, the velocity of water in the intake structure increases from the surface to the bottom due to the intake pumps. An accurate correlation between river elevation and the number of impinged fish for the five years cannot be made because of the very low number of fish impinged. The increase in velocity at the bottom of the intake structure may, to some degree, explain why the majority of the fish impinged were Trinectes maculatus, a bottom dweller. The intake structure is located on a straight shoreline which would not harbor many fish, especially predatory game species. Low intake velocities and site location are probably the primary factors resulting in low numbers of impinged fish.

Summary

The impingement data for the five years indicates that impingement losses at Plant Edwin I. Hatch are extremely low. The findings show that impingement does not create a significant environmental effect.

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Table 1. Scientific and common names of species of fish collected during the entrainment study.

Scientific Name	Common Name
Alosa aestivalis	Blueback herring
Alosa sapidissima	American shad
Dorosoma spp.	Shad
Clupeidae	Herring and shad
Esox spp.	Pickerel
Esox americanus	Redfin pickerel
Hybognathus nuchalis	Silvery minnow
Notropis chalybaeus	Ironcolor shiner
Notropis petersoni	Coastal shiner
Cyprinidae	Minnow
Carpiodes velifer	Highfin carpsucker
Minytrema melanops	Spotted sucker
Moxostoma anisurum.	Silver redhorse
Ictalurus brunneus	Snail bullhead
Ictalurus nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Noturus gyrinus	Tadpole madtom
Aphredoderus sayanus	Pirate perch
Labidesthes sicculus	Brook silverside
Strongylura marina	Atlantic needlefish
Lepomis spp.	Sunfish
Lepomis auritus	Redbreast sunfish
Micropterus salmoides	Largemouth bass
Pomoxis spp.	Crappie
Perca flavescens	Yellow Perch
Percidae	Darter
Trinectes maculatus	Hogchoker
Unknown egg	
Unknown larvae	

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Table 2. Species, number of individuals collected for each month-day and night, totals for the month, for day and night, and percent composition of each taxa and each family.

		Feb.		March		Apr.		May		June		July		Aug.		Sept.		Totals		% of	% of	% of
Species		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Fish	Egg	Family
Clupeidae																						10.9
	<u>*Alosa aestivalis*</u>						1										1	0	2	0.23		
	<u>*Alosa sapidissima*</u>																					
	Egg				4	1	6											1	10		44	
	Fish				1	2	2	7	28	2	3							11	34	10.41		
	<u>*Dorosoma spp.*</u>					1												1	0	0.23		
	<u>*Clupeidae*</u>							1										1	0	0.23		
Esocidae																						1.4
	<u>*Esox spp.*</u>			2	3													2	3	1.13		
	<u>*Esox americanus*</u>						1											0	1	0.23		
Cyprinidae																						29
	<u>*Hybognathus nuchalis*</u>						1	30									1	30	7.01			
	<u>*Notropis chalybaeus*</u>					1											0	1	0.23			
	<u>*Notropis petersoni*</u>										8		2					0	10	2.26		
	Cyprinidae			4	9	1	26		9	1	22		5		4		5	6	80	19.46		
Catostomidae																						23*
	<u>*Carpiodes velifer*</u>					4			6	3	12	4	12		34		1	11	65	17.19		
	<u>*Minytrema melanops*</u>				8	14		1									8	15	5.2			
	<u>*Moxostoma anisurum*</u>						1	1									1	1	0.45			

*corrected from original report

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Table 2. (Con't)

Species		Feb. Day	Feb. Night	March Day	March Night	Apr. Day	Apr. Night	May Day	May Night	June Day	June Night	July Day	July Night	Aug. Day	Aug. Night	Sept. Day	Sept. Night	Totals Day	Totals Night	% of Fish	% of Egg	% of Family
Ictaluridae																						6.6
Ictalurus								12									0	12	2.71			
Ictalurus nebulosus									2	5		7					2	12	3.17			
Ictalurus punctatus												2					0	2	0.45			
Noturus gyrinus										1							0	1	0.23			
Aphredoderidae																						5.6
Aphredoderus sayanus					2	22		1		1							2	24	5.66			
Atherinidae																						0.7
Labidesthes sicculus										3							0	3	0.68			
Belonidae																						0.7
Strongylura marina								1	1	1							1	2	0.68			
Centrarchidae																						17.6
Lepomis spp.					1			1	1	7		1			56	1	2	66	15.38			
Lepomis auritus						1											0	1	0.23			
Micropterus salmoides										1							0	1	0.23			
Pomoxis spp.			5	3													5	3	1.81			
Percidae																						2.9
Perca flavescens			1	1	2	2	4									1	7	4	2.49			
Percidae						2											0	2	0.45			
Soleidae																						0.2
Trinectes maculatus									1								1	0	0.23			
Unknown Egg				6		2		6									2	12		56		
Unknown Fish								4				1		1				6	1.36			1.4
Totals	0	0	12	27	22	80	14	100	11	64	4	30	0	95	0	9	65	403	100		100	100

Letter C-12. Attachment (page 47 of 73)

Table 3. Mean and Range of the Total Lengths (mm) for Each Species for Each Month Sampled (Specimens Which Could Be Identified But Were Damaged Were Not Measured or Included in This Table).

Species	Feb.	March	April	May	June	July	Aug.	Sept.
Alosa aestivalis			4.9					
Alosa sapidissima		6.6	10.2 (6.2-11.8)	17.9 (7.7-25.0)	20.2 (17.0-23.0)			
Dorosoma spp.			3.5					
Clupeidae				4.6				
Esox spp.		17.2 (11.2-21.0)						
Esox americanus			45.0					
Hybognathus nuchalis				19.5 (15.0-25.0)				
Notropis chalybaeus			37.0					
Notropis petersoni					10.5 (8.8-12.9)	15.5 (15.0-16.0)		
Cyprinidae		4.7 (3.8-7.1)	8.6 (3.9-15.0)	19.3 (7.7-24.0)	5.7 (3.5-9.8)	4.8 (3.9-5.3)	5.0 (4.9-5.2)	6.6 (4.8-9.1)
Carpiodes velifer			7.5 (6.7-8.0)	6.4 (5.3-7.4)	6.6 (5.3-8.4)	5.9 (5.3-6.6)	6.4 (5.3-7.7)	7.3
Minytrema melanops			11.2 (8.7-15.0)	11.5				
Moxostoma anisurum				23.5 (21.0-26.0)				
Ictalurus brunneus				19.5 (17.0-21.0)				
Ictalurus nebulosus					19.6 (17.0-25.0)	16.1 (15.0-17.0)		

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Table 3. (Con't)

Species	Feb.	March	April	May	June	July	Aug.	Sept.
Ictalurus punctatus						24.0 (18.0-30.0)		
Noturus gyrinus					13.0			
Aphredoderus sayanus			8.1 (3.5-27.0)'	33.0				
Labidesthes sicculus					4.7 (4.2-4.9)			
Strongylura marina				17.0	15.5 (13.0-18.0)			
Lepomis spp.			5.3	7.3	9.6 (5.2-13.4)	13.0	6.9 (4.2-8'.3)	15.0
Lepomis auritus			27.0					
Micropterus salmoides					6.3			
Pomoxis spp.		4.2 (3.8-5-3)						
Perca flavescens		7.1 (6.9-7-3)	6.1 (5.6-7.0)	7.4 (6.7-8.8)				5.9
Percidae			6.2					
Trinectes maculatus					76.0			
Unknown Fish	Not measured because all these specimens were damaged.							

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Table 4. Average Monthly Densities for Each Family, the Estimated Number Found in the River in the Vicinity of the Plant, the Percent of River Discharge Entrained, and the Estimated Number Entrained for 1980.

Month	Family	Monthly Densities Per 1000 m3 of Water	Estimated Number of Eggs & Fish in the Vicinity of the Plant	Percent of River Discharge Entrained	Estimated Number of Eggs & Fish Entrained by the Plant Each Month
February	NOSP*	NOSP	NOSP	0.5	NOSP
March	Clupeidae	0.9	84,609	0.2	177
	Clupeidae egg	1.0	94,010		197
	Esocidae	0.7	65,807		138
	Cyprinidae	3.3	313,053		657
	Centrarchidae	4.1	381,680		801
	Percidae	0.6	53,116		112
	Unknown egg	1.5	140,075		294
	TOTAL	12.1	1,132,350		2,376
April	Clupeidae	1.8	173,628	0.2	365
	Clupeidae egg	2.0	192,910		405
	Esocidae	0.3	28,938		61
	Cyprinidae	7.9	762,034		1,600
	Catostomidae	7.8	752,388		1,580
	Aphredoderidae	6.6	636,636		1,337
	Centrarchidae	0.6	57,876		122
	Percidae	1.8	173,628		365
	Unknown egg	0.6	57,876		122
	TOTAL	29.4	2,835,914		5,955
May	Clupeidae	10.5	286,330	0.8	2,293
	Cyprinidae	13.0	354,516		2,836
	Catostomidae	2.6	70,903		567
	Ictaluridae	3.5	95,447		764
	Aphredoderidae	0.3	8,181		65
	Belonidae	0.3	8,181		65
	Centrarchidae	0.3	8,181		65

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Table 4. (Con't)

Month	Family	Monthly Densities Per 1000 m3 of Water	Estimated Number of Eggs & Fish in the Vicinity of the Plant	Percent of River Discharge Entrained	Estimated Number of Eggs & Fish Entrained by the Plant Each Month
May (Con't)	Percidae	1.0	27,270	0.8	218
	Unknown egg	1.7	46,356		371
	Unknown	1.1	29,998		240
	TOTAL	34.3	935,662		7,485
June	Clupeidae	1.8	45,086	1.0	437
	Cyprinidae	12.3	308,088		2,988
	Catostomidae	5.0	125,239		1,215
	Ictaluridae	1.8	45,086		437
	Aphredoderidae	0.4	10,019		97
	Atherinidae	1.3	32,562		316
	Belonidae	0.9	22,543		219
	Centrarchidae	3.8	95,182		923
	Soleidae Adult	0.5	12,524		121
	TOTAL	27.8	696,328		6,754
July	Cyprinidae	2.1	31,060	1.5	478
	Catostomidae	3.6	53,246		820
	Ictaluridae	2.1	31,060		478
	Centrarchidae	0.4	5,916		91
	Unknown	0.4	5,916		91
	TOTAL	8.6	127,198		1,959
August	Cyprinidae	11.5	85,847	3.2	2721
	Centrarchidae	20.8	155,271		4,922
	Unknown	0.3	2,240		74
	TOTAL	32.6	243,458		7,718
September	Cyprinidae	2.9	17,493	3.5	616
	Catostomidae	0.6	3,619		127
	Centrarchidae	0.6	3,619		127
	Percidae	0.6	3,619		127
	TOTAL	4.7	28,350		998

*Indicates No Species Found

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Table 5. Altamaha River Monthly Discharge, Plant Hatch River Pumping Data, and the percent river flow entrained for each month for 1975, 1976, and 1980.

Year	1975			1976			1980		
	Altamaha River Discharge (MGD)	Plant Hatch Pumping Data (MGD)	Percent of River Discharge Entrained	Altamaha River Discharge (MGD)	Plant Hatch pumping Data (MGD)	Percent of River Discharge Entrained	Altamaha River Discharge (MGD)	Plant Hatch pumping Data (MGD)	Percent of River Discharge Entrained
Month									
January	11,800	36.5	0.3%	9,433	36.5	0.4%	6,982	50.9	0.7%
February	17,160	36.5	0.2%	10,461	36.5	0.3%	10,282	51.4	0.5%
March	30,556	36.5	0.1%	13,558	36.5	0.3%	24,761	52.7	0.2%
April	26,981	36.5	0.1%	8,450	36.5	0.4%	25,507	53.8	0.2%
May	13,331	36.5	0.3%	10,810	36.5	0.3%	7,210	57.5	0.8%
June	9,479	36.5	0.4%	9,375	36.5	0.4%	6,623	64.3	1.0%
July	7,397	36.5	0.5%	5,450	36.5	0.7%	3,908	60.2	1.5%
August	7,856	36.5	0.5%	2,688	36.5	1.4%	1,984	62.5	3.2%
September	4,797	36.5	0.8%	2,566	36.5	1.4%	1,596	56.1	3.5%
October	7,248	36.5	0.5%	4,659	36.5	0.8%	1,946	57.3	2.9%

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Table 6. Percent Composition of Fish Taxa for 1974, 1975, 1976, 1979, and 1980 Entrainment Data.

	Fish Percent Composition				
Family	1974	1975	1976	1979	1980
Aphredoderidae	2.11	2.98	1.11	--	5.89
Atherinidae	--	--	--		0.7
Belonidae	--	--	--	--	0.7
Catostomidae	61.75	12.38	56.18	17.8	22.9
Centrarchidae	5.27	21.85	14.46	23.2	17.6
Clupeidae	5.23	2.39	2.54	1.3	10.9
Cyprinidae	13.66	37.21	18.65	48.4	29
Esocidae	1.33	0.53	0.11	0.7	1.4
Ictaluridae	0.16	11.57	0.29	2.7	6.6
Percidae	6.38	4.21	4.44	6	2.9
Soleidae	--	--	--	--	0.2
Other Taxa	0.12	1.05	0.36		--
Unidentified	3.54	5.83	1.86	--	1.4
Total Fish Collected	2,562	1,712	2,793	151	442
	Eggs Percent Composition				
Alosa sapidissima	51.16	52.71	86.16	--	44
Other Taxa	48.84	47.29	13.84		56
Total Eggs Collected	258	258	1,033		25

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Table 7. Comparison of Monthly Entrainment Data for each Taxa for 1975, 1976, and 1980 for Plant Hatch

Larvae

	Clupeidae			Catostomidae			Centrarchidae		
Month	1975	1976	1980	1975	1976	1980	1975	1976	1980
February	0	7	0	0	0	0	11	0	0
March	0	88	176	1978	580	0	216	562	405
April	1	492	374	2860	6987	1582	82	362	123
May	31	47	2277	1342	1443	559	1426	346	65
June	202	0	426	140	109	1205	4153	219	932
July	*	0	0	*	589	823	*	667	80
August	*	**	0	*	**	0	*	**	4911
September	*	**	0	*	**	122	*	**	122

*Sampling was discontinued after the June survey in 1975
**Sampling was discontinued after the July survey in 1976

	Cyprinidae			Other			Total Larvae		
	1975	1976	1980	1975	1976	1980	1975	1976	1980
Month									
February	433	0	0	60	0	0	504	7	0
March	5420	128	664	1422	228	259	9036	1585	1504
April	1289	2445	1600	2775	810	1753	7022	11095	5432
May	455	346	2837	1019	248	1366	4273	2429	7104
June	258	749	2978	1206	52	1122	5959	1129	6663
July	*	185	479	*	18	159	*	1958	1541
August	*	**	2714	*	**	78	*	**	7703
September	*	**	609	*	**	122	*	**	975

Egg

	Clupeidae			Other			Total Eggs		
Month	1975	1976	1980	1975	1976	1980	1975	1976	1980
February	34	271	0	49	13	0	83	284	0
March	93	1258	199	137	228	297	230	1486	496
April	38	1518	408	201	358	122	239	1876	530
May	351	1018	0	438	66	370	789	1083	390
June	11	0	0	0	0	0	11	0	0
July	*	0	0	*	12	0		12	0
August	*	**	0	*	**	0			0
September	*	**		*	**				

*Sampling was discontinued after the June survey in 1975
**Sampling was discontinued after the July survey in 1976

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Table 8. Species and Numbers of Fish Collected in Monthly Impingement Surveys at Plant Edwin I. Hatch for 1980.

Date	Species Collected*	Length (mm)	Weight (grams)
1-15-80	NOSP**		
2-15-80	NOSP		
3-18-80	Trinectes maculatus (6)	61	5.0
		63	5.7
		65	6.0
		54	3.3
		61	4.9
		61	5.0
	Percina nigrofasciata (1)	43	.8
4-15-80	Aphredoderus sayanus (1)	816	11.3
5-10-80	Amia calva (3)	115	17.0
		107	15.5
		107	14.0
6-17-80		NOSP	
7-15-80	Ictalurus spp. (1) Specimen Damaged		
	Lepomis auritus (1)	55	2.7
8-19-80	Ictalurus punctatus (1)	203	84.3
9-16-80		NOSP	
10-14-80		NOSP	
11-12-80		NOSP	
12-17-80		NOSP	

*Number Collected in Parenthesis

**Indicates No Species Collected

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Table 9. Species and Numbers of Fish Collected in Impingement Surveys at Plant Edwin I. Hatch for 1975, 1976, 1977, 1979, and 1980.

Species	Common Name	1975	1976	1977	1979	1980	Totals
Amia calva	Bowfin			3		3	6
Alosa sapidissima	American shad			1			1
Dorosoma cepedianum	Gizzard shad	2					2
Dorosoma petenense	Threadfin shad		3				3
Esox americanus	Redfin pickerel	1					1
Hybognathus nuchalis	Silvery minnow	1		1			2
Notropis callisema.	Altamaha shiner	1					1
Notropis hudsonius	Spottail shiner			1			1
Notropis spp.	Minnow	1					1
Ictalurus brunneus	Snail bullhead			1			1
Ictalurus nebulosus	Brown bullhead	1					1
Ictalurus platycephalus	Flat bullhead.			1			1
Ictalurus punctatus	Channel catfish	1	1	1		1	4
Ictalurus spp.	Catfish						1
Aphredoderus sayanus	Pirate perch	2				1	3
Acantharchus pomotis	Mud sunfish		2	1			3
Centrarchus macropterus	Flier	3		1	1		5
Lepomis auritus	Redbreast sunfish	1	1	2		1	5
Lepomis gulosus	Warmouth			15	1		16
Lepomis macrochirus	Bluegill	4			1		5
Lepomis punctatus	Spotted sunfish			2			2
Lepomis spp.	Sunfish			1			1
Pomoxis nigromaculatus	Black crappie		1	1			2
Percina nigrofasciatus	Blackbanded darter			1	1	2	
Trinectes maculatus	Hogchoker	43	15	15	16	6	95
Totals		61	23	47	20	14	165

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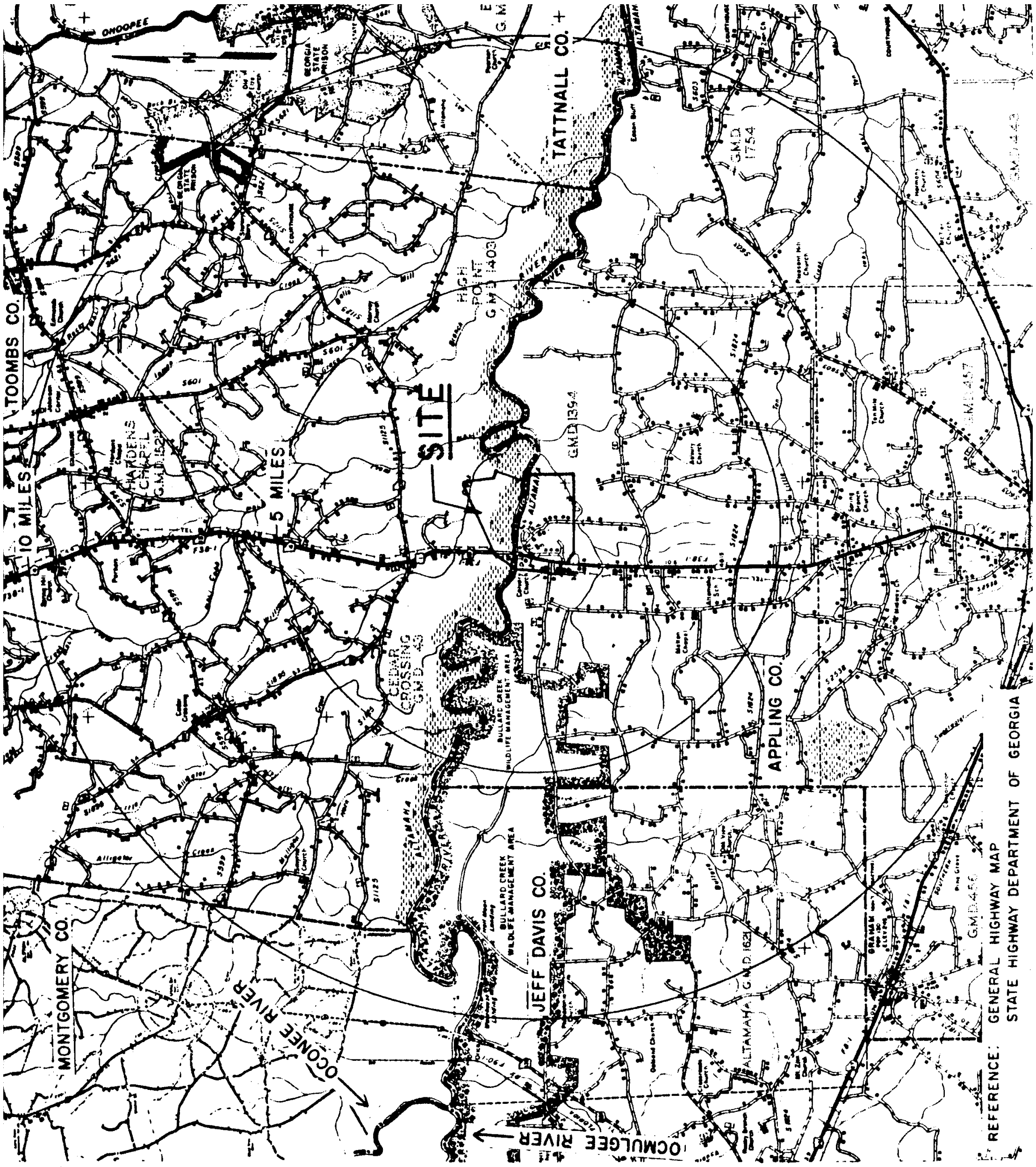

Figure 1. Plant Edwin I. Hatch Site

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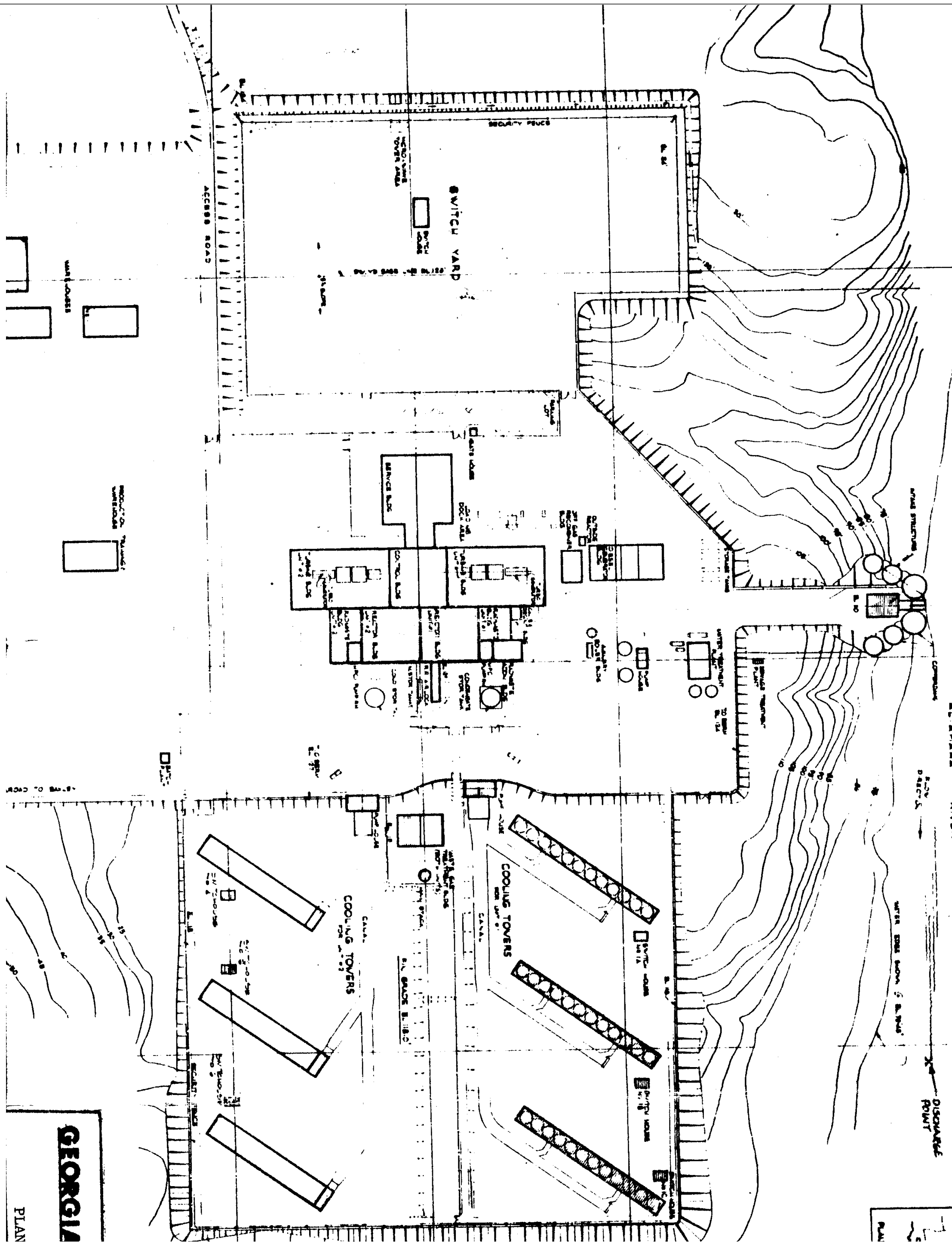

Figure 1A. Plant Edwin I Hatch Plant Layout

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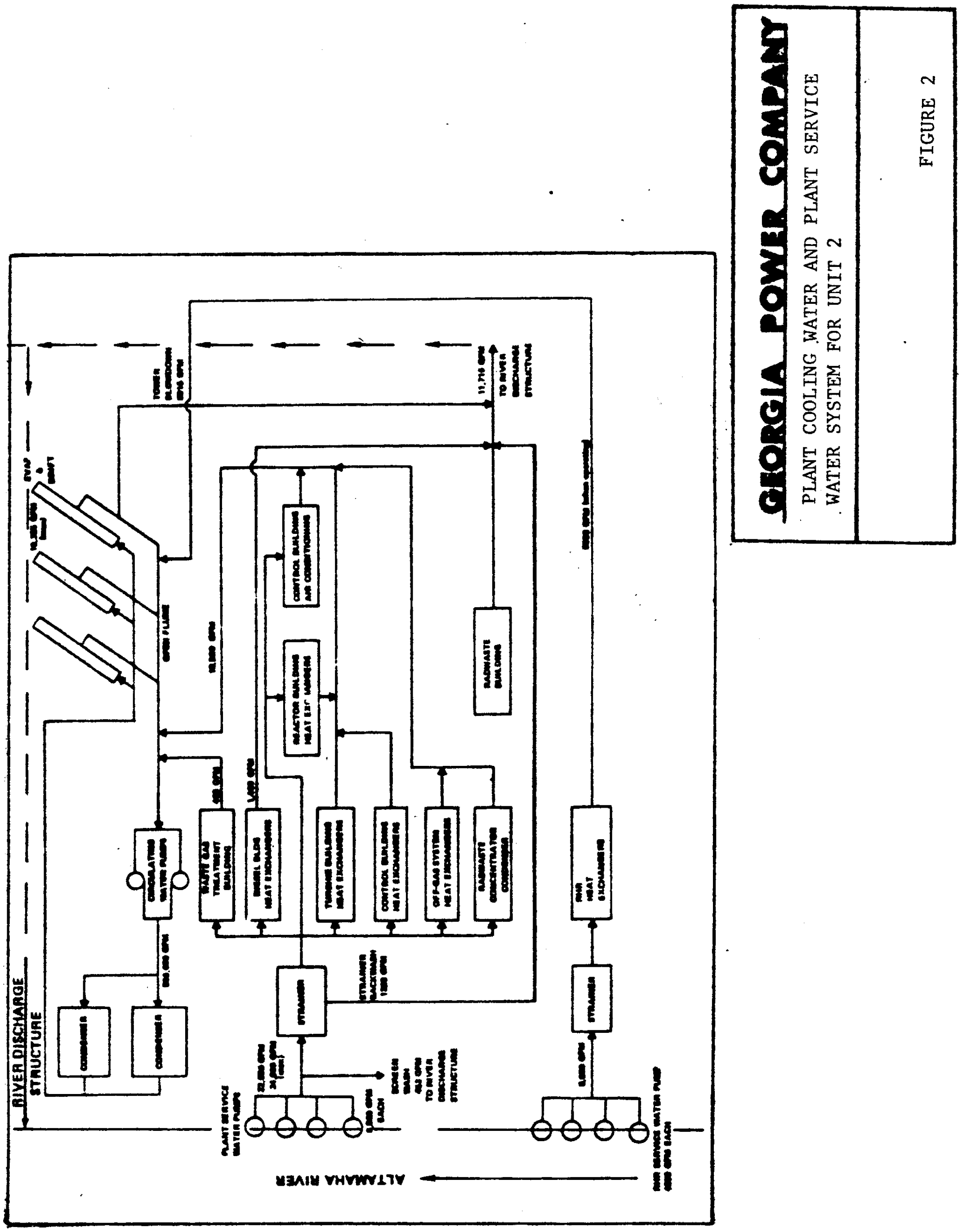

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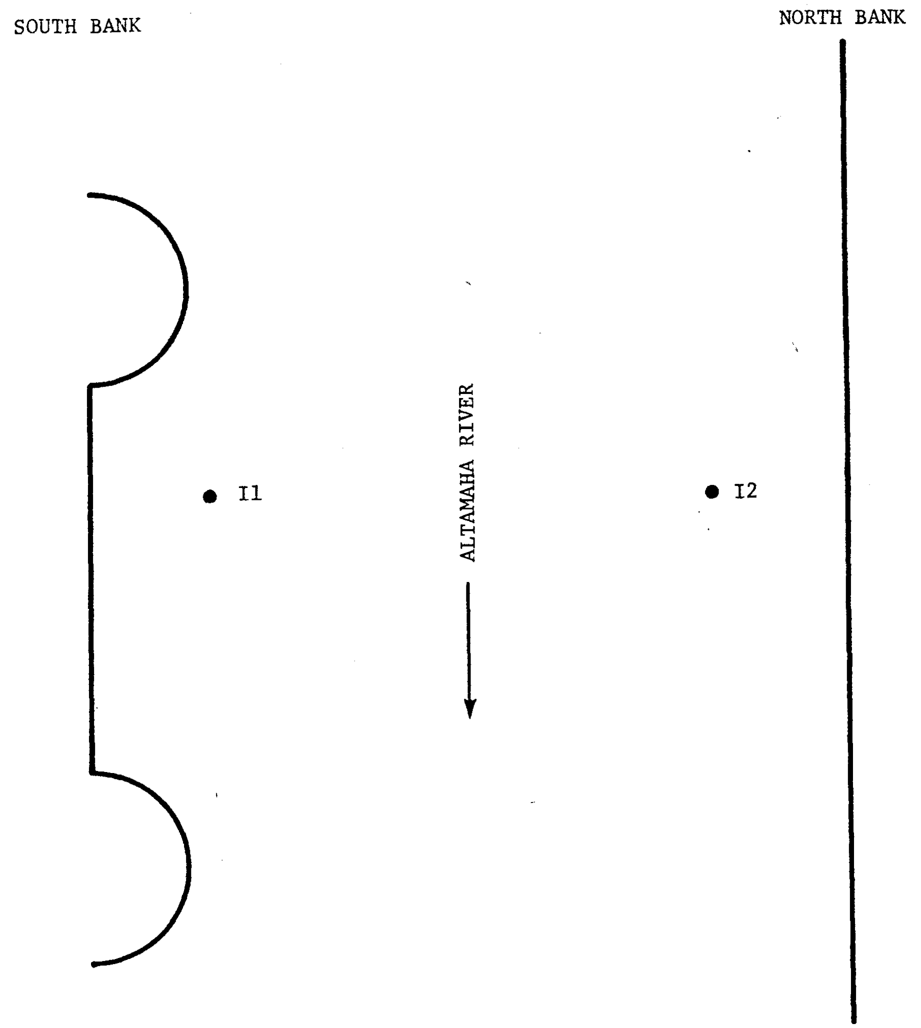
Letter C-12. Attachment (page 60 of 73)



GEORGIA POWER COMPANY

LOCATION OF THE ENTRAINMENT SAMPLING STATIONS ON THE ALTAMAHA RIVER AT

PLANT EDWIN I. HATCH

FIGURE 3

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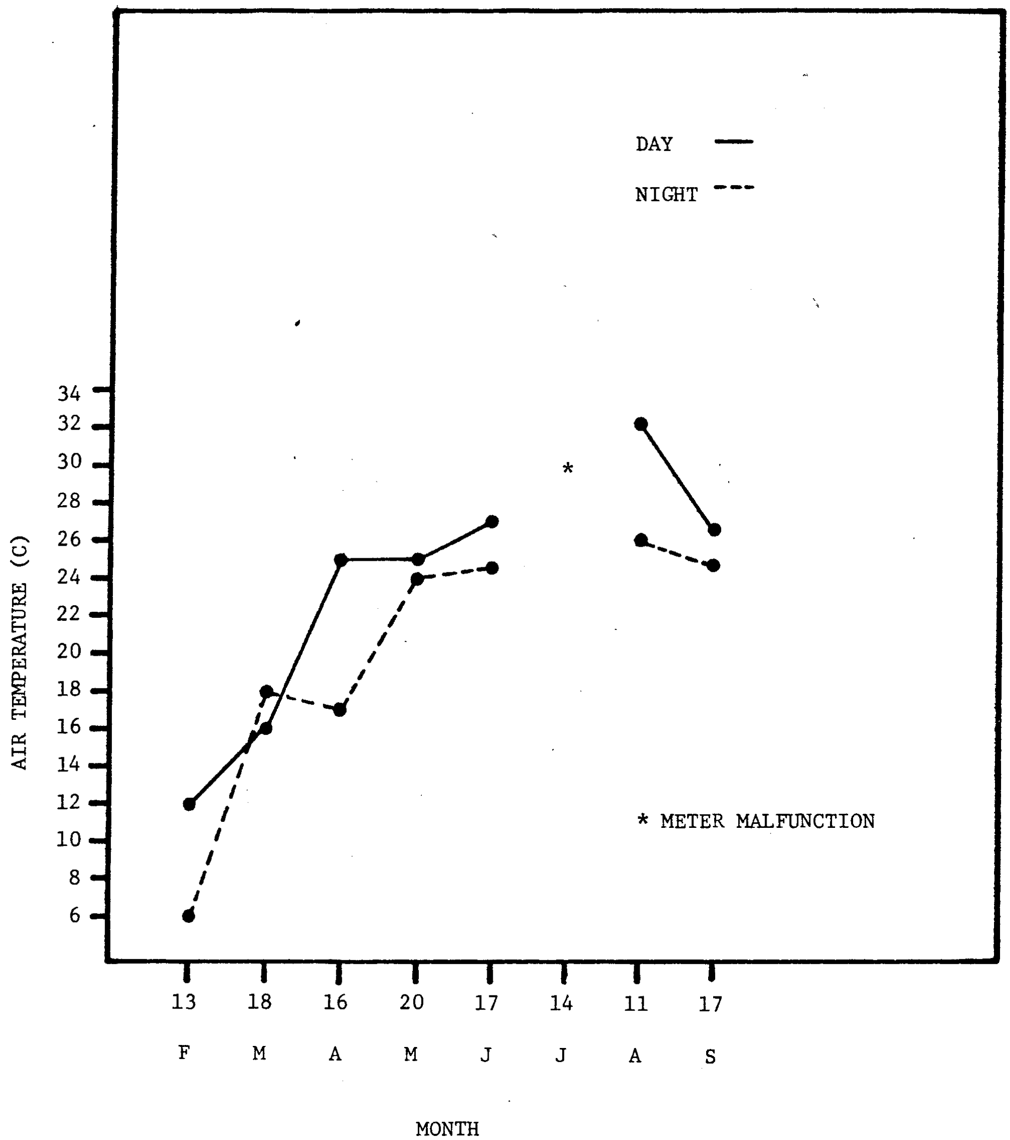
Letter C-12. Attachment (page 61 of 73)



GEORGIA POWER COMPANY

AIR TEMPERATURES FOR THE DAY AND NIGHT ENTRAINMENT SURVEYS ON THE ALTAMAHA RIVER

AT PLANT EDWIN I. HATCH FROM FEBRUARY, 1980 - SEPTEMBER, 1980

FIGURE 4

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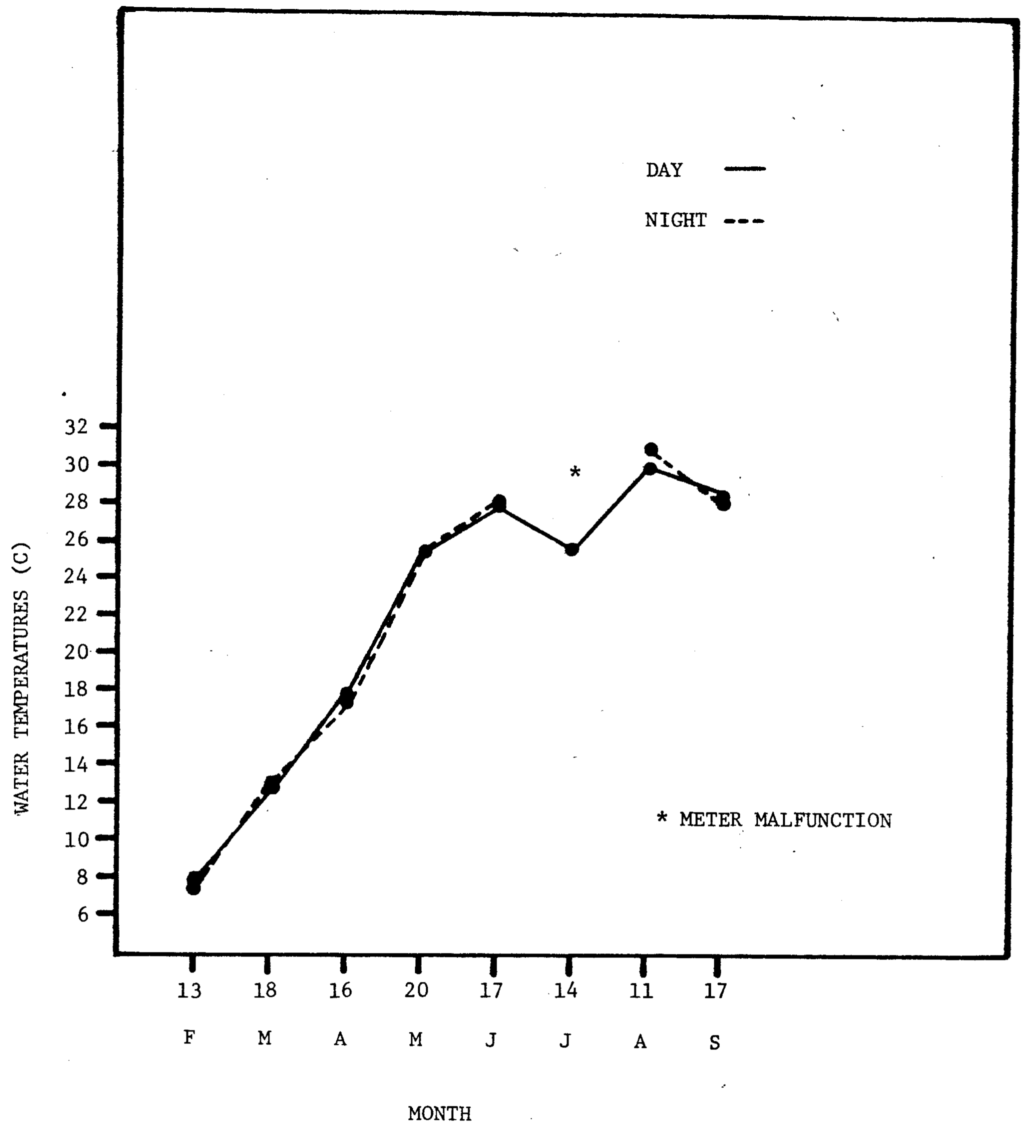
Letter C-12. Attachment (page 62 of 73)



GEORGIA POWER COMPANY

WATER TEMPERATURES FOR THE DAY AND NIGHT ENTRAINMENT SURVEYS ON THE ALTAMAHA RIVER

AT PLANT EDWIN I. HATCH FROM FEBRUARY, 1980 SEPTEMBER, 1980

FIGURE 5

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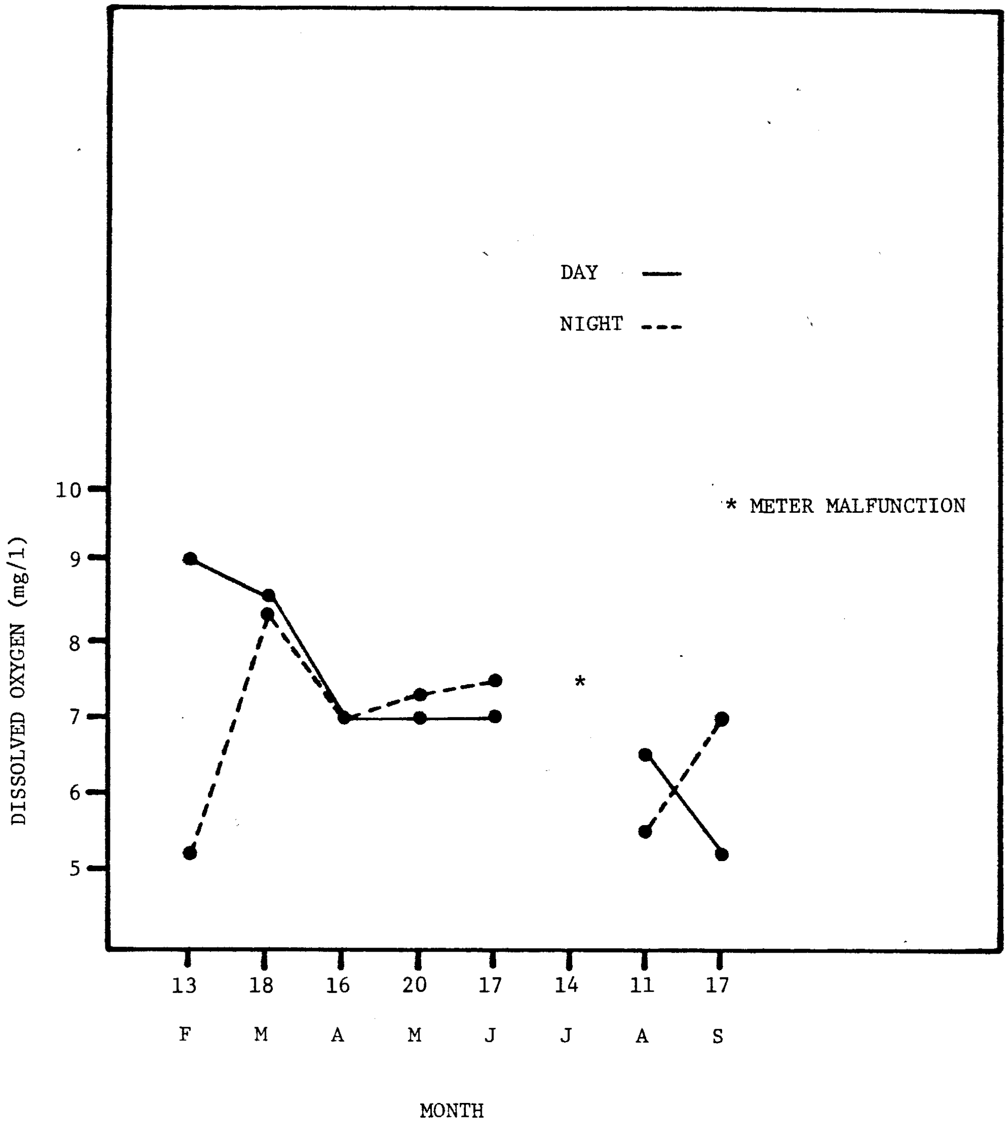
Letter C-12. Attachment (page 63 of 73)



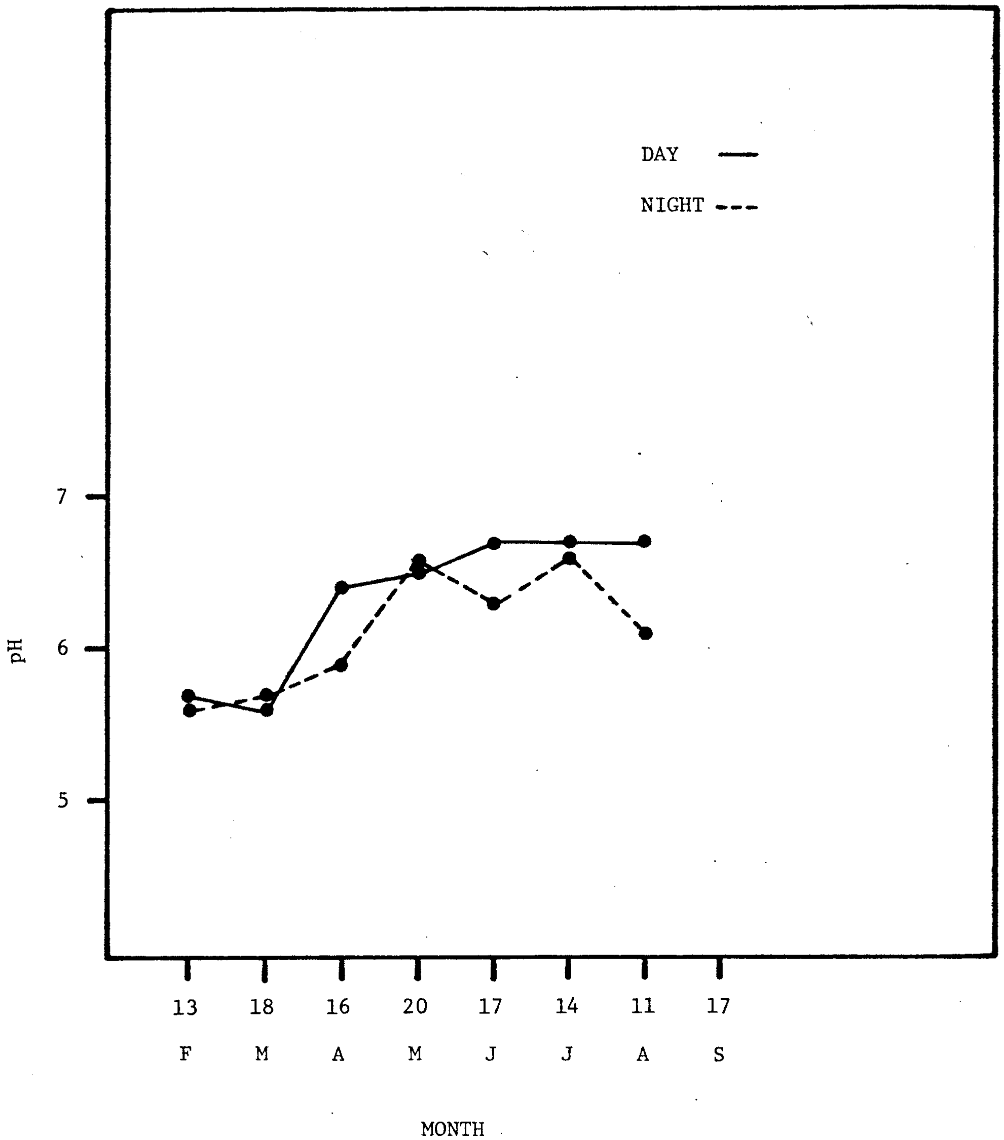
GEORGIA POWER COMPANY

DISSOLVED OXYGEN CONCENTRATIONS FOR THE DAY AND NIGHT ENTRAINMENT SURVEYS ON THE ALTAMAHA RIVER AT PLANT EDWIN I. HATCH FROM FEBRUARY, 1980 - SEPTEMBER, 1980

FIGURE 6

31

Letter C-12. Attachment (page 64 of 73)



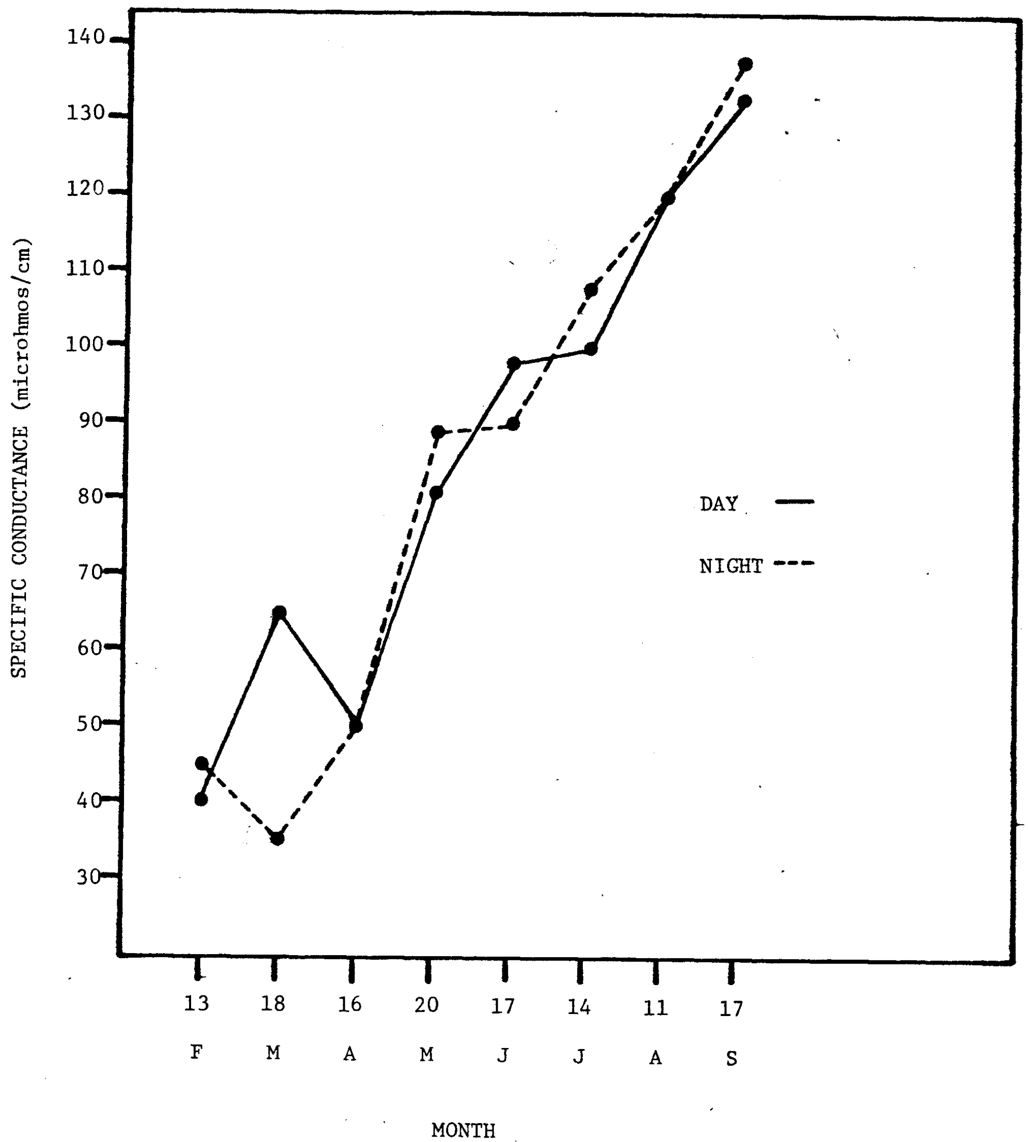
GEORGIA POWER COMPANY

pH VALUES FOR THE DAY AND NIGHT ENTRAINMENT SURVEYS ON THE ALTAMAHA RIVER AT PLANT EDWIN I. HATCH FROM FEBRUARY, 1980 - SEPTEMBER, 1980

FIGURE 7

32

Letter C-12. Attachment (page 65 of 73)



GEORGIA POWER COMPANY

SPECIFIC CONDUCTANCE FOR THE DAY AND NIGHT ENTRAINMENT SURVEYS ON THE ALTAMAHA RIVER AT PLANT EDWIN I. HATCH FROM FEBRUARY, 1980 - SEPTEMBER, 1980

FIGURE 8

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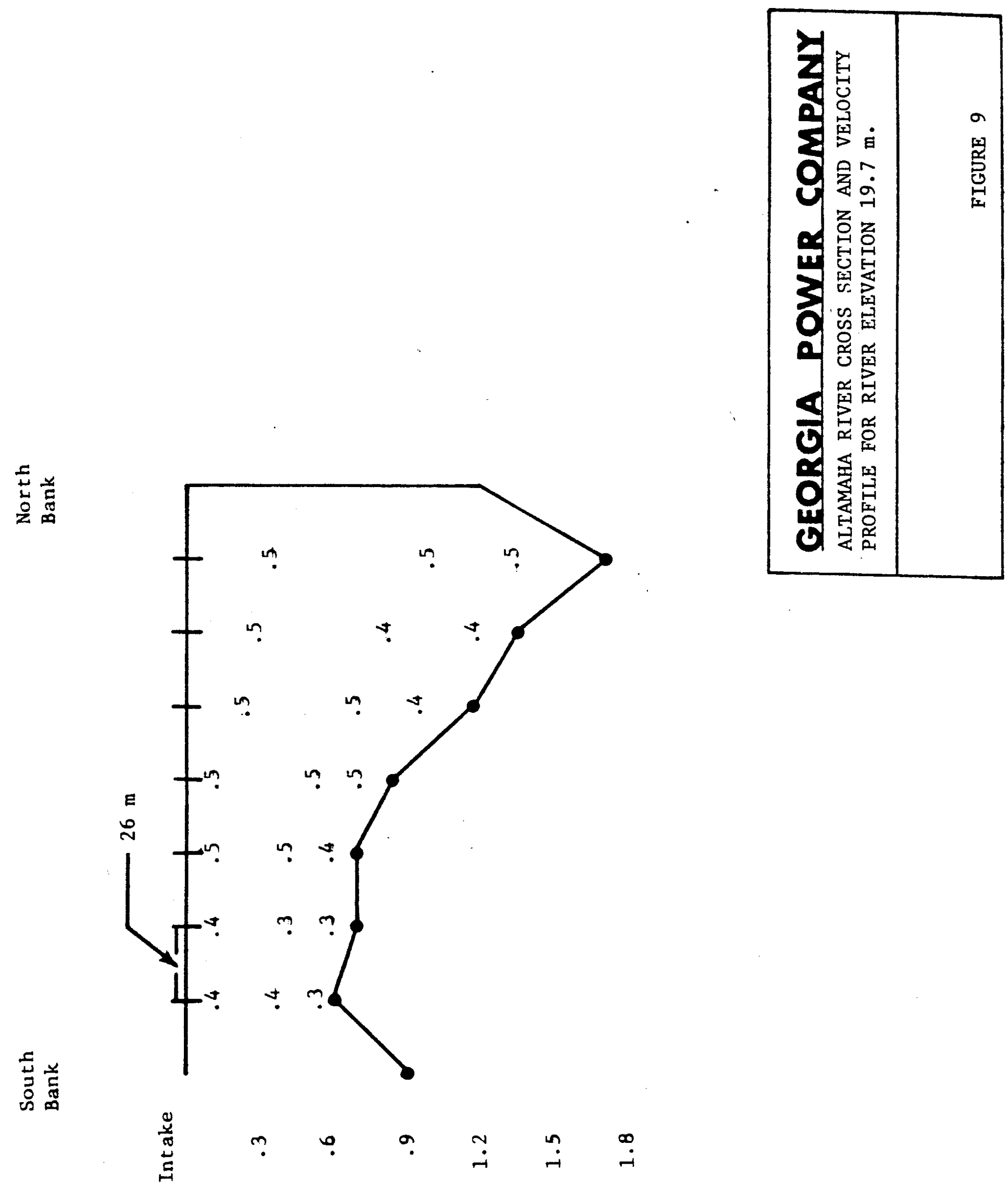
Letter C-12. Attachment (page 66 of 73)



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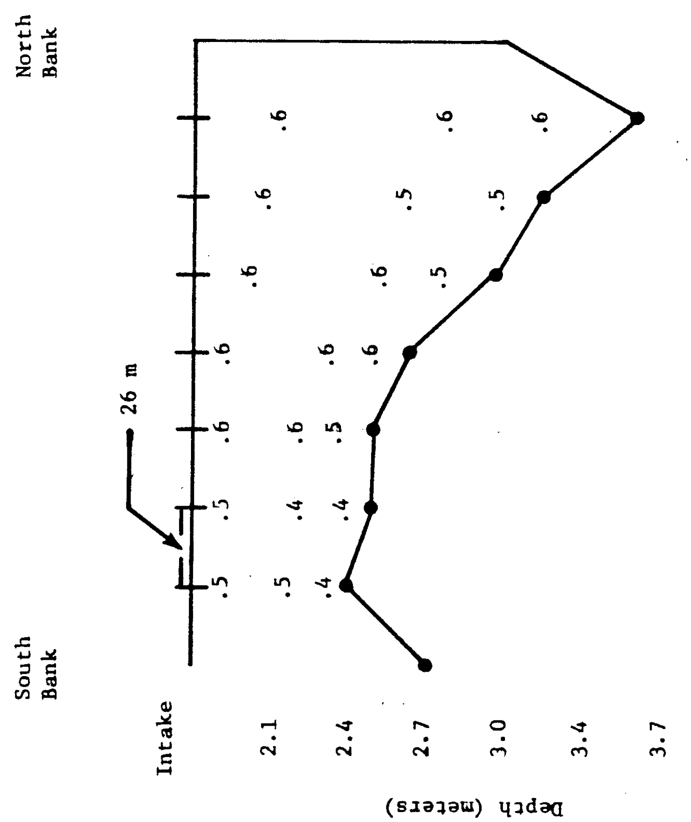


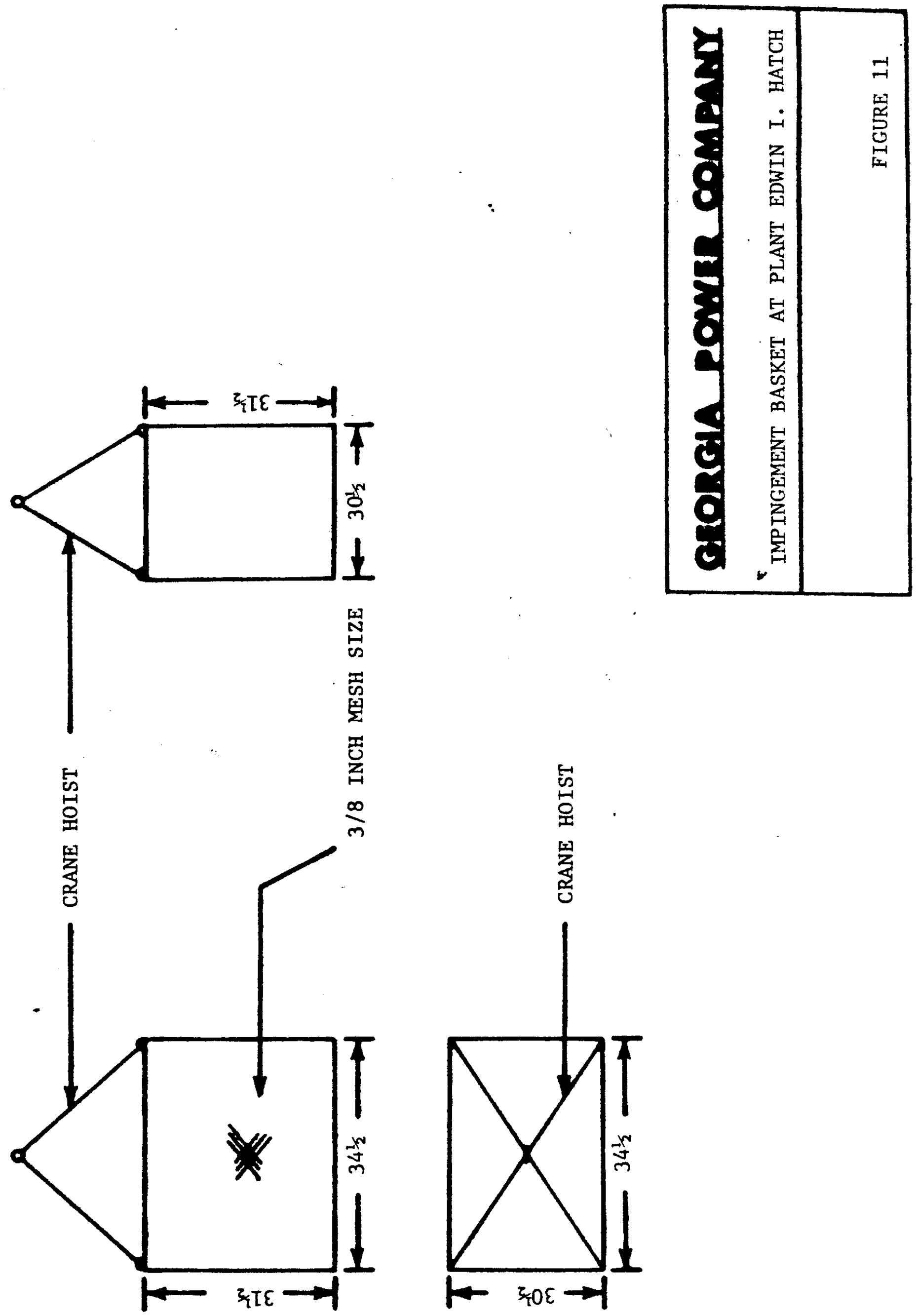
GEORGIA POWER COMPANY

ALTAMAHA RIVER CROSS SECTION AND VELOCITY PROFILE FOR RIVER ELEVATION 21.5 m.

FIGURE 10

35

Letter C-12. Attachment (page 68 of 73)



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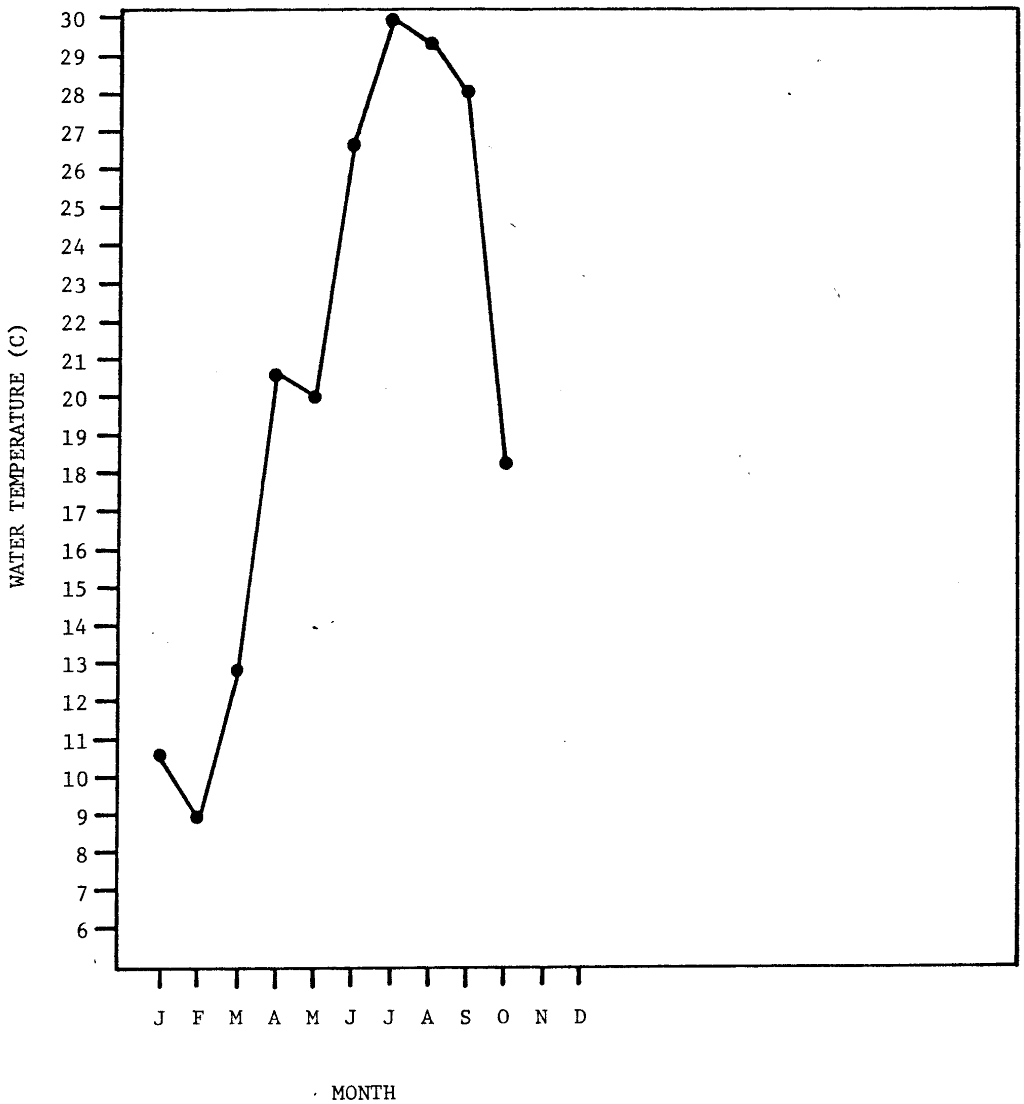
Letter C-12. Attachment (page 69 of 73)



GEORGIA POWER COMPANY

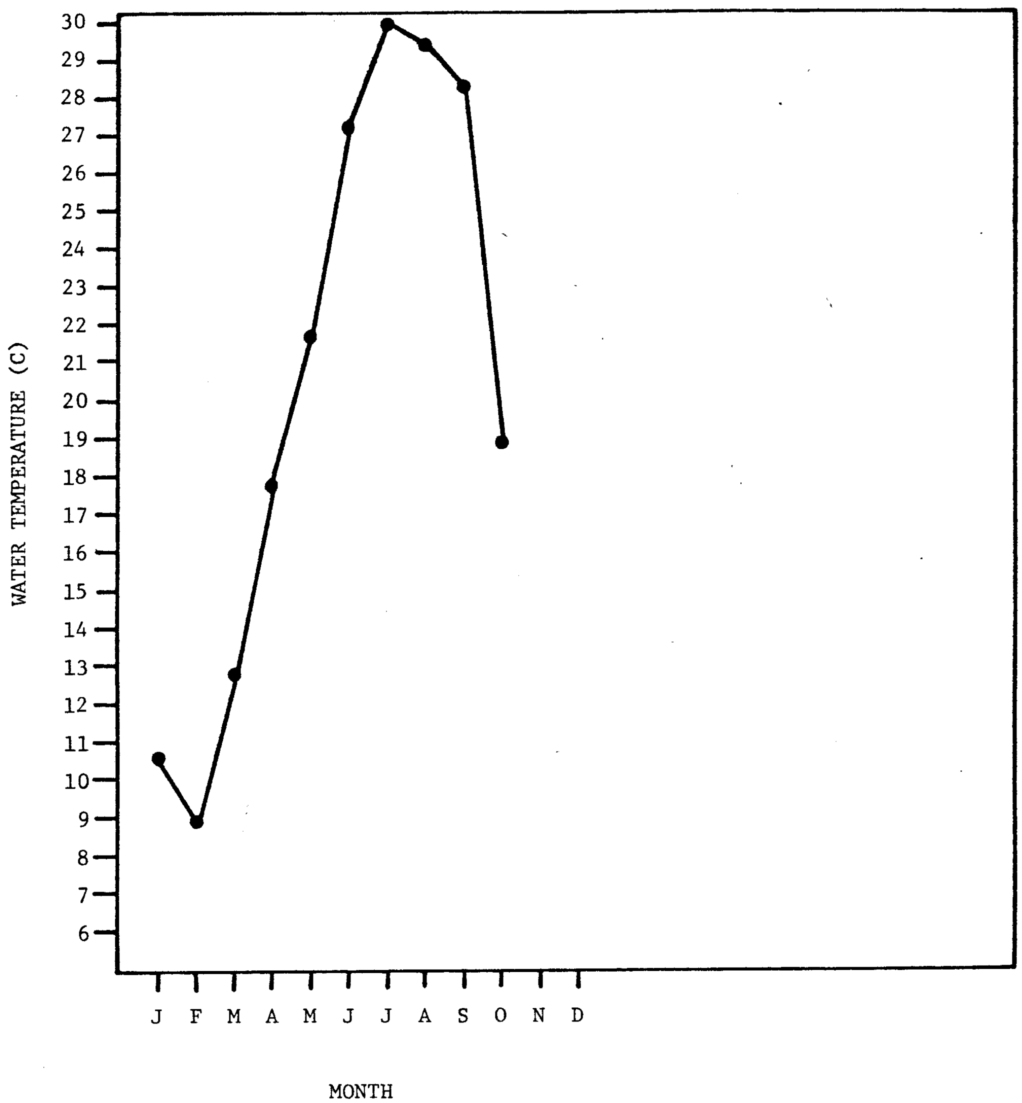
WATER TEMPERATURES FOR THE ALTAMAHA RIVER AT THE BEGINNING OF EACH IMPINGEMENT SURVEY

AT PLANT EDWIN I. HATCH FROM JANUARY, 1980 - DECEMBER, 1980

FIGURE 12

37

Letter C-12. Attachment (page 70 of 73)



GEORGIA POWER COMPANY

WATER TEMPERATURES FOR THE ALTAMAHA RIVER AT THE END OF EACH IMPINGEMENT SURVEY AT

PLANT EDWIN I. HATCH FROM JANUARY, 1980 - DECEMBER, 1980

FIGURE 13

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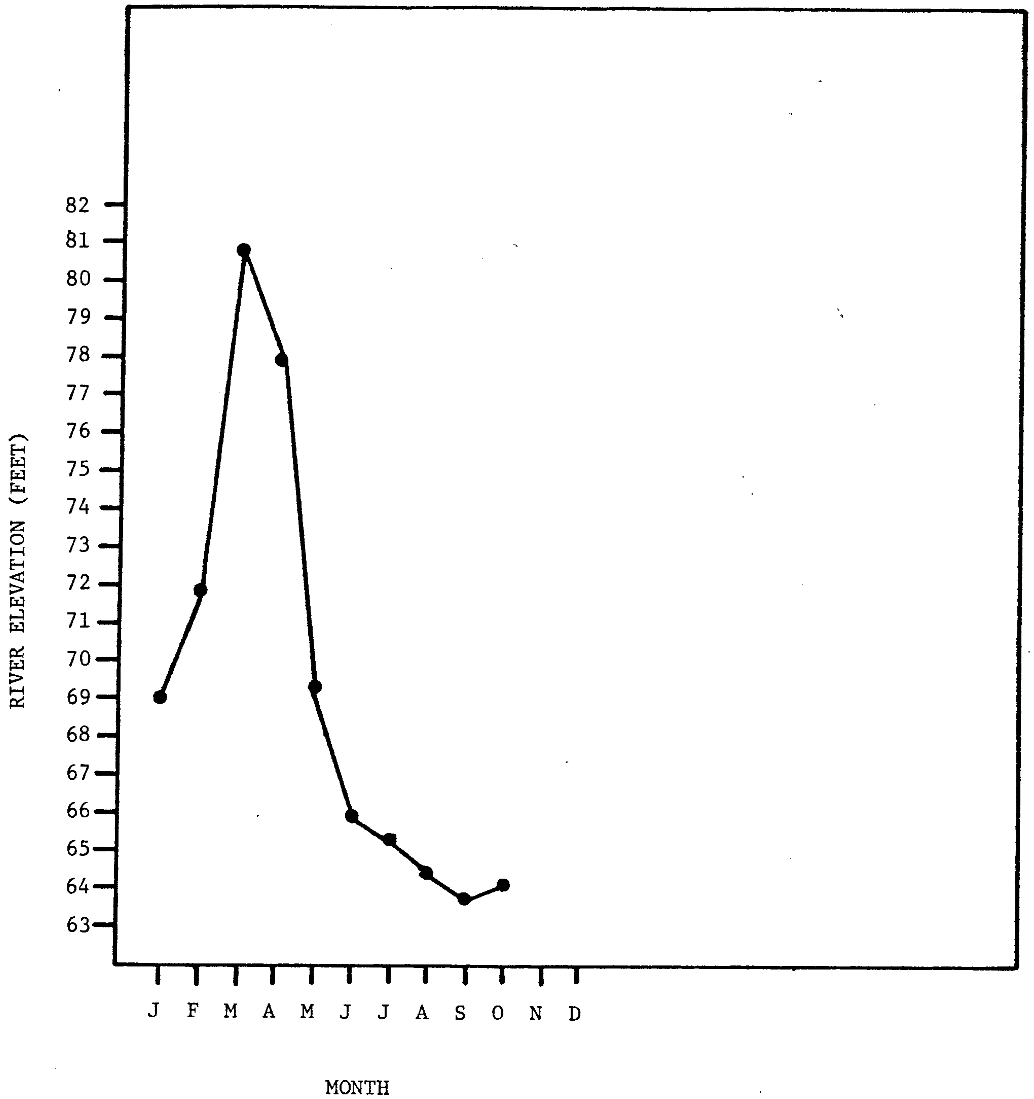
Letter C-12. Attachment (page 71 of 73)



GEORGIA POWER COMPANY

RIVER ELEVATION FOR THE ALTAMAHA RIVER AT THE BEGINNING OF EACH IMPINGEMENT SURVEY AT PLANT EDWIN I. HATCH FROM JANUARY, 1980 - DECEMBER, 1980

FIGURE 14

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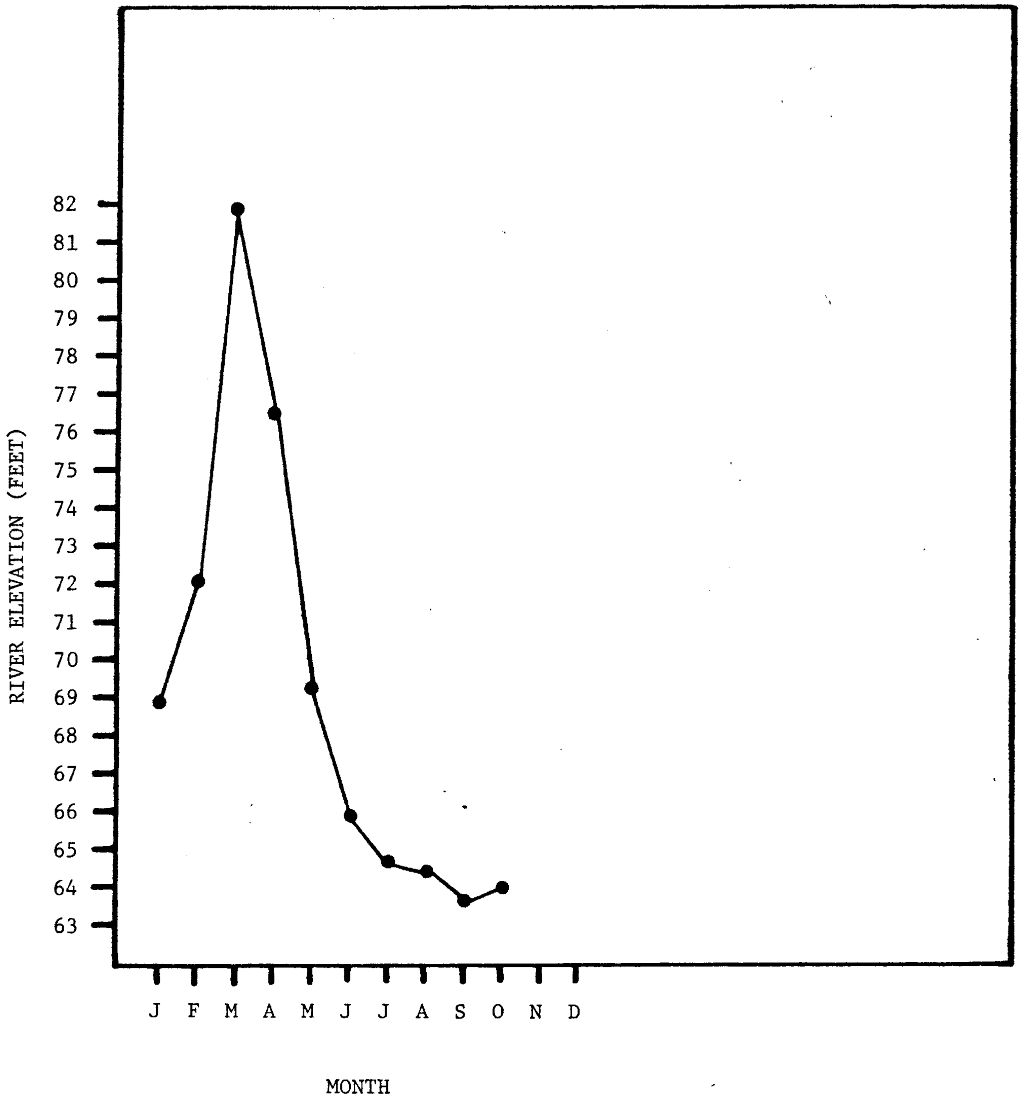
Letter C-12. Attachment (page 72 of 73)



GEORGIA POWER COMPANY

RIVER ELEVATION FOR THE ALTAMAHA RIVER AT THE END OF EACH IMPINGEMENT SURVEY AT PLANT EDWIN I. HATCH FROM JANUARY, 1980 - DECEMBER, 1980

FIGURE 15

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Letter C-12. Attachment (page 73 of 73)

ATTACHMENT D. CULTURAL RESOURCES CONSULTATION

Attachment D presents Southern Nuclear Operating Company's request to the Georgia Historic Preservation Officer for of historical and cultural consultations under Section 106 of the National Historic Preservation Act of 1966.

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

September 15, 1999 LRS-99-003

Historic Preservation Division
Georgia Department of Natural Resources
500 The Healey Building
57 Forsyth Street NW
Atlanta, Georgia 30303

Attn: Mr. Ray Luce, State Historic Preservation Officer

Re: License renewal activity for Hatch Nuclear Plant

Southern Nuclear Operating Company ("SNC") is preparing an application to renew the Edwin I. Hatch ("HNP") Nuclear Power Plant operating licenses consistent with the U.S. Nuclear Regulatory Commission ("NRC") regulations. This application would provide for an additional 20 years of operation beyond the current license term. As part of the license renewal process, the NRC requires applicants to identify whether any historic or archeological properties will be affected by the proposed project.

HNP Unit 1 began commercial operation December 31, 1974, and is licensed to operate through August 5, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed through June 13, 2018. The Plant is in Appling County, Georgia, approximately 11 miles north of the town of Baxley. HNP's six transmission lines cross 17 counties in the Coastal Plain of Georgia (see attached figure for details).

The *Final Environmental Statement for Edwin I. Hatch Nuclear Plants Unit 1 and Unit 2* prepared in 1972 by the U.S. Atomic Energy Commission stated that "no archaeologically valuable materials or information" were uncovered during the construction of the plant. The Final Environmental Statement further stated that ". . . the Georgia Historic Commission has indicated that the project area and the proposed right-of-way for transmission lines connected with the project do not involve, pass through, or pass near any known points of historical or archeological significance." The National Register of Historic Places currently lists three properties in Appling County, Georgia. All of these properties lie within the Baxley town limits, well south of the plant.

Page 1 of 2

Letter D-1. Historic Preservation Division letter (page 1 of 3).

LR-99-03
RE: License renewal activity for Hatch Nuclear Plant
Page 2 of 2

SNC is committed to the preservation of Georgia's historic and archeological properties and expects that operation of HNP through the license renewal period (an additional 20 years) would not adversely affect any such properties. SNC has no plans to alter current operations for the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously-disturbed areas. No additional land disturbance in anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that the license renewal process would have no effect on any historic or archeological properties.

Please do not hesitate to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by October 22, 1999, to enable us to meet our application preparation schedule.

Sincerely,

C. R. Pierce

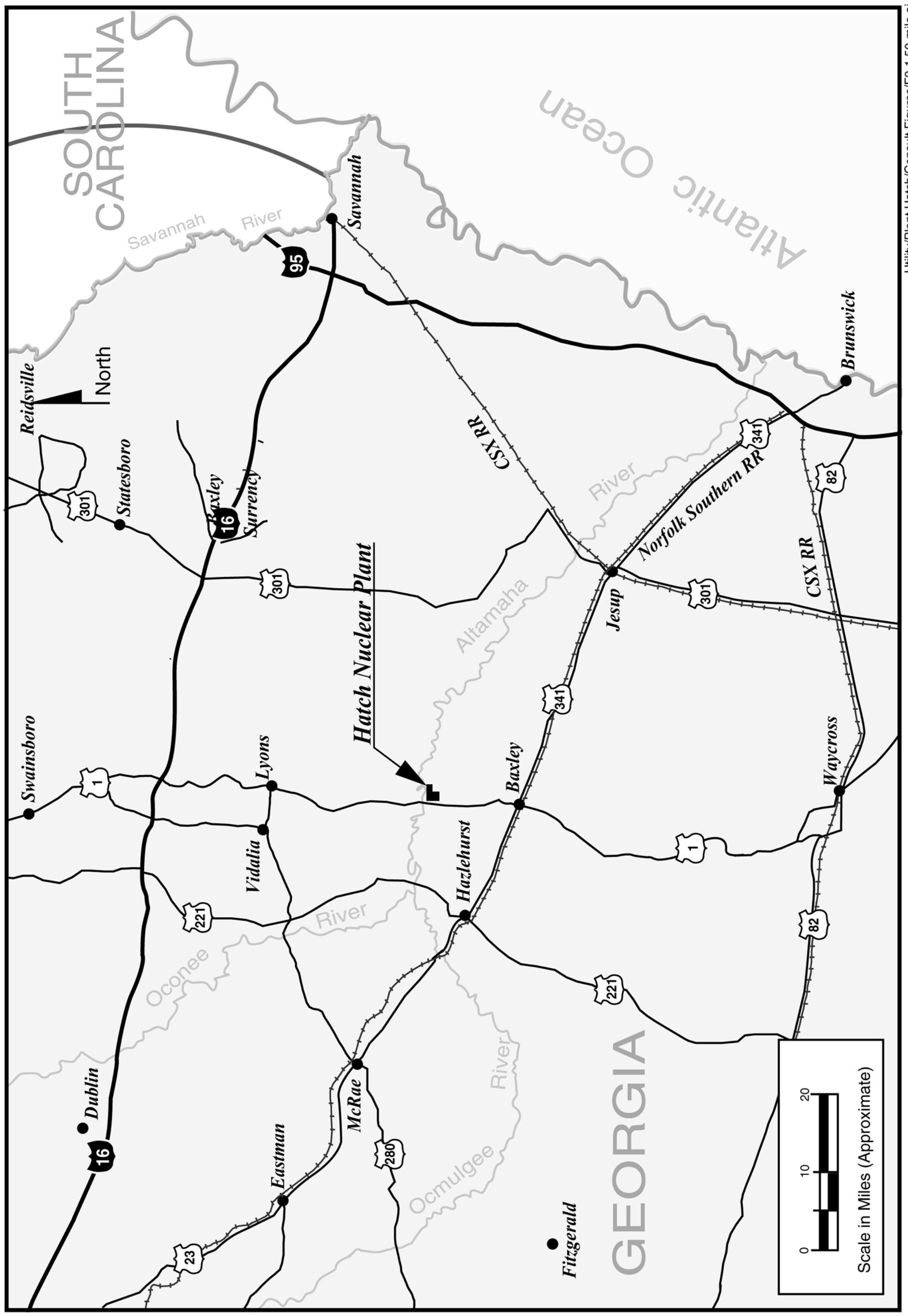
C. R. Pierce
License Renewal Services Manager

CRP/JTD

Attachment

cc: P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter D-1. Historic Preservation Division letter (page 2 of 3).



Edwin I. Hatch Nuclear Plant , 50-mile region.

Letter D-1. Historic Preservation Division letter (page 3 of 3).

Georgia Department of Natural Resources

Lonice C. Barrett, Commissioner

Historic Preservation Division

W. Ray Luce, Division Director and Deputy State Historic Preservation Officer
500 The Healey Building, 57 Forsyth Street, N. W., Atlanta, Georgia 30303
Telephone (404) 656-2840 Fax (404) 657-1040

October 29, 1999

C.R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Re: License Renewal Activity for Hatch Nuclear Plant
Appling County, Georgia
HP990917-001

Dear Mr. Pierce:

The Historic Preservation Division (HPD) has reviewed the information submitted concerning the proposed operating renewal license of Edwin I. Hatch Nuclear Power Plant located in Appling County, Georgia. Our comments are offered to advise the U.S. Nuclear Regulatory Commission (NRC) and Southern Company on the effects of this undertaking for compliance with Advisory Council regulations 36 CFR Part 800.

HPD concurs with your conclusion that the project will have no significant impact upon historic or archaeological resources which are listed in or eligible for listing in the National Register of Historic Places and are located within the project's area of potential effects.

If we may be of further assistance, please contact Serena Bellew, Environmental Review Associate Planner, at (404) 651-6624.

Sincerely,

W. Ray Luce

W. Ray Luce
Division Director and Deputy State Historic Preservation Officer

WRL:kcs

cc: Jim Davis, Southern Nuclear Operating Company, Inc.
Robin B. Nail, Heart of Georgia RDC

Letter D-2. Southern Nuclear Operating Company, Inc. Letter (page 1 of 1).

ATTACHMENT E. OTHER CONSULTATIONS

Attachment E presents Southern Nuclear Operating Company's request to the Georgia Department of Natural Resources for information regarding thermophilic organisms in the Altamaha River in the vicinity of Plant Hatch.

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

September 15, 1999 LRS-99-004

Watershed Planning and Monitoring Program
Environmental Protection Division
Georgia Department of Natural Resources
7 Martin Luther King Drive SW, Suite 643
Atlanta, GA 30334

Attn: Mr. W. M. Winn, Director

Re: Formal request for information on thermophilic microorganisms in the Altamaha River

Southern Nuclear Operating Company ("SNC") is preparing an application to renew the Edwin I. Hatch ("HNP") Nuclear Power Plant operating licenses consistent with the U.S. Nuclear Regulatory Commission ("NRC") regulations. This application would provide for an additional 20 years of operation beyond the current license term. The plant lies on the west bank of the Altamaha River in Appling County, Georgia, and uses a closed-loop cooling water system that withdraws from and discharges to the Altamaha River. Discharge limits and monitoring requirements for Plant Hatch are set forth in NPDES Permit GA 0004120, which was issued by the Georgia Department of Natural Resources in 1997.

The NRC requires license applicants to provide "...an assessment of the impact of the proposed action [license renewal] on public health from thermophilic organisms in the affected water." The NRC regulations state that "these organisms are not expected to be a problem at most operating plants" but state further that "without site-specific data, it is not possible to predict the effects generically."

SNC believes that Plant Hatch discharge temperatures, which do not exceed 95°F (even in summer), are below those known to be conducive to growth and survival of thermophilic pathogens. Plant operations and plant cooling systems are not expected to change significantly over the license renewal term, and there is no reason to believe that discharge temperatures will increase. However, in strict compliance with NRC regulations, we are requesting any

Page 1 of 2

Letter E-1. Watershed Planning and Monitoring Program letter (page 1 of 3).

information that EPD may have compiled on the presence of thermophilic microorganisms in the Altamaha River in the vicinity of Plant Hatch, including results of any monitoring or special studies that might have been conducted by EPD or its subcontractors. Specifically, SNC requests information on the enteric pathogens *Salmonella* sp. and *Shigella* sp. as well as the *Pseudomonas aeruginosa* bacterium and other less-common aquatic microorganisms that sometimes occur in heated water such as the Legionnaire's disease bacteria (*Legionella* sp.) and free living amoeba of the genus *Naegleria* (esp. *Naegleria fowleri*).

Please feel free to call Mr. Jim Davis of my staff at 205-992-7692, if you have any questions or require any additional information. We would appreciate receiving your input by October 22, 1999, to enable us to meet our application preparation schedule.

Sincerely,

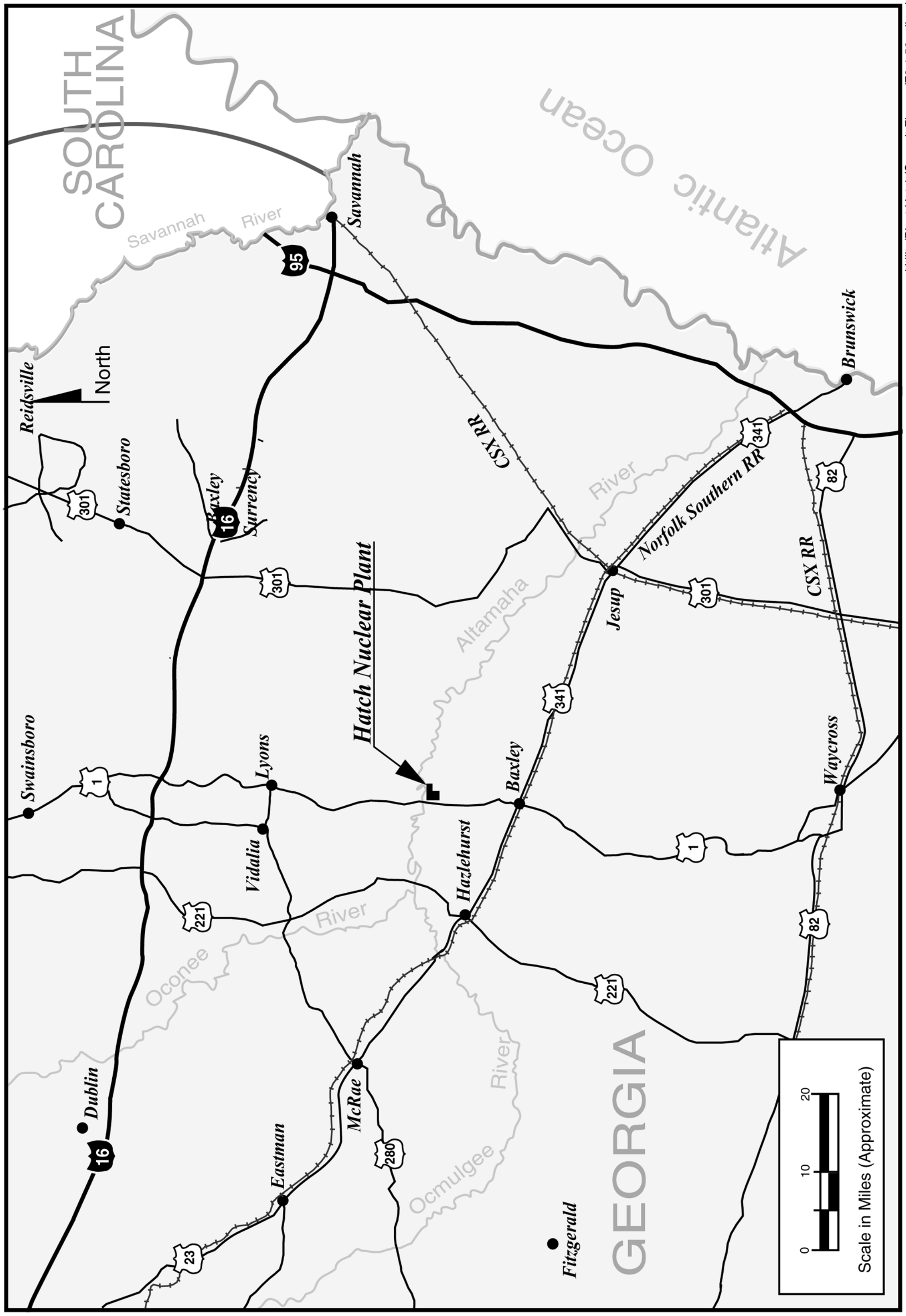
C. R. Pierce
License Renewal Services Manager

CRP/JTD

Attachment

cc: P. R. Moore, Tetra Tech NUS
M. C. Nichols, Georgia Power Company
T. C. Moorer, Southern Nuclear Operating Company
W. C. Carr, Southern Nuclear Operating Company
J. T. Davis, Southern Nuclear Operating Company
D. S. Read, Southern Nuclear Operating Company
D. M. Crowe, Southern Nuclear Operating Company
K. W. McCracken, Southern Nuclear Operating Company
LRS File: R.01.06
NORMS

Letter E-1. Watershed Planning and Monitoring Program letter (page 2 of 3).



Utility/Plant Hatch/Consult Figures/F2-1 50-mile.ai

Edwin I. Hatch Nuclear Plant , 50-mile region.

Letter E-1. Watershed Planning and Monitoring Program letter (page 3 of 3).

Georgia Department of Natural Resources

Environmental Protection Division, Water Protection Branch
4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Alan W. Hallum, Branch Chief
404.675.6232
FAX: 404.675.6247

October 20, 1999

Mr. C. R. Pierce
Southern Nuclear
Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201

Re: Request for information in the Altamaha River

We have reviewed your request for information on thermophilic microorganisms in the Altamaha River. Georgia Environmental Protection Division, Watershed Planning and Monitoring Program has not conducted any studies in the Plant Hatch area however, historical data may be available through USEPA STORET system.

If we can be of any further help please do not hesitate to contact me.

Sincerely,

Becky J. Blasius

Becky J. Blasius
Water Protection Division

BJB/bjb

Letter E-2. Southern Nuclear Operating Company, Inc. Letter (page 1 of 1).

ATTACHMENT F: SEVERE ACCIDENT MITIGATION ALTERNATIVES AT THE EDWIN I. HATCH NUCLEAR PLANT

1.0 Methodology

The methodology selected for this analysis involves identifying those SAMA candidates that have the most potential for reducing core damage frequency and person-rem risk. The phased approach consists of:

- Extending the HNP PRA/IPE results to a Level 3 analysis by determining offsite dose and economic baseline risk values,
- Determining the maximum averted risk that is possible based on the HNP baseline risk,
- Identifying potential SAMA candidates based on NRC and industry documents,
- Screening out potential SAMA candidates that are not applicable to the HNP design or are of low benefit in Boiling Water Reactors
- Screening out SAMA candidates whose estimated cost exceeds the maximum possible averted risk,
- Performing a more detailed cost estimate and Level 3 dose and economic risk evaluation of remaining candidates to see if any have a benefit in risk aversion that exceeds the expected cost.

2.0 Level 3 PRA Analysis

The MACCS2 code (Reference 1) was used to perform the level 3 probablistic risk assessment (PRA) for the HNP. The input parameters given with the MACCS2 "Sample Problem A," which included the NUREG-1150 food model (Reference 2), formed the basis for the present analysis. These generic values were supplemented with parameters specific to HNP and the surrounding area. Site-specific data included population distribution, economic parameters, and agricultural production. Plant-specific release data included the time-nuclide distribution of releases, release frequencies, and release locations. The behavior of the population during a release (evacuation parameters) was based on plant and site-specific set points (i.e., declaration of a General Emergency) and the site evacuation plan (Reference 3). This data was used in combination with site-specific meteorology to simulate the probability distribution of impact risks (exposure and economic) to the surrounding (within 50 miles) population from the large early release accident sequences at HNP.

Population

The population surrounding the plant site was estimated for the year 2030. The distribution was given in terms of population at distances to 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the plant and in the direction of each of the 16 compass points (i.e., N, ENE, NE……WNW). The total population for the 160 sectors (10 distances × 16 directions) in the region was estimated as 498,834, the distribution of which is given in Tables 1 and 2.

Table 1. Estimated population distribution within a 10-mile radius of HNP, year 2030.

Sector	0-1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-mile total
N	0	14	38	0	116	540	708
NNE	0	1	0	0	10	400	411
NE	0	0	0	23	39	370	432
ENE	0	0	0	0	3	155	158
E	0	0	0	0	30	30	60
ESE	0	0	46	0	0	306	352
SE	0	0	27	16	61	368	472
SSE	0	0	50	32	163	573	818
S	0	29	185	70	62	2,545	2,891
SSW	0	35	109	83	44	420	691
SW	0	74	31	19	13	312	449
WSW	0	0	44	0	20	542	606
W	0	97	0	180	0	150	427
WNW	0	0	0	51	0	445	496
NW	0	0	0	12	29	534	575
NNW	0	2	136	100	57	490	785
Total	0	252	666	586	647	8,180	10,331

Table 2. Estimated population distribution within a 50-mile radius of HNP, year 2030.

Sector	0-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50-mile total
N	708	15,316	5,979	1,566	15,056	38,625
NNE	411	1,439	2,575	7,994	7,051	19,470
NE	432	5,199	3,784	3,409	51,355	64,179
ENE	158	3,997	5,356	5,603	10,224	25,338
E	60	991	8,894	2,100	77,421	89,466
ESE	352	597	1,657	4,272	11,779	18,657
SE	472	368	2,740	21,220	1,215	26,015
SSE	818	1,235	1,619	5,407	3,601	12,680
S	2,891	8,854	1,923	2,541	45,212	61,421
SSW	691	1,594	7,126	3,286	2,800	15,497
SW	449	2,088	1,666	8,278	28,568	41,049
WSW	606	10,953	1,510	3,476	3,366	19,911
W	427	2,965	2,292	1,948	3,462	11,094
WNW	496	745	2,985	8,320	3,088	15,634
NW	575	1,752	5,818	1,400	6,530	16,075
NNW	785	5,906	4,985	6,450	5,597	23,723
Total	10,331	63,999	60,909	87,270	276,325	498,834

Population projections within 50 miles of HNP were determined using a geographic information system (GIS), U.S Nuclear Regulatory Commission (NRC) sector population data, and county-level population projections. Counties that partially fell within the 50-mile radius were truncated to include only those portions that fell within the 50-mile radius. Population sectors were created for 16 sectors at an interval of 1 mile from 0 to 10 miles, then at 10-mile intervals from 10 miles to 50 miles. The counties were combined with the sectors to determine what counties fell within each sector. The area of each county within a given sector was calculated to determine the county or counties that comprise each sector.

Using the NRC 1990 sector population data for HNP provided in NUREG/CR-6525 (Reference 4), the ratio of the county area to the sector area was multiplied by the 1990 sector population to give the estimated population per sector by county. The 1990 population per county and projected county population for year 2000 are provided in Reference 2. It was assumed that population growth would remain constant to that projected between 1990 and year 2000. Using this population growth rate, projections were made for year 2010, 2020 and 2030 by multiplying the estimated population of the previous decade by the constant growth rate. This resulted in the estimated population for each county within each sector for each decade. All county portions were combined, by sector, to determine the estimated population of each sector for each decade.

Economy

MACCS2 requires the spatial distribution of certain economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and non-farm land) in the same manner as the population. This was done by specifying the data for each of the 29 counties surrounding the plant, to a distance of 50 miles. The values used for each of the 160 sectors was then the data corresponding to that county which made up the majority of the land in that sector. For 10 sectors, no county encompassed the majority of the area, so conglomerate data (weighted by the fraction of each county in that sector) was defined.

In addition, generic economic data that is applied to the region as a whole was revised from the MACCS2 sample problem input when better information was available. These revised parameters include per diem living expenses (applied to owners of interdicted properties and relocated populations), relocation costs (for owners of interdicted properties), value of farm and non-farm wealth, and fraction of farm wealth from improvements (e.g., buildings, equipment).

Agriculture

Agricultural production information was taken from the 1997 Agricultural Census (Reference 5). Production within 50 miles of the site was estimated based on those counties within this radius. Production in those counties, which lie partially outside of this area, was multiplied by the fraction of the county within the area of interest. Cotton and tobacco, non-foods, were harvested from 33 percent of the croplands within 50 miles of the site. Of the food crops, legumes (16 percent of total cropland, made up of soybeans and peanuts) and grain (13 percent of the total cropland, made up corn and wheat) were harvested from the largest areas.

The duration of the growing seasons were obtained from the Atkinson County Extension Service. MACCS2 does not allow the use of split growing seasons. Accordingly, the beginning and total duration of each MACCS food category was estimated. The category growing seasons used in the analysis were: 9 months beginning in March for grains, stored forage and pasture; 10 months beginning in February for green leafy vegetables; and 7 months beginning in April for other food crops including legumes, roots and tubers.

Nuclide Release

The core inventory at the time of the accident was based on the input supplied in the MACCS Users Guide (Reference 1). The core inventory (Table 3) corresponds to the end-of-cycle values for a 3578-MWth BWR plant. A scaling factor of 0.772 was used to provide a representative core inventory for the 2763-MWth HNP. Table 3 includes the 3578-MWth BWR core and the estimated HNP core inventory. Release frequencies (1.79×10-6, 7.42×10-7, 1.66×10-7, 7.42×10-7, and 9.24×10-10 for sequences 2, 4, 5, 11, and 15, respectively) and nuclide release fractions (of the core inventory) were analyzed to determine the sum of the exposure (50-mile dose) and economic (50-mile economic costs) risks from large early release sequences 2, 4, 5, 11 and 15. HNP nuclide release categories were related to the MACCS categories as shown in Table 4.

Table 3. Estimated HNP core inventory.

Nuclide	Core Inventory (Bequerels)	Nuclide	Core Inventory (Bequerels)
Co-58	1.563×10^{16}	Te-131m	3.906×1017
Co-60	1.871×10^{16}	Te-132	3.819×1018
Kr-85	2.562×10^{16}	I-131	2.639×1018
Kr-85m	9.315×10^{17}	I-132	3.878×1018
Kr-87	1.693×10^{18}	I-133	5.540×1018
Kr-88	2.287×10^{18}	I-134	6.064×1018
Rb-86	1.434×10^{15}	I-135	5.214×1018
Sr-89	2.837×10^{18}	Xe-133	5.548×1018
Sr-90	2.008×10^{17}	Xe-135	1.318×1018
Sr-91	3.685×10^{18}	Cs-134	4.323×1017
Sr-92	3.850×10^{18}	Cs-136	1.159×1017
Y-90	2.149×10^{17}	Cs-137	2.587×1017
Y-91	3.462×10^{18}	Ba-139	5.107×1018
Y-92	3.865×10^{18}	Ba-140	5.037×1018
Y-93	4.395×10^{18}	La-140	5.140×1018
Zr-95	4.556×10^{18}	La-141	4.747×1018
Zr-97	4.691×10^{18}	La-142	4.566×1018
Nb-95	4.311×10^{18}	Ce-141	4.574×1018
Mo-99	4.971×10^{18}	Ce-143	4.453×1018
Tc-99m	4.290×10^{18}	Ce-144	2.967×1018
Ru-103	3.767×10^{18}	Pr-143	4.359×1018
Ru-105	2.513×10^{18}	Nd-147	1.947×1018
Ru-106	1.025×10^{18}	Np-239	5.805×1019
Rh-105	1.867×10^{18}	Pu-238	4.037×1015
Sb-127	2.376×10^{17}	Pu-239	1.023×1015
Sb-129	8.249×10^{17}	Pu-240	1.282×1015
Te-127	2.301×10^{17}	Pu-241	2.206×1017
Te-127m	3.098×10^{16}	Am-241	2.242×1014
Te-129	7.740×10^{17}	Cm-242	5.922×1016
Te-129m	2.035×10^{17}	Cm-244	3.195×1015

Table 4. MACCS release categories vs. HNP release categories.

MACCS Release Categories	HNP Release Categories
Xe/Kr	1 – noble gases and inert aerosols
I	2 – CsI and RbI
Cs	6 – CsOH
Te	3 & 11- TeO_2 & Te_2
Sr	4 – SrO
Ru	5 – MoO_2 (Mo is in Ru MACCS category)
La	8 – Lanthanides
Ce	9 – CeO_2
Ba	7 – BaO
Sb (supplemental category)	10 – Sb

Multiple release duration periods were defined which most closely represented the duration of the majority of each category's releases while keeping the number of intervals minimal. Conservative approximations were made to assure that the numerical release periods were no longer than those indicated in the figures. In all cases, the cumulative released material for each category indicated on the figures was simulated.

The reactor building dimensions are 155 × 149 × 154 feet (height). All modeled releases except sequence 15 were released at ground level. Sequence 15 was released through the stack, the height of which is 100 meters. The thermal content of each of the releases was conservatively assumed as to be the same as ambient, i.e., buoyant plume rise was not modeled.

<u>Evacuation</u>

Scram for each sequence was taken as time 0 relative to the core containment response times. A General Emergency is assumed to be at the time of core uncovery except for sequences 2, 11, and 15. A General Emergency is declared at 1 hour for Sequence 2, and at 15 minutes (after scram) for Sequences 11 and 15.

The MACCS2 Users Guide input parameters of 95 percent of the population within 10 miles of the plant (Emergency Planning Zone) evacuating and 5 percent not evacuating were employed. These values have been used in similar studies (i.e., Calvert Cliffs, Reference 6) and are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the emergency planning zone (Reference 6). The evacuees are assumed to begin evacuation 45 minutes (notification + preparation time, Table A5-3, Reference 3) after a general emergency has been declared and are evacuated at a radial speed of 2.5 m/sec. This speed is taken as the minimum speed for any evacuation zone for special need persons evacuating under adverse conditions.

<u>Meteorology</u>

HNP site meteorology from 1997 was used to create the one-year sequential hourly data set used in MACCS2. Wind speed and direction from the 10-meter sensor were combined with precipitation (hourly cumulative) and atmospheric stability (specified according to the vertical temperature gradient as measured between the 60-meter and 10-meter levels). Hourly stability was classified according to the scheme used by the NRC (Reference 6). The supplied one-year data set contained 16 hours (of a total of 8,760 hours) during which at least one parameter was missing. In such cases, the missing parameter was filled in with the previous hour's value. No parameter was missing for two consecutive hours.

Atmospheric mixing heights were specified for AM and PM hours. These values were taken as 400 and 1500 meters, respectively (Reference 7)

<u>MACCS2 Results</u>

The resulting annual risk from HNP early release sequences 2, 4, 5, 11 and 15 (and their sum) are as provided below in Table 5. The largest risks are from sequence 2, owing to its greatest (of those sequences analyzed) probability of occurrence. Sequence 2 contributes more than half of the sum of the risks from these large early releases.

Table 5. Results of HNP Level 3 PRA analysis.

Sequence	2	4	5	11	15	Sum of annual risk
Population dose risk (person-rem)						
0-50 miles	1.89	0.76	0.19	0.52	0.00104	3.372
Total economic cost risk ($)						
0-50 miles	5,546	1,974	691	1,040	2.59	9,262

Quantification of the base case shows a baseline Core Damage Frequency (CDF) of 1.6384×10-5 based on 10,721 cutsets (accident scenarios). The baseline Large Early Release Frequency (LERF) is 2.7030×10-6 based on 5,278 cutsets. MACCS2 calculated the annual baseline population dose risk within 50 miles at 3.372 person-rem. The total annual economic risk was calculated at $9,262.

3.0 Determination of Present Value

This Section explains how SNC calculated the monetized value of the status quo (i.e., accident consequences without SAMA implementation). SNC also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all HNP risk.

Offsite Exposure Cost

The baseline annual offsite exposure risk was converted to dollars using the NRC's conversion factor of $2,000 per person-rem (Reference 8, Section 5.7.1.2), and discounting to present value using NRC standard formula (Reference 8, Section 5.7.1.3):

$W_{pha} = C \times Z_{pha}$

Where:

W_{pha} = monetary value of public health risk after discounting
C = $[1-\exp(-rt_f)]/r$
T_f = years remaining until end of facility life = 20 years
r = real discount rate (as fraction) = 0.07/year
Z_{pha} = monetary value of public health (accident) risk per year before discounting ($/year)

The calculated value for C using 20 years and a 7 percent discount rate is 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose (person-rem per year) by $2,000 and by the C value (10.76). The calculated offsite exposure cost is $72,565.

Offsite Economic Cost

The Level 3 analysis showed an annual offsite economic risk of $9,262. Calculated values for offsite economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting value is $99,659.

Onsite Exposure Cost

SNC evaluated occupational health using the NRC methodology in Reference 8, Section 5.7.3, which involves separately evaluating "immediate" and long-term doses.

<u>Immediate Dose</u> - For the case where the plant is in operation, the equations that NRC recommends using (Reference 8, Sections 5.7.3 and 5.7.3.3) is:

Equation 1:

$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\}\{[1 - \exp(-rt_f)]/r\}$

Where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting
R = monetary equivalent of unit dose ($/person-rem)
F = accident frequency (events/yr)
D_{IO} = immediate occupational dose (person-rem/event)
$_S$ = subscript denoting status quo (current conditions)
$_A$ = superscript denoting after implementation of proposed action
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the HNP analysis are:

R = $2,000/person-rem
r = 0.07
D_{IO} = 3,300 person-rem/accident (best estimate)
t_f = 20 years (license extension period)
F = 1.64×10^{-5} (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$W_{IO} = R\,(FD_{IO})_S\{[1 - \exp(-rt_f)]/r\}$
$= 2{,}000 * 1.64\times10^{-5} * 3{,}300 * \{[1 - \exp(-0.07 * 20)]/0.07\}$
= $1,164

<u>Long-Term Dose</u> - For the case where the plant is in operation, the NRC equations (Reference 8, Sections 5.7.3 and 5.7.3.3) is:

Equation 2:

$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$

Where:

W_{IO} = monetary value of accident risk avoided long-term doses, after discounting, $
m = years over which long-term doses accrue

The values used in the HNP analysis are:

R = $2,000/person-rem
r = 0.07
D_{LTO} = 20,000 person-rem/accident (best estimate)
m = "as long as 10 years"
t_f = 20 years (license extension period)
F = 1.64×10^{-5} (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

$W_{LTO} = R\,(FD_{LTO})_S\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$
$= 2{,}000 * 1.64\times10^{-5} * 20{,}000 * \{[1 - \exp(-0.07 * 20)]/0.07\}\{[1 - \exp(-0.07 * 10)]/0.07 * 10\}$
= $5,073

Total Occupational Exposure - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) is:
$W_O = W_{IO} + W_{LTO} =$ (\$1,164 + \$5,073) = \$6,237

Onsite Cleanup and Decontamination Cost

The net present value that NRC provides for cleanup and decontamination for a single event is \$1.1 billion, discounted over a 10-year cleanup period (Reference 8, Section 5.7.6.1). NRC uses the following equation in integrating the net present value over the average number of remaining service years:

$U_{CD} = [PV_{CD}/r][1-\exp(-rt_f)]$

Where:

PV_{CD} = Net present value of a single event
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the HNP analysis are:

PV_{CD} = $\$1.1x10^9$
r = 0.07
t_f = 20

The resulting net present value of cleanup integrated over the license renewal term, $\$1.2x10^{10}$, must multiplied by the total core damage frequency of $1.64x10^{-5}$ to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is \$193,973.

Replacement Power Cost

Long-term replacement power costs was determined following the NRC methodology in Reference 8 Section 5.7.6.2. The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$PV_{RP} = [\$1.2E + 08/r] * [1 - \exp(-rt_f)]^2$

Where:

PV_{RP} = net present value of replacement power for a single event, (\$)
R = 0.07
t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$U_{RP} = [PV_{RP} /r] * [1 - \exp(-rt_f)]^2$

Where:

U_{RP} = net present value of replacement power over life of facility (\$-year)

After applying a correction factor to account for HNP's size relative to the "generic" reactor described in NUREG/BR-0184 (i.e., 845 MWe/910 MWe), the replacement power costs are determined to be 7.33E + 09 (\$-year). Multiplying this value by the CDF (1.64E-05) results in a replacement power cost of \$120,041.

Baseline Screening

The sum of the baseline costs is as follows:

Offsite exposure cost = $72,565
Offsite economic cost = $99,659
Onsite exposure cost = $6,237
Onsite cleanup cost = $193,973
Replacement Power cost = $120,041
Total cost = $492,476

SNC rounded this value up to $500,000 to use in screening out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $500,000, SNC discarded it from further analysis. Exceeding this threshold would mean that a SAMA would not have a positive net value even if it could eliminate all severe accident costs.

4.0 SAMA Candidates and Screening Process

An initial list of 115 SAMA candidates was developed from lists of Severe Accident Mitigation Design Alternatives at other nuclear power plants, NRC documents, and documents related to advanced power reactor designs. This initial list was then screened to remove those that we not applicable to the HNP plant due to design differences.

Twenty-six of the initial 115 candidate SAMAs were removed from further consideration as they did not apply to the BWR-4/Mark I design used at HNP. An additional nine candidates were removed from consideration because they were related to mitigation of an Intersystem Loss of Coolant Accident (ISLOCA). According to NRC Information Notice 92-36 and its supplement, ISLOCA contributes little risk for boiling water reactors because of the lower primary pressures.

Eleven SAMA candidates were related to Reactor Coolant Pump seal leakage. NUREG-1560 indicates that although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to core damage frequency in BWRs. Therefore, these eleven candidates were removed from further consideration.

Sixteen SAMA candidates were found to be in place at HNP and were thus dropped from further consideration. Ten SAMA candidates were of sufficient similarity to other SAMA candidates that they were either combined or dropped from further consideration.

This left 43 unique SAMA candidates that were applicable to HNP and were of potential value in averting the risk of severe accidents. A preliminary cost estimate was prepared for each of these candidates to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were clearly beyond the possibility of any corresponding benefit.

When the screening cutoff of $500,000 was applied, 27 candidates were eliminated that were more expensive than any possible offsetting benefit. This left 16 candidates for further analysis.

Table 6 shows the disposition of the initial set of candidate SAMAs, including an indication of the screening criterion that was applicable for those candidate SAMAs that were removed fromcirculation.

5.0 Level II SAMA Analysis

For each of the 16 remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed estimated cost. This information was then used to evaluate the effect of the candidate changes upon the plant safety model.

Table 6. Disposition of initial SAMAs investigated.

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
1	Cap downstream piping of normally closed component cooling water drain and vent valves.	SAMA to reduce the frequency of a loss of component cooling event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	N/A	—
2	Enhance loss of component cooling procedure to facilitate stopping reactor coolant pumps.	SAMA to reduce the potential for RCP seal damage due to pump bearing failure.	B	—
3	Enhance loss of component cooling procedure to present desirability of cooling down RCS prior to seal LOCA.	SAMA would reduce the potential for RCP seal failure.	B	—
4	Additional training on the loss of component cooling.	SAMA would potentially improve the success rate of operator actions after a loss of component cooling (to restore RCP seal damage).	B	—
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	SAMA would reduce effect of loss of component cooling by providing a means to maintain the centrifugal charging pump seal injection after a loss of component cooling.	N/A	—
5A	Procedures changes to allow cross connection of motor cooling for RHRSW pumps.	SAMA would allow continued operation of both RHRSW pumps on a failure of one train of PSW.	C (1.4.1 of IPE)	—
6	On loss of essential raw cooling water, proceduralize shedding component cooling water loads to extend component cooling heatup.	SAMA would increase time before the loss of component cooling (and reactor coolant pump seal failure) in the loss of essential raw cooling water sequences.	B	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
7	Increase charging pump lube oil capacity.	SAMA would lengthen the time before centrifugal charging pump failure due to lube oil	N/A	—
8	Eliminate the RCP thermal barrier dependence on component cooling such that loss of component cooling does not result directly in core damage.	SAMA would prevent the loss of recirculation pump seal integrity after a loss of component cooling. Watts Bar Nuclear Plant IPE said that they could do this with essential raw cooling water connection to charging pump seals.	N/A	—
9	Add redundant DC Control Power for PSW Pumps C & D	SAMA would increase reliability of PSW and decrease core damage frequency due to a loss of SW.	None	2-7
10	Create an independent RCP seal injection system, with a dedicated diesel.	SAMA would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of component cooling or service water or from a station blackout event.	B	—
11	Use existing hydro test pump for RCP seal injection.	SAMA would provide an independent seal injection source, without the cost of a new system.	B	—
12	Replace ECCS Cooling System pump motor with air-cooled motors.	SAMA would eliminate ECCS dependency on component cooling system.	N/A	—
13	Install improved RCS pumps seals.	RCP seal O-ring constructed of improved materials would reduce probability of RCP seal LOCA	B	—
14	Install additional component cooling water pump.	SAMA would reduce probability of loss of component cooling leading to RCP seal LOCA.	B	—
15	Prevent centrifugal charging pump flow diversion from the relief valves.	If relieve valve opening causes a flow diversion large enough to prevent RCP seal injection, then the modification would reduce the frequency of the loss of RCP seal cooling.	B	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
16	Change procedures to isolate RCP seal letdown flow on loss of component cooling, an guidance on loss of injection during seal LOCA.	SAMA would reduce CDF from loss of seal cooling.	B	—
17	Implement procedures to stagger HPSI pump use after a loss of service water.	SAMA would allow HPSI to be extended after a loss of service water.	N/A	—
18	Use fire protection system pumps as a backup seal injection and high pressure make-up.	SAMA would reduce the frequency of the RCP seal LOCA and the SBO CDF.	B	—
19	Procedural guidance for use of cross-tied component cooling or service water pumps.	SAMA would reduce the frequency of the loss of component cooling water and service water.	C	(2-10)
20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	SAMA would potentially improve the success rate of operator actions subsequent to support system failures.	D (various SAMAs for specific systems)	—
21	Improved ability to cool the residual heat removal heat exchangers	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water cross-tie.	D—29 and 30	—
22	Provide reliable power to Control Building fans	SAMA would increase availability of control room ventilation on a loss of power.	None	2-15
23	Provide a redundant train of ventilation.	SAMA would increase the availability of components dependent on room cooling.	D—22 and 25	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
24	Procedures for actions on loss of HVAC.	SAMA would provide for improved credit to be taken for loss of HVAC sequences (improved affected electrical equipment reliability upon a loss of Control Building HVAC).	C	—
25	Add a diesel building switchgear room high temperature alarm.	SAMA would improve diagnosis of a loss of switchgear room HVAC.		
		Option 1: Install high temp alarm	None	2-5A
		Option 2: Redundant louver and thermostat	None	2-5B
26	Create ability to switch fan power supply to direct current (DC) in an SBO event.	SAMA would allow continued operation in an SBO event. This SAMA was created for reactor core isolation cooling system room at Fitzpatrick Nuclear Power Plant.	N/A	—
27	Delay containment spray actuation after large LOCA.	SAMA would lengthen time of RWST availability.	N/A	—
28	Install containment spray pump header automatic throttle valves.	SAMA would extend the time over which water remains in the RWT, when full CS flow is not needed	N/A	—
29	Install an independent method of suppression pool cooling.	SAMA would decrease the probability of loss of containment heat removal.	E	—
30	Develop an enhanced drywell spray system.	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	E	—
31	Provide dedicated existing drywell spray system.	SAMA would provide a source of water to the containment to control containment pressure, when used in conjunction with containment heat removal. This would use an existing spray loop instead of developing a new spray system.	E	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
32	Install an unfiltered hardened containment vent.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products not being scrubbed.	C	—
33	Install a filtered containment vent to remove decay heat.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products being scrubbed.		
		Option 1: Gravel Bed Filter	E	—
		Option 2: Multiple Venturi Scrubber	E	—
34	Install a containment vent large enough to remove ATWS decay heat.	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	E	—
35	Create/enhance hydrogen recombiners with independent power supply.	SAMA would reduce hydrogen detonation at lower cost, Use either a new, independent power supply, a nonsafety-grade portable generator, existing station batteries, or existing AC/DC independent power supplies.	E	—
35A	Install hydrogen recombiners.	SAMA would provide a means to reduce the chance of hydrogen detonation.	E (Unit 1) C (Unit 2)	—
36	Create a passive design hydrogen ignition system.	SAMA would reduce hydrogen denotation system without requiring electric power.	E	—
37	Create a large concrete crucible with heat removal potential under the basemat to contain molten core debris.	SAMA would ensure that molten core debris escaping form the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt-through of the basemat.	E	—
38	Create a water-cooled rubble bed on the pedestal.	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	E	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
39	Provide modification for flooding the drywell head.	SAMA would help mitigate accidents that result in the leakage through the drywell head seal.	E	—
40	Enhance fire protection system and/or standby gas treatment system hardware and procedures.	SAMA would improve fission product scrubbing in severe accidents.	C	(2-4)
41	Create a reactor cavity flooding system.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	E	(2-16)
42	Create other options for reactor cavity flooding.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	D—See 41	—
43	Enhance air return fans (ice condenser plants).	SAMA would provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	N/A	—
44	Create a core melt source reduction system.	SAMA would provide cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal form the vitrified compound would be facilitated, and concrete attack would not occur.	E	—
45	Provide a containment inerting capability.	SAMA would prevent combustion of hydrogen and carbon monoxide gases.	C	—
46	Use the fire protection system as a back-up source for the containment spray system.	SAMA would provide redundant containment spray function without the cost of installing a new system.	None	2-2

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
47	Install a secondary containment filter vent.	SAMA would filter fission products released from primary containment.	C (SGTS)	—
48	Install a passive containment spray system.	SAMA would provide redundant containment spray method without high cost.	E	—
49	Strengthen primary/secondary containment.	SAMA would reduce the probability of containment overpressurization to failure.	E	—
50	Increase the depth of the concrete basemat or use an alternative concrete material to ensure melt-through does not occur.	SAMA would prevent basemat melt-through.	E	—
51	Provide a reactor vessel exterior cooling system.	SAMA would provide the potential to cool a molten core before it causes vessel failure, if the lower head could be submerged in water.	D—See 41	—
52	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	SAMA would provide a method to depressurize containment and reduce fission product release.	N/A	—
53	Not Used		None	—
54	Proceduralize alignment of spare diesel to shutdown board after Loss of Offsite Power and failure of the diesel normally supplying it.	SAMA would reduce the SBO frequency.	C (with current swing diesel generator)	—
55	Not Used		None	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
56	Provide an additional diesel generator.	SAMA would increase the reliability and availability of onsite emergency AC power sources.	E	—
57	Provide additional DC battery capacity	SAMA would ensure longer batter capability during an SBO, reducing the frequency of long-term SBO sequences.	E	—
58	Use fuel cells instead of lead-acid batteries.	SAMA would extend DC power availability in an SBO.	E	—
59	Procedure to cross-tie high pressure core spray diesel.	SAMA would improve core injection availability by providing a more reliable power supply for the high pressure core spray pumps.	N/A	—
60	Improve 4.16 kV bus cross-tie ability.	SAMA would improve AC power reliability.	None	2-11
61	Incorporate an alternate battery charging capability.	SAMA would improve DC power reliability by either cross-tying the AC buses, or installing a portable diesel-driven batter charger.	E	—
62	Increase/improve DC bus load shedding.	SAMA would extend battery life in an SBO event.	E	—
63	Replace existing batteries with more reliable ones.	SAMA would improve DC power reliability and thus increase available SBO recovery time.	N/A	—
63A	Mod for DC Bus A reliability	Loss of DC Bus A causes a loss of main condenser, prevents transfer from the main transformer to offsite power, and defeats one half of the low vessel pressure permissive for LPCI/CS injection valves. SAMA would increase the reliability of AC power and injection capability.	C	(2-13)
64	Create AC power cross-tie capability with other unit.	SAMA would improve AC power reliability.	E	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
65	Create a cross-tie for diesel fuel oil.	SAMA would increase diesel fuel oil supply and thus diesel generator, reliability.	C	—
66	Develop procedures to repair or replace failed 4 kV breakers.	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16kV non-emergency busses from unit station service transformers, leading to loss of emergency AC power.	C	(2-9)
67	Emphasize steps in recovery of offsite power after an SBO.	SAMA would reduce human error probability during offsite power recovery.	C	—
68	Develop a severe weather conditions procedure.	For plants that do not already have one, this SAMA would reduce the CDF for external weather-related events.	C	—
69	Develop procedures for replenishing diesel fuel oil.	SAMA would allow for long-term diesel operation.	C	—
70	Install gas turbine generator.	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	E	—
71	Not Used		None	—
72	Create a back-up source for diesel cooling. (Not from existing system)	This SAMA would provide a redundant and diverse source of cooling for the diesel generators which would contribute to enhanced diesel reliability.	D—73	—
73	Use Fire Protection System as a back-up source for diesel cooling.	This SAMA would provide a redundant and diverse source of cooling for the diesel generators which would contribute to enhanced diesel reliability.	None	2-8
74	Provide a connection to an alternate source of offsite power.	SAMA would reduce the probability of a loss of offsite power event.	E	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
75	Bury offsite power lines.	SAMA could improve offsite power reliability, particularly during severe weather.	E	—
76	Replace anchor bolts on diesel generator oil cooler.	Millstone Nuclear Power Station found a high seismic SBO risk due to failure of the diesel oil cooler anchor bolts. For plants with a similar problem, this would reduce seismic risk. Note that these were Fairbanks Morse DGs.	D—See 114	—
77	Change Undervoltage (UV), Auxiliary Feedwater Actuation Signal (AFAS) Block and High Pressurizer Pressure Actuation Signals to 3-out-of-4, instead of 2-out-of-4 logic.	SAMA would reduce risk of 2/4 inverter failure.	N/A	—
78	Provide DC power to the 120/240 V vital AC system from the Class 1E station service battery system instead of its own battery.	SAMA would increase the reliability of the 120 VAC Bus.	None	2-12
79	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture (SGTR).	SAMA would enhance depressurization during a SGTR.	N/A	—
80	Improve SGTR coping abilities.	SAMA would improve instrumentation to detect SGTR, or additional system to scrub fission product releases.	N/A	—
81	Add other SGTR coping abilities.	SAMA would decrease the consequences of an SGTR.	N/A	—
82	Increase secondary side pressure capacity such that an SGTR would not cause the relief valves to lift.	SAMA would eliminate direct release pathway for SGTR sequences.	N/A	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
83	Replace steam generators (SG) with a new design.	SAMA would lower the frequency of an SGTR.	N/A	—
84	Revise emergency operating procedures to direct that a faulted SG be isolated.	SAMA would reduce the consequences of an SGTR.	N/A	—
85	Direct SG flooding after a SGTR, prior to core damage.	SAMA would provide for improved scrubbing of SGTR releases.	N/A	—
86	Implement a maintenance practice that inspects 100% of the tubes in an SG.	SAMA would reduce the potential for an SGTR.	N/A	—
87	Locate RHR inside of containment.	SAMA would prevent ISLOCA out the RHR pathway.	A	—
88	Not Used.		None	—
89	Install additional instrumentation for ISLOCAs.	Pressure of leak monitoring instruments installed between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HPSI lines would decrease ISLOCA frequency.	A	—
90	Increase frequency for valve leak testing.	SAMA could reduce ISLOCA frequency.	A	—
91	Improve operator training on ISLOCA coping.	SAMA would decrease ISLOCA effects.	A	—
92	Install relief valves in the CC System.	SAMA would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	A	—

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
93	Provide leak testing of valves in ISLOCA paths.	At Kewaunee Nuclear Power Plant, four MOVs isolating RHR from the RCS were not leak tested. This SAMA would help reduce ISLOCA frequency.	A	—
94	Revise EOPs to improve ISLOCA identification.	Salem Nuclear Power Plant had a scenario where an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside containment. Procedure enhancements would ensure LOCA outside containment could be identified as such.	A	—
95	Ensure all ISLOCA releases are scrubbed.	This SAMA would scrub all ISLOCA releases. One example is to plug drains in the break area so that the break point would cover with water.	A	—
96	Add redundant and diverse limit switches to each containment isolation valve.	Enhanced isolation valve position indication could reduce the frequency of containment isolation failure and ISLOCAs.	A	—
97	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	SAMA would prevent flood propagation, for a plant where internal flooding from turbine building to safeguards areas is a concern.	D—See 99	—
98	Improve inspection of rubber expansion joints on main condenser.	SAMA would reduce the frequency of internal flooding, for a plant where internal flooding due to a failure of circulating water system expansion joints is a concern.	D—See 99	—
99	Implement internal flood prevention and mitigation enhancements.	This SAMA would reduce the consequences of internal flooding.	None	2-14

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
100	Implement internal flooding improvements such as those implemented at Fort Calhoun.	This SAMA would reduce flooding risk by preventing or mitigating: a rupture in the RCP seal cooler of the component cooling system an ISLOCA in a shutdown cooling line, an AFW flood involving the need to remove a watertight door.	D—See 99	—
101	Install a digital feedwater upgrade.	This SAMA would reduce the chance of a loss of main feedwater following a plant trip.	C	—
102	Perform surveillances on manual valves used for back-up AFW pump suction.	This SAMA would improve success probability for providing alternative water supply to the AFW pumps.	N/A	—
103	Install manual isolation valves around AFW turbine-driven steam admission valves.	This SAMA would reduce the dual turbine-driven AFW pump maintenance unavailability.	N/A	—
104	Install accumulators for turbine-driven AFW pump flow control valves (CVs).	This SAMA would provide control air accumulators for the turbine-driven AFW flow CVs, the motor-driven AFW pressure CVs and SG PORVs. This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOOP.	N/A	—
105	Proceduralize intermittent operation of HPCI.	SAMA would allow for extended duration of HPCI availability.	None	2-3

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
106	Increase the reliability of safety relief valves. (Adding signals to add electrical signal to open automatically).	SAMA reduces the probability of a certain type of medium break LOCA. Hatch evaluates medium LOCA initiated by an MSIV closure transient with a failure of SRVs to open. Reducing the likelihood of the failure for SRVs to open, subsequently reduces the occurrence of this medium LOCA.	C	—
107	Install motor-driven feedwater pump.	This would increase the availability of injection subsequent to MSIV closure.	E	—
108	Procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	SAMA increases availability of required RHR/CS pumps. Reduction in room heat load allows continued operation of required RHR/CS pumps, when room cooling is lost.	C, IPE 1.4.1	—
109	Increase available NSPH for injection pumps.	SAMA increases the probability that these pumps will be available to inject coolant into the vessel by increasing the available NPSH for the injection pumps.	C	—
110	Increase the SRV reseat reliability.	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after SLC injection.	E	—
111	Reduce DC dependency between high pressure injection system and ADS.	SAMA would ensure containment depressurization and high pressure injection upon a DC failure.	N/A	—
112	Modify RWCU for use as a decay heat removal system and proceduralize use.	SAMA would provide an additional source of decay heat removal.	C	(2-6)
113	Use of CRD for alternate boron injection.	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	C	(2-1)

Table 6. (Continued).

Phase I SAMA ID number	SAMA title	Description of potential enhancement	Screening criterion*	Phase II SAMA ID number**
114	Increase seismic ruggedness of plant components.	SAMA would increase the availability of necessary plant equipment during and after seismic events.	C	—
115	Allow cross connection of uninterruptable compressed air supply to opposite unit.	SAMA would increase the ability to depressurize containment using the hardened vent.	C	—

* N/A indicates that the proposed SAMA is not applicable to the Hatch BWR-4/Mark I design.
A indicates that the proposed SAMA is related to mitigation of an Intersystem LOCA (ISLOCA). Per IN-92-36, and its supplement, ISLOCA contributes little risk for boiling water reactors, because of the lower primary pressures. Because of the low risk contribution due to ISLOCA, this SAMA has not been developed further.
B indicates that the proposed SAMA is related to RCP seal leakage. A review of NUREG-1560 indicates that although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.
C indicates that the proposed SAMA has already been installed at Hatch.
D indicates that similar item is addressed under other proposed SAMAs.
E indicates that SAMA did not pass initial screening to move into Phase II—no Phase II number assigned.
** ID numbers in parenthesis show SAMAs initially considered but dropped from Phase II analysis.

During the Level II analysis, it was determined that six of the SAMA candidates were adequately covered by existing plant design and procedures. In addition, the phase II costing for one of the candidates was found to be in excess of the $500,000 screening criterion. As a result, these six SAMA candidates [SAMA numbers (2-1, 2-4, 2-6, 2-9, 2-10, 2-13, and 2-16) in Table 6] were dropped from further consideration.

A description of each of the remaining nine evaluated SAMA candidates follows.

5.1 SAMA Candidate 2-2, Use Of Fire Protection System As A Backup Source For The Containment Spray System.

Description: Alternate water supplies from the Residual Heat Removal Service Water System (RHRSW) and from fire water to containment spray were added as redundant to the normal supply from RHR in the HNP model, as a result of this SAMA. The current base model does not credit possible cross-tie from either the RHRSW system or from the fire water system.

Cost: $25,000/unit Reduction in Risk Benefit: $0

Net Benefit: ($25,000/unit)

5.2 SAMA Candidate 2-3, Proceduralize Intermittent Operation of HPCI (High Pressure Coolant Injection)

HPCI is a standby system and this SAMA has no effect on initiating event frequencies. The intermittent operation of HPCI is already credited in the HNP PRA model by way of operator actions. As a result, there would be no change in the Large Early Release Frequency.

Cost: $22,200/unit Reduction in Risk Benefit: $0

Net Benefit: ($22,200/unit)

5.3 SAMA Candidate 2-5(A/B) Modifications to add Diesel Generator Room and Switchgear Room High Temperature Alarms or Redundant Louver/Thermostats

Emergency diesel generators are very important to LERF and improving diesel generator availability would have a significant impact on LERF. This SAMA would add redundant heat protection to the Diesel Generator Room and would be effective only if existing heat protection failed.

Cost: $100,000/unit Reduction in Risk Benefit: $2,492

Net Benefit: ($97,508/unit)

5.4 SAMA Candidate 2-7, Add Redundant DC Control Power for PSW Pumps

PSW supplies cooling water to several safety-related systems that are important to the mitigation of core melt progression. These include drywell cooling, control room HVAC, and decay heat removal. Improving the availability of PSW would reduce the large-early release frequency (LERF).

Cost: $97,000/unit Reduction in Risk Benefit: $500

Net Benefit: ($96,500/unit)

5.5 SAMA Candidate 2-8, Use Fire Protection as a Back-Up to Diesel Generator Cooling

This SAMA involves providing alternate cooling water to the emergency diesel generators from the fire protection system by connecting a hose from a fire hydrant to a supply header and another hose from the supply header to the affected diesel generator(s). Emergency diesel generators are important to CDF and improving diesel generator availability would reduce core damage frequency. In the case of the 1B diesel generator, an alternate supply from the standby service water system or from plant service water (depending on the initial alignment) is already available. This SAMA would add an additional source of potential cooling water should other sources fail.

Cost: $126,000/unit   Reduction in Risk Benefit: $2,098

Net Benefit: ($123,902/unit)

5.6 SAMA Candidate 2-11, Improve 4.16kV Bus Cross-Tie Ability

This SAMA involves supplying power to PSW pumps from an alternate source. The purpose is to ensure cooling water supply to the only available diesel generator, when the other two EDGs have failed. As the required conditions for this SAMA to be of benefit are low frequency, the benefit is small as well.

Cost: $100,000/unit   Reduction in Risk Benefit: $61

Net Benefit: ($99,939/unit)

5.7 SAMA Candidate 2-12, Provide Alternate DC Power to the 120/240 V Vital AC System

This SAMA involves providing DC power to the vital AC system from a station service battery instead of from the vital AC battery that currently supplies DC power. The supply from the battery is a third supply and is redundant to the supplies from two different power buses. The vital AC system supplies power for feedwater control and for bypass valve operation. The vital AC battery is not important to CDF and as a result, this SAMA has no impact.

Cost: $106,360/unit   Reduction in Risk Benefit: $78

Net Benefit: ($106,282/unit)

5.8 SAMA Candidate 2-14, Implement Internal Flood Identification and Mitigation Enhancements

This SAMA involves adding controls for the three fire pumps in the main control room and revising procedures to allow shutdown of the fire pumps, given a high level alarm in one or more of the reactor building drain sumps, after verifying that a fire does not exist. Reducing the frequency of the two flooding initiators will reduce the frequency of core damage. The two internal flooding initiating events in the baseline model do not contribute to LERF, so there is no impact on the frequency of large early release from changes in these initiating event frequencies.

Cost: $325,000/unit   Reduction in Risk Benefit: $98

Net Benefit: ($324,902/unit)

5.9 SAMA Candidate 2-15, Provide Reliable Power to Control Building Fans

This SAMA involves modifying the electric power supply to the switchgear room fans so that at least one supply fan and one exhaust fan for each unit are supplied by emergency power. None of the switchgear room HVAC fans are relied upon in the current HNP model. Therefore, there is no impact on core damage frequency or frequency of large early release, given the current models, from the changes described in this SAMA.

Cost: $202,000 for both units Reduction in Risk Benefit: $0

Net Benefit: ($101,000/unit)

A summary of the Phase II analyses is presented in Table 7.

Table 7. Summary of Phase II SAMA analyses.

SAMA ID number	Averted offsite exposure	Averted offsite costs	Averted onsite exposure	Averted onsite cleanup cost	Averted replacement power	Total benefits	Cost of implementation	Net value of modifications
2-2	$0	$0	$0	$0	$0	$0	$25,000/unit	($25,000/unit)
2-3	$0	$0	$0	$0	$0	$0	$22,200/unit	($22,200/unit)
2-5 (A/B)	$757	$1,110	$12	$379	$234	$2,492	$100,000/unit	($97,508/unit)
2-7	$74	$74	$7	$213	$132	$500	$97,000/unit	($96,500/unit)
2-8	$635	$915	$11	$331	$205	$2,098	$126,000/unit	($123,902/unit)
2-11	$25	$36	$0	$0	$0	$61	$100,000/unit	($99,939/unit)
2-12	$0	$0	$1	$47	$29	$78	$106,360/unit	($106,282/unit)
2-14	$0	$0	$2	$59	$37	$98	$325,000/unit	($324,902/unit)
2-15	$0	$0	$0	$0	$0	$0	$202,000 both units	($101,000/unit)

6.0 Conclusions

None of the SAMAs analyzed would be being justified on a cost-benefit basis. The area surrounding HNP is predominantly agricultural and forested land with sparse population. As a result, the baseline risk of the plant is low both for population doses and economic risk. This limits the potential averted risk from any severe accident modifications. As the analysis shows, none of the analyzed modifications would provide more benefit than they would cost.

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