CEDAR BAY COGENERATION PROJECT

APPLICATION FOR MODIFICATION

t o

CONDITIONS OF CERTIFICATION

AUGUST 26, 1991

SUBMITTED BY:

AES CEDAR BAY, INC.
and
SEMINOLE KRAFT CORP.

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

AES CEDAR BAY, INC., and
SEMINOLE KRAFT CORPORATION,

Petitioner,

vs.

DER CASE NO. PA 88-24
DOAH CASE NO. 88-5740

DEPARTMENT OF ENVIRONMENTAL
REGULATION,

Respondent,

and

CITY OF JACKSONVILLE, DEPARTMENT
OF COMMUNITY AFFAIRS, PUBLIC
SERVICE COMMISSION, ST. JOHNS
WATER MANAGEMENT DISTRICT,
JACKSONVILLE ELECTRIC AUTHORITY,
CHARLES L. BOSTWICK, BARNETT BANKS
TRUST COMPANY, IMESON INTERNATIONAL
PARK, INC., and INDUSTRIAL PARK
DEVELOPMENT CORPORATION,

Intervenors.
_____/

NOTICE OF FILING PROPOSED AGREEMENT

AES/Cedar Bay, Inc. hereby gives notice that concurrent herewith it has filed with the Florida Department of Environmental Regulation a Proposed Agreement to Modify Conditions of Certification for the Cedar Bay Cogeneration Project located in Duval County, Florida. Pursuant to Rule 17-17-211(4), F.A.C., original parties to the certification proceeding have forty-five (45) days to respond to the proposed agreement, except as to parties referenced in Condition of Certification XXV concerning the cooling water use portion of the requested modification.

Respectfully submitted,

OERTEL, HOFFMAN, FERNANDEZ
& COLE, P.A.
Post Office Box 6507
Tallahassee, FL 32314-6507
(904) 877-0099

Terry Cole
TERRY COLE
SCOTT SHIRLEY

Attorneys for AES CEDAR BAY, INC.,
and SEMINOLE KRAFT CORPORATION

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that the original and one copy of the foregoing and the Proposed Agreement to Modify Conditions of Certification have been furnished by **hand delivery** to the CLERK OF THE OFFICE OF GENERAL COUNSEL, Florida Department of Environmental Regulation, Twin Towers Office Building, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, and copies were furnished by **United States Mail** this **26th** day of **August, 1991** to:

Kathryn Funchess, Esquire
Office of General Counsel
Department of Community Affairs
2740 Centerview Drive
Tallahassee, FL 32399-2100

Susan Clark, Esquire
General Counsel
Public Service Commission
101 East Gaines #226
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Charles L. Bostwick
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421 West Church Street
Jacksonville, FL 32202

Terry Cole
Attorney

SS:cjb/1219-4.nof

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_____/

PROPOSED AGREEMENT TO MODIFY
CONDITIONS OF CERTIFICATION

Petitioners, AES/CEDAR BAY, INC. and SEMINOLE KRAFT CORPORATION, pursuant to Section 403.516, Florida Statutes (Supp. 1990) and the Order Approving Certification issued February 11, 1991, hereby propose an agreement to modify the Conditions of Certification for the Cedar Bay Cogeneration Project as follows:

Background

1. Petitioners are AES Cedar Bay, Inc. (AES Cedar Bay) and Seminole Kraft corporation. Petitioner, AES Cedar Bay, is the holder of a certification for a power plant site in the City of

Jacksonville. Seminole Kraft operates a kraft paper mill in the City of Jacksonville and is the owner of the property.

2. Petitioners request modification on the following grounds:

a. Reclaimed Wastewater for Cooling Purposes -- The Governor and Cabinet sitting as the Siting Board required that a source of water other than groundwater be used for cooling purposes. Condition of Certification XXV.A. requires that a modification be requested to approve the use of the cooling water source selected and its discharge, and requires submittal of supporting information. AES Cedar Bay has selected reclaimed water from the Seminole Kraft paper-making process as its cooling water source. Cooling system blowdown will be treated so that discharges will comply with the certified discharge limitations. Consequently, no change to water quality discharge parameters nor additional variances are requested. Use of reclaimed water for cooling purposes at the Cedar Bay Cogeneration Project will satisfy the public policies of conservation of groundwater resources through efficient water use and environmental protection through adherence to established standards.

b. Deletion of Conditions Relating to Construction Dewatering -- The elimination of authorization to withdraw or discharge dewatering water is requested due to previous concerns expressed about the effect that dewatering withdrawals from the surficial aquifer will have on groundwater flow. Since that time, AES has developed improved methods for construction of the coal

unloading facility, the circulating water pipes and pump pits, which will eliminate the need for dewatering discharge.

c. Use of Additional Startup Fuel During First Two Years of Operation -- A modification to the limit on startup fuel which can be used is required. Additional experience at facilities similar to AES Cedar Bay has led to a revision in the calculations related to startup. It is now known that additional startup fuel will be required during the first and second years of commercial operation. Additional startup fuel usage reduces coal usage. This results in reduced emissions and, thus, will have only a positive environmental impact.

d. Deletion of Capacity Limitations Related to NO_x Emissions -- A modification is required to delete certain capacity limitations related to NO_x. Now that additional data is available from other circulating fluidized bed boilers, it is apparent that AES Cedar Bay can meet NO_x limits without the necessity for limitations. Therefore, Condition II.A.9.b. should now be deleted from the Conditions of Certification.

3. Transmitted together with this proposed agreement and incorporated herein by reference is a modification application containing referenced modifications to the original application. The attachment also constitutes the information submittal required by Condition XXV.A. with respect to use of water for cooling purposes. In addition to establishing compliance with relevant agency standards for each requested modification, this submittal discusses how the proposed modification affects AES Cedar Bay,

Inc., Seminole Kraft Corporation, the public, and the environment. Also included is a full text of the specific proposed modifications to the Conditions of Certification. The attached information establishes that overall, there will be a net environmental improvement as a result of the requested modification to the Conditions of Certification.

4. As ultimate facts entitling Petitioner to relief, AES/Cedar Bay incorporates paragraphs 2-4 above, as well as the modification application submitted herewith.

5. As a statement of how the proposed modification affects the application as modified by the Order Approving certification, the Conditions of Certification, findings of fact, and conclusions of law, and studies conducted pursuant to Rule 17-17.050, F.A.C., Petitioners also reference paragraphs 1-4 above, as well as the modification application submitted herewith.

6. Petitioners cite the following rules and statutes entitling them to relief:

a. Section 403.501, et seq., Fla. Stat.;

b. Fla. Admin. Code Chapter 17-17;

c. Fla. Admin. Code Chapter 17-302;

d. Fla. Admin. Code Chapter 17-2;

e. Fla. Admin. Code Chapter 40C-2; and

f. Section 120.57, Fla. Stat.

7. Petitioner therefore requests that the parties agree to the proposed modification of the terms and Conditions of Certification.

Agreement

Each party signing below hereby agrees to the proposed modifications of the Conditions of Certification for the Cedar Bay Cogeneration Project as indicated in the attachment hereto.

Terry Cole, Esquire
Scott Shirley, Esquire
OERTEL, HOFFMAN, FERNANDEZ
& COLE, P.A.
Post Office Box 6507
Tallahassee, FL 32314-6507

DATE: _____

Richard Donelan, Esquire
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
Twin Towers Office Building
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Tallahassee, FL 32399-2400

DATE: _____

Kathryn L. Menella, Esquire
ST. JOHNS RIVER WATER
MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, FL 32178-1429

DATE: _____

Greg Radlinski, Esquire
Office of General Counsel
City of Jacksonville
Towncentre Ste. 715
421 W. Church Street
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DATE: _____

Earl Barker, Esquire
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Jacksonville, FL 32202

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344 East Duval Street
Jacksonville, FL 32202

this _____ day of _____, **1991.**

_____
Attorney

SS:cjb/1219-4.agm

CEDAR BAY COGENERATION PROJECT

APPLICATION FOR MODIFICATION

to

CONDITIONS OF CERTIFICATION

AUGUST 26, 1991

SUBMITTED BY:

AES CEDAR BAY, INC.
and
SEMINOLE KRAFT CORP.

CBCP Conditions of Certification Modifications

August 26, 1991

Condition XXV requires AESCB to modify the certification to provide "information concerning the design and operation of the plant cooling systems as appropriate for the cooling water source selected. The selected cooling water source is reclaimed water received from Seminole Kraft after treatment. This source was chosen because it will be available in sufficient quantities at the commencement of operation and because its quality is such that the discharge limitations previously certified can be met. Reclaimed water from the City of Jacksonville may not be available in sufficient quantities at the commencement of operation. However, permitting and use of this water at a later date has not been ruled out. The quality of the river water is such that the cooling water discharge would not meet Class III water quality standards. Thus, from the perspectives of reliability and environmental impact, Seminole Kraft reclaimed water is the best source of cooling water for AESCB.

AESCB has also decided to delete our construction dewatering discharge due to concerns over impacts on groundwater movement. Improved construction techniques and elevating the site have made dewatering unnecessary. All conditions relating to dewatering discharges are to be deleted.

AESCB also requests modification to the start-up fuel allocation and deletion of the capacity factor limitations imposed upon the boilers for NO_x control.

The following represents the technical support for the modifications requested for the selection of Seminole Kraft reclaimed water as makeup to the cooling tower, deletion of dewatering discharges, and the other minor modifications being requested at this time. Section designations refer to the original Site Certification Application.

Proposed language for the revised Conditions of Certification is included in Appendix A .

For your convenience, a table is included below which identifies the particular Condition of Certification being modified along with the sections of the Site Certification Application which are being modified accordingly.

Table 1

Cross Reference for Modifications to
Conditions of Certification and SCA

Condition of Certification being Modified	Sections of SCA being Revised
Cooling Water Source	
III.A.7, IX, XXV	3.5, 3.5.1, 3.7.1, 5.1.1, 5.1.4.2, 5.2.2
III.A.13	5.2.2
Deletion of Dewatering	
III.A.12, XXVIII	4.3.1.2, 4.11
III.A.13, III.A.14	5.12
Fuel Allocation Revision	
II.A.1.e, II.B.3	3.3.2
Capacity Factor Deletion	
II.A.9.b	NA

3.5 Plant Water Use

The primary source of water for the Cedar Bay Cogeneration Plant will be treated effluent from the Seminole Kraft paper mill which will be used for makeup to the cooling towers. Ground water from the Floridian aquifer will be used for potable water, general plant uses, fire water, and makeup to the steam cycle. A water mass balance diagram for average flows based upon full load operation is shown on Figure 3.5-1. A process flow diagram of the cooling water treatment system is included as Figure 3.5-2.

AESCB and our water treatment consultant, Betz Industrial, have defined the expected quality of the effluent which will be produced by Seminole Kraft after their conversion to 100% recycle. The expected water quality, shown in Table 3.5-1, is based upon analyses of wastewater from a facility in Ontario, California which is very similar to the Seminole Kraft 100% recycle process being presently installed. Together with confirming analyses of samples from a similar European facility and from a paper recycle process in the Fernandina Beach, FL area, we were able to arrive at a "worst case" characterization of the future SK wastewater quality. The metals in the expected effluent are "worst case" and based upon the limits set out in the Seminole Kraft NPDES Permit, Permit No. FL0000400.

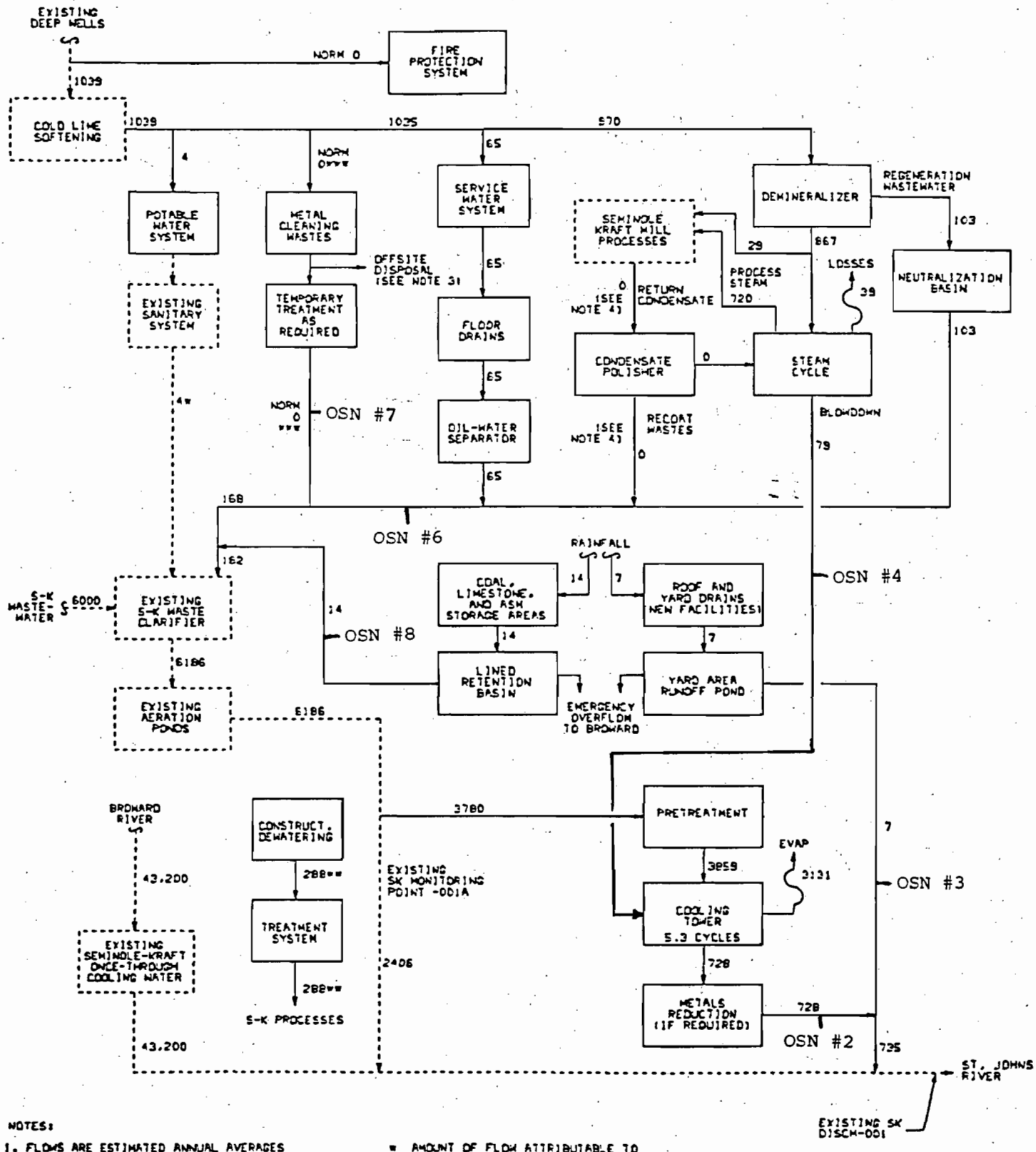
The raw water makeup to the Ontario, CA facility was also compared to that of the SK. Although the raw water analysis is only a part of the ultimate wastewater analysis, a comparison confirms that the make-up waters are similar, and thus will have a similar impact on the respective recycle mill wastewater streams. The raw water makeup analysis comparison is shown in Table 3.5-1a.

Makeup to the cooling towers from the discharge of the SK IWTS will be pretreated in a solids contact clarifier for removal of suspended solids and organics before admission to the cooling system. Solids from the clarifier will be dewatered and disposed of in a permitted landfill or reused for agricultural uses, see Section 3.7.1 for more details.

Section 3.5.1 Cooling Tower System

The majority of the makeup water will be treated reclaimed effluent from Seminole Kraft. Boiler blowdown will be routed to the cooling tower to supply a small portion of the makeup.

3.5.1.1 System Design. The AESCB facility will be constructed so that reclaimed water from the mill or any of the alternative sources certified by the Siting Board can be used for cooling water. All materials of construction have



NOTES:

1. FLOWS ARE ESTIMATED ANNUAL AVERAGES EXPRESSED IN 1000 GALLONS PER DAY FOR 100 PERCENT LOAD.
2. SOLID LINES REPRESENT NEW EQUIPMENT OR PIPELINES. DASHED LINES REPRESENT EXISTING EQUIPMENT OR PIPELINES.
3. ACID CLEANING SOLUTIONS TO BE DISPOSED OFFSITE TO APPROVED FACILITY.
4. RETURN CONDENSATE CAN VARY FROM 0 TO 432,000 GPD.
5. INCLUDES CONSTRUCTION RUNOFF.

* AMOUNT OF FLOW ATTRIBUTABLE TO CEDAR BAY COGENERATION PROJECT

** MAXIMUM FLOW DURING CONSTRUCTION DEWATERING. FLOW WILL OCCUR ONLY DURING CONSTRUCTION.

*** FLOW WILL OCCUR ONLY DURING MAINTENANCE OUTAGES.

FIGURE 3.5-1

AES CEDAR BAY
WATER BALANCE DIAGRAM

AES CEDAR BAY

CLASS III DISCHARGE COOLING SYSTEM TREATMENT

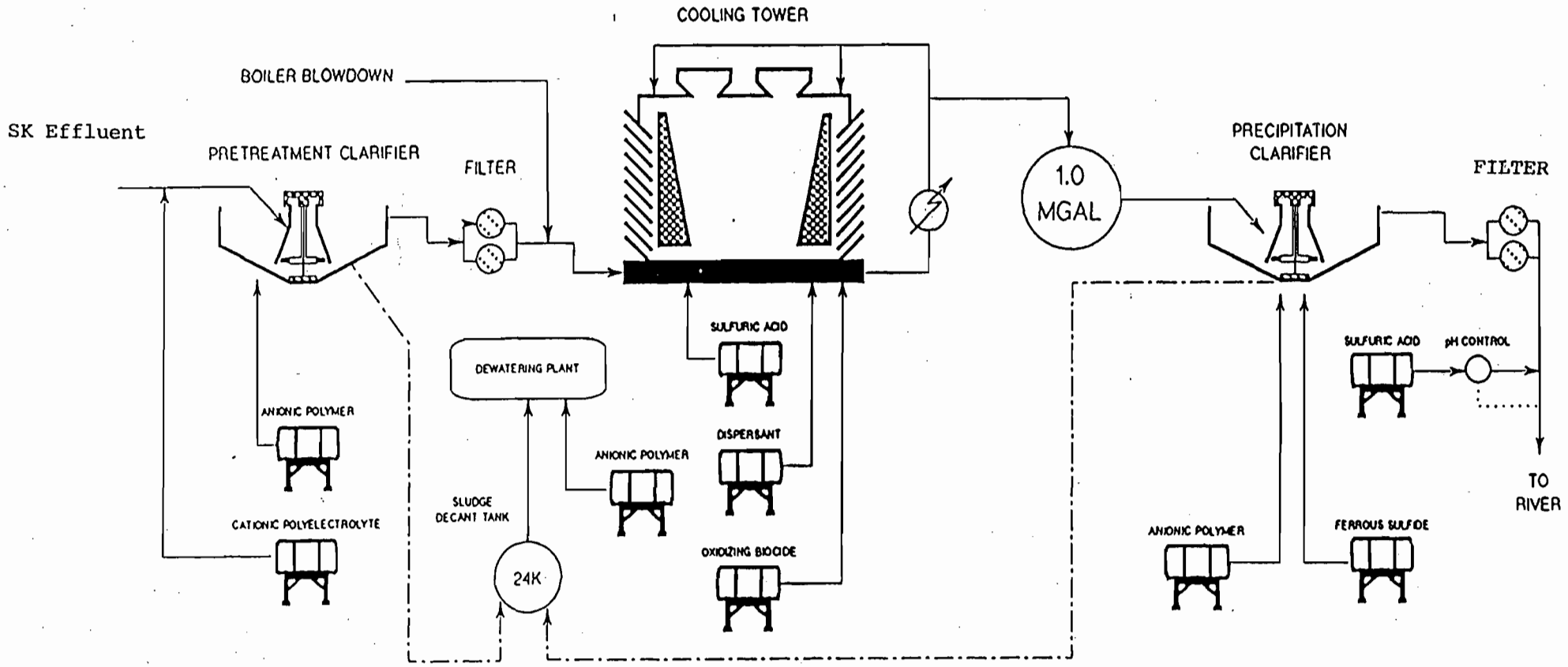


FIGURE 3.5-2

been upgraded to provide this flexibility. The changes in design were described in Steve Wolf's letter to DER dated September 27, 1990 (Appendix B).

The expected evaporation rate is approximately 2200 gpm and the estimated average makeup rate is 2680 gpm. The predicted makeup water quality should allow the cooling tower to operate at 5.3 cycles of concentration. Based on the 5.3 cycles of concentration, average blowdown will be approximately 505 gpm. Blowdown will still be from the cold side of the tower with a maximum expected temperature of 95 deg F and discharged via the existing SK discharge pipeline to the St. Johns River.

3.5.1.2 Source of Cooling Water. The water for use in the heat dissipation system will be primarily treated effluent from the SK mill. The expected quality is shown in Table 3.5-3 along with the expected circulating water quality. A small portion of the cooling water makeup will be obtained by routing the boiler blowdown water to the cooling towers.

TABLE 3.5-1
Anticipated SK Effluent Quality

Alkalinity, ppm as $CaCO_3$	874
Calcium, ppm as $CaCO_3$	169
Magnesium, ppm as $CaCO_3$	41
Sodium, ppm as Na	680
Iron, ppm as Fe	< 1.0
Silver, ppm as Ag	< 0.05
Aluminum, ppm as Al	< 2.2
Copper, ppm as Cu	< 0.015
Phosphate, Total as PO_4	3.4
Sulfate, ppm as SO_4	388
Chloride, ppm as Cl	84
Silica, ppm as SiO_2	22
Conductivity, umhos	2500
pH	6-8
Total Dissolved Solids, ppm	2300

TABLE 3.5-1a
Raw Water Makeup Analysis Comparison

Parameter	Ontario Facility	Seminole Kraft
Alkalinity, ppm as $CaCO_3$	156	61
Calcium, ppm as CaCO3	172	129
Magnesium, ppm as $CaCO_3$	35	65
Sodium, ppm as Na	22	17
Iron, ppm as Fe	0.1	0.09
Copper, ppm as Cu	0.05	0.07
Phosphate, Total as PO_4	0.4	0.2
Sulfate, ppm as SO_4	29	112
Chloride, ppm as Cl	29	38
Silica, ppm as SiO_2	32	13
Conductivity, umhos	470	414
pH	8.3	8.4
Total Dissolved Solids, ppm	346	309

TABLE 3.5-3
Anticipated Cooling Water Makeup
and Circulating Water Analyses

Parameter	Makeup Water	Circulating Water
Alkalinity,ppm as $CaCO_3$	874	4632
Calcium, ppm as CaCO3	169	896
Magnesium, ppm as $CaCO_3$	41	217
Sodium, ppm as Na	680	3604
Iron, ppm as Fe	< 1.0	< 5.3
Copper, ppm as Cu	< 0.015	< 0.08
Phosphate, Total as PO_4	3.4	18
Sulfate, ppm as SO_4	388	2056
Chloride, ppm as Cl	84	445
Silica, ppm as SiO_2	22	117
Total Dissolved Solids, ppm	2300	12190

Section 3.7.1 Solid Waste

The by-product from both the cooling water makeup clarifier and the metals treatment system will be dewatered in a thickener, then further dewatered in a sludge press. The characterization of the predominant components of the sludge, and the range of sludge volumes that is expected is listed below.

Source	Wet TPD	Characterization
Makeup clarifier	1.7-3.9	Paper fiber, suspended BOD, silt, suspended organic material
Blowdown treatment clarifier	0.2-1.1	Ferric hydroxides, copper sulfate, iron phosphate

The sludge will be stored on-site until loaded into trucks for disposal at a local landfill. Depending upon exact analysis, some of the sludge may be sold for reuse as an agricultural additive.

AESCB agrees to report the quantities of sludge produced, the amount disposed, and the location of the disposal site.

Section 4.3.1.2 Shallow Aquifer

Due to concerns expressed regarding dewatering waters and the effects of withdrawals of surficial water on groundwater flow, deletion of the dewatering discharge is requested. An explanation of the construction techniques to be used to eliminate the need for dewatering follows.

Since construction dewatering is being deleted and no dewatering will be required there will be no impact on the shallow aquifer as earlier stated.

AESCB's contractor originally proposed to construct certain structures and equipment below the natural groundwater table by dewatering. Dewatering is technique where a series of wells are installed around the perimeter of an excavation at depths below the bottom of the excavation. These wells pump continuously and pull the groundwater in the area down to acceptable levels. While keeping the excavation dry these wells draw water from the surrounding area or "cone of influence". This can have a significant impact on natural groundwater flow of movement.

During the siting process it was determined that these dewatering activities could pull up to 2000 gallons per minute of groundwater which would require discharging off-site. It was also determined that it would be difficult for dewatering discharges to meet Class III standards, particularly for copper.

The major structure which required the most significant and lengthy dewatering was the Coal Unloading Facility. Because concerns raised over the discharge of dewatering groundwater, AES and our contractor decided not to dewater during construction of this structure. However, the technique ultimately certified is not being modified. It involved the construction of a coffer dam consisting of sheet piling and bentonite cement slurry wall will be installed around the excavation. The bottom will be sealed with jet grout. Any leakage through the coffer dam will be minimal; most certainly less than 100 gallons per minute and possibly zero.

The remaining structures and equipment which were originally slated for dewatering included the circulating water piping and storm water pump pits. These structures could be built to minimize dewatering (less than 200 gallons per minute). These changes in construction techniques, as currently certified, significantly decreased the dewatering flowrate allowing a treatment system to be designed to successfully (yet costly) treatment of dewatered groundwater.

Subsequent to certification, AESCB and our contractor have made additional proposed enhancements to the designs in order to more cost effectively construct the facility. The most significant one being that the site elevation has been raised 5 feet. This allows us to totally eliminate dewatering and subsequent effects of impacting groundwater movement.

Circulating Water Piping

The circulating water piping is no longer significantly in the groundwater. The bottom of the pipe is essentially at the groundwater level and be installed without the use of dewatering wells and no dewatering discharge is required. Any groundwater which might seep into this excavation will be controlled, as much as practical, within the excavation during the installation of this pipe. No discharge or impacts to groundwater movement will occur.

Pump Pits

While the bottom of these structures are still below the water table it has been determined that they can also be installed without utilizing dewatering wells. These pump pits will be precast concrete or precast in sections in order to allow rapid installation into the excavation. No discharge or impact to groundwater movement will occur.

Coal Unloading Structure

The coffer dam with a bottom seal will be installed as described above. A greater effort is now contemplated to completely seal any leaks into this excavation to effectively eliminate any leakage. Any groundwater leaking into the coffer dam structure will be returned to the "wet" side of the dam and all practical efforts will be used to eliminate the leakage. No discharge or effect on groundwater movements will occur.

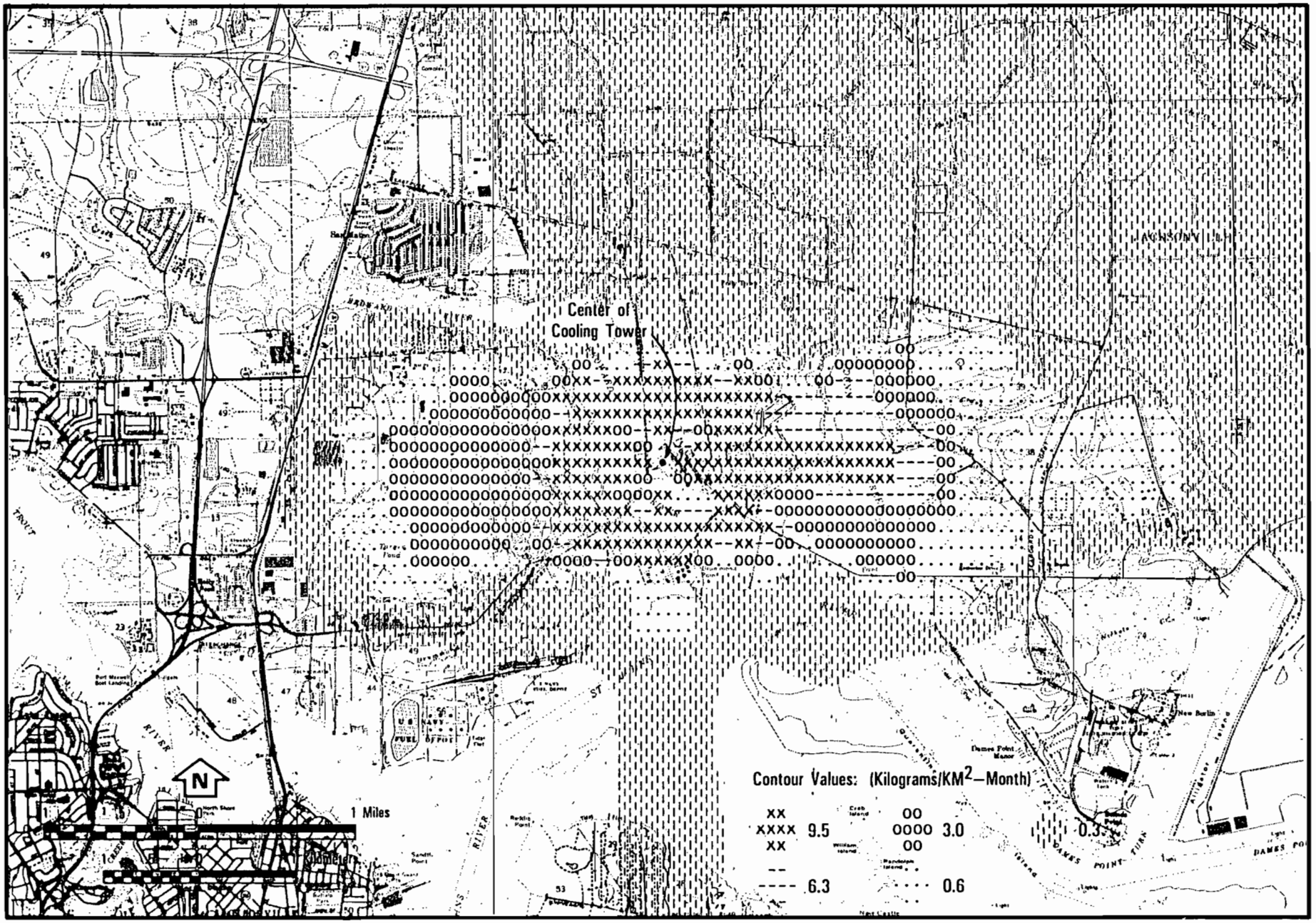
Section 4.11 Variances

Since all construction dewatering discharges have been eliminated, as described above, no variances will be required for the dewatering discharge as previously certified. No other construction related variances from applicable standards have been identified by AESCB at this time for construction of the CBCP.

Section 5.1 Effects of the Operation of the Heat Dissipation System

5.1.1 Temperature Effects on Receiving Body of Water Due to the change in source of cooling water makeup, the cooling tower will operate at a slightly higher cycles of concentration, 5.3 instead of 4.6. This change reduces the amount of cooling water blowdown discharged to the St. John's River via the existing SK outfall. The average blowdown flowrate has been reduced from 633 gpm to 505 gpm. The thermal effects of this reduced flowrate have been studied with the following results; the thermal mixing zone can be reduced from 30 feet to 15 feet in radius for each of the four discharge points. This is based upon recalculation of the six cases originally performed in the SCA. The case which resulted in the largest mixing zone was Case 4, combined SK and CBCP discharge during average ambient temperature (73.9 deg F) and minimum river salinity (5000 mg/l). The resulting total mixing zone required is now 265 m^2 (0.065 acres).

5.1.4.2 Salt Deposition The SACTI program was used to predict salt deposition totals surrounding the cooling tower. The revised salt deposition calculations were based upon the cooling tower drift analysis performed for the original Site Certification Application. The impacts determined for original application, based upon groundwater makeup, were multiplied by the ratio of SK salt concentrations to groundwater concentrations. Figure 5.1-1 has been revised to reflect the changes. The estimated maximum salt deposition rate is approximately 700 kilograms per square kilometer per month (kg/km^2/month) or about 6.2 lb/acre/month. The location of the maximum rate is 200



Based on Seminole Kraft Effluent

PLUME SALT DEPOSITION FROM
THE CEDAR BAY COOLING TOWER

Figure 5.1-1

meters east of the tower. The estimated average is 32.2 kg/km^2/month or 0.3 lb/acre/month.

The salt deposition rate decreases significantly with distance within the first 300 meters and then continues out to 1,300 meters. Beyond 1,300 meters, the average salt deposition rate is reduced to less than 5.6 kg/km^2/month. The estimated average deposition rate is reduced further at 3,000 meters to less than 1.0 kg/km^2/month or 0.01 lb/acre/month.

The highest salt deposition rates occur very near the cooling tower onsite and on the adjacent Seminole Kraft property. Since the area has been previously greatly disturbed and only sparse or no vegetation remains, there is little potential for adverse impacts. The salt deposition rates on areas of offsite vegetation fall well below 400 kg/km^2/month. This rate was determined[1] to be the minimum threshold level for sensitive plant species above which plant damage occurs. There are no known threatened or endangered species that occur in the vicinity of the cooling tower.

Section 5.2 Effects of Chemical and Biocide Discharges

5.2.2 Cooling Tower Blowdown Approximately 728,000 gallons per day (gpd) of cooling tower blowdown will result from cooling tower operations. The maximum cooling tower blowdown flow is expected to be 1,566,000 gpd. The cooling tower blowdown flow will be directed to a metals treatment system to ensure compliance with water quality standards before being discharged through the existing SK outfall. The cooling tower blowdown stream may require treatment for certain heavy metals, if present in the SK effluent, to meet the previously certified discharge limitations. Data from recycle mills similar to the proposed SK configuration indicate that the metals in the cooling tower blowdown will meet the certified discharge limitations without further treatment. However, if treatment is required, several possibilities exist for the reduction in metal concentrations. The primary option identified and the one AESCB will install is an iron co-precipitation process for metals treatment on the cooling tower blowdown stream. A bench scale testing program has been initiated by AESCB to determine the best practical means of operating the system to maximize any metals reduction which may be required. The results of this program, using water as similar in quality as possible to that expected from the SK recycle mill, will be used to fine tune the design installed by AESCB. The bench testing program will include toxicity screening on the

[1]Dr. Charles Mulchi, Professor at the University of Maryland in telephone conversation to Dan Wilkus, Black & Veatch, August 14 and 21, 1991.

treated blowdown stream. Further confirmation testing will be conducted by AESCB once the SK mill completes their conversion to 100% recycle and effluent is available for testing.

In the iron co-precipitation process, metals are removed in the effluent as the hydroxides and sulfides in the presence of precipitating ferric hydroxide. This is facilitated by the addition of an alkaline chemical and an iron salt. In the presence of the alkali and upon aeration, metal hydroxides begin to form and precipitate. Ferrous sulfate is used as the iron source, improving the precipitation performance of the metals. To further the removal of heavy metals, a soluble sulfide is added to the process to precipitate residual metals as metal sulfides. The process is attractive because a very high degree of metal removal is attained. This process is presently being used at facilities such as the City of Lakeland's McIntosh Unit for removal of metals in effluent to acceptable levels. Table 5.2-8a lists typical metal removal efficiencies based upon the similar installation at Lakeland's McIntosh plant and are only intended to be representative of what the process is capable of achieving. While AESCB's effluent will be different from that at McIntosh, actual removal efficiencies at AESCB are expected to be similar.

A typical flow schematic for the iron co-precipitation process is shown in Figure 5.2-1. The influent water enters the rapid mix basin where the pH is adjusted by caustic addition and the ferrous sulfate is introduced. The solution is well mixed and a constant pH is attained when it enters the reactor. In the reactor the solution is aerated. Metal hydroxides first begin to form in the reactor, but are kept in suspension by the agitation of the aerators. As the reactor effluent enters the solids contact basin, a soluble sulfide is introduced to convert residual metals to metal sulfide precipitates. A polymer is added in the basin to aid in coagulation. Clarified treated effluent is filtered in gravity filters to ensure suspended solids removal prior to discharge. Solids collected in the solids contact clarifier will be dewatered and disposed, see Section 3.7.1 for further details on the sludge and its disposal. Reliability and a high degree of availability of the above process will be assured through the use of on-line spare pumps and spare components in our warehouse facility.

The treated cooling tower blowdown quality is given in Table 5.2-8b. The effluent quality will meet those limitations previously certified and will not exceed Class III standards. The previously granted variance for iron will no longer be required due to the metals treatment system being installed. The cooling tower blowdown discharge stream will have no adverse impacts on the St. John's River water quality as it will meet all relevant water quality standards.

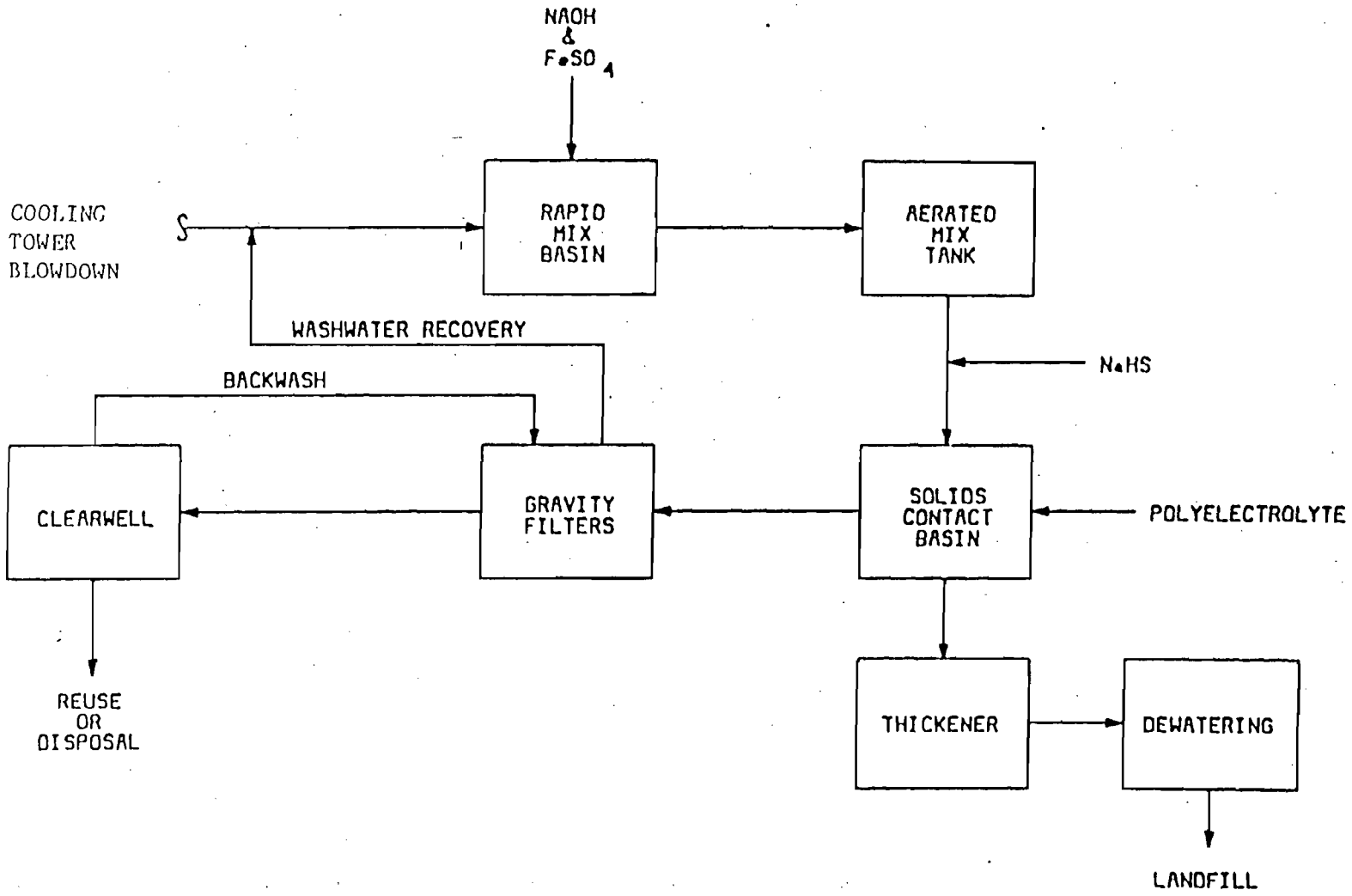


FIGURE 5.2-1

Iron Co-precipitation Process Schematic

Table 5.2-8a
Typical Metals Removal Efficiencies [1]

Metal	Influent level ug/l	Effluent level ug/l	% Removal
Aluminum	870	31	96
Cadmium	10	2	80
Chromium	50	12	76
Copper	30	8	75
Iron	410	42	90
Lead	80	33	60
Mercury	240	NA[2]	NA
Silver	10	3	70
Zinc	430	15	97

[1] Based upon actual performance at Lakeland's McIntosh Unit

[2] Data not available due to inconsistent test results

Table 5.2-8b Cooling Tower Blowdown Quality
Post Metals Treatment

Constituent	Average Concentration mg/l	Maximum Concentration mg/l
BOD_5	< 10.0	10.0
COD	< 10.0	10.0
Total organic carbon	< 10.0	10.0
Total suspended solids	20.0	30.0
Ammonia	< 1.0	1.0
pH	7.2	8.0
Oil and grease	(1)	(1)
Calcium	896	1000
Magnesium	217	300
Sodium	3604	5000
Potassium	56	80
M-alkalinity as $CaCO_3$	4632	6000
Sulfate	6360	9000
Chloride	445	600
Nitrate	35	56
Fluoride	< 5.0	5.0
Silica	117	200
Chlorine	0.05	0.10
Phosphate (total)	18	30
Cyanide	(1)	(1)
Iron	0.1	0.3
Manganese	(1)	(1)
Aluminum	< 1.5	1.5
Nickel	(1)	(1)
Zinc	< 1.0	1.0
Copper	< 0.015	0.015
Cadmium	<0.005	0.005
Chromium	<0.05	0.05
Beryllium	(1)	(1)
Arsenic	<0.05	0.05
Selenium	<0.025	0.025
Antimony	< 0.2	0.2
Mercury	< 0.001	0.0001
Barium	(1)	(1)
Silver	< 0.0005	0.0005
Lead	< 0.05	0.05
Thallium	(1)	(1)

(1) Not present in significant quantity

Section 5.4 Solid Waste Disposal Impacts

5.4.1 Solid Waste The sludge generated by the cooling water pretreatment and blowdown metals treatment operations will be dewatered and disposed of in a local landfill or sold for agricultural reuse as a soil amendment. AESCB will report on an annual basis the amount of sludge disposed of and the location of the landfill site.

Section 5.12 Variances

The variance from Class III water quality standards for iron will no longer be required as the cooling water blowdown metals treatment process will remove iron to below the 0.3 mg/l level.

Section 3.3 Fuel

3.3.2 Fuel Quantities Additional experience at facilities similar to AESCB have led to revisions in the calculations related to start-up fuel use. Start-up of a relatively new technology has proven to result in a higher number of shutdowns during early operation to correct design and construction flaws than would be expected from a well-known traditional technology. Accordingly, the amount of fuel oil or natural gas used for start-ups is expected to be higher in the first two years of commercial operation than was previously certified.

Since the maximum number of annual hours burning fuel oil or gas is being increased, a reduction in the annual hours burning coal occurs. As modeling was done on coal and coal has higher emission levels than either fuel oil or natural gas, the increased start-up fuel allocation will only decrease the annual emissions and thus does not impact the "worst case" air modeling already conducted. No further air modeling is necessary.

Condition II.A.9.b Capacity Factor Limitation

Based upon the experience AES has gained operating fluidized bed boilers, the certified NO_x emission rate limitation will be met at low loads. Accordingly, deletion of this condition limiting the capacity factor of the facility is requested. Supporting data from the AES Thames facility (Appendix C) and the letter from DER expressing no objection to this condition's deletion (Appendix D) are included in this document.

APPENDICES

CEDAR BAY COGENERATION PROJECT
Proposed Modifications to Conditions of Certification

II.A.1.e: Auxiliary fuel burners shall be fueled only with natural gas or No. 2 fuel oil with a maximum sulfur content of 0.3% by weight. The fuel oil or natural gas shall be used only for start-ups. During the first year of commercial operation the maximum annual oil usage shall not exceed 350,000 gals./year, nor shall the maximum annual natural gas usage exceed 49 MMCF per year. During the second year of commercial operation, the maximum annual oil usage shall not exceed 250,000 gals./year, nor shall the maximum annual natural gas usage exceed 35 MMCF per year. During the third and subsequent years of commercial operation, the maximum annual oil usage shall not exceed 160,000 gals./year, nor shall the maximum annual natural gas usage exceed 22.4 MMCF per year. The maximum heat input from the fuel oil or gas shall not exceed 1120 MMBtu/hr. for the CFBs.

II.A.9. Operations Monitoring for each CFB

a. Devices shall be installed to continuously monitor and record steam production, and flue gas temperature at the exit of the control equipment.

~~b. The furnace heat load shall be maintained between 70% and 100% of the design rated capacity during normal operations.~~

c. The coal, bark, natural gas and No. 2 fuel oil usage shall be recorded on a 24-hr (daily) basis for each CFB.

II.B.3: The VOC emissions from the maximum No. 2 fuel oil utilization rate of 240 gals./hr., ~~2,100,000 gals./year~~ for the limestone dryers; and 8000 gals./hr., ~~160,000 gals./year~~ for the three boilers are not expected to be significant.

III.A.3. Thermal Mixing Zones - The instantaneous zone of thermal mixing for the AESCB cooling system shall not exceed an area of 0.065 acres. The temperature at the point of discharge into the St. John's River shall not be greater than 95 degrees F. The temperature of the water at the edge of the mixing zone shall not exceed the limitations of Section 17-3.05(1)(d), F.A.C. Cooling tower blowdown shall not exceed 95° F as an instantaneous maximum.

III.A.7. Cooling Tower Blowdown - AESCB's discharge from Outfall Serial Number 002 - Cooling Tower Blowdown shall be limited and monitored as specified below:

a.

Parameter	Discharge Limit	Monitoring Frequency	Requirement Type
Discharge flow (mgd)	Report	1/day	Totalizer
Discharge Temp (°F)	Instantaneous Maximum	Continuous	Recorder
Total Residual Oxidants	Instantaneous Maximum - .05 mg/1	Continuous	Recorder
Time of Total Residual Oxidant Discharge (TRO)	120 minutes per day	Continuous	Recorder
Iron	Instantaneous Maximum - ~~0.5~~ 0.1 mg/1	1/week	grab
pH	6 - 9	1/week	grab

~~III.A.12. Construction Dewatering~~

~~a. Discharge of construction dewatering to the SKC once-through cooling system from outfall serial number 005 shall be limited and monitored as specified below:~~

~~Effluent Characteristic~~	~~Discharge Limits~~	~~Monitoring Requirements~~	
	~~Instantaneous Maximum~~	~~Measurement Frequency~~	~~Sample Type~~
~~Flow - (MGD)~~	~~.288~~	~~daily~~	~~Totalizer~~
~~Turbidity (NTU)~~	~~29.000~~	~~1/week~~	~~composite/grab~~
~~Aluminum mg/L~~	~~1.500~~	~~1/week~~	~~composite/grab~~
~~Copper mg/L~~	~~0.015~~	~~1/week~~	~~composite/grab~~
~~Iron mg/L~~	~~0.300~~	~~1/week~~	~~composite/grab~~
~~Lead mg/L~~	~~0.050~~	~~1/week~~	~~composite/grab~~
~~Mercury µg/1~~	~~0.100~~	~~1/week~~	~~composite/grab~~
~~Phenol µg/1~~	~~1.000~~	~~1/week~~	~~composite/grab~~

~~TSS mg/l~~	~~50.000~~	~~1/week~~	~~composite/grab~~
~~pH~~	~~6.000-9.000~~	~~1/week~~	~~composite/grab~~

~~Report N.D. if below detection limit, giving method used and detection limit. If the discharge limit is below the detection limit, then N.D. signifies compliance.~~

~~AES/CB shall take composite samples of dewatering effluent once a week for one month following the start of dewatering, then if no violations are found, grab samples may be taken for the remainder of dewatering.~~

~~AES Cedar Bay shall treat the construction dewatering discharge so as not to exceed the above effluent limits. AES/CB shall utilize the advanced treatment systems consisting of sand filter, carbon filter, and selective ion exchange, as shown in their letter of October 26, 1990, to Hamilton S. Oven, unless testing demonstrates that the above limits can be met without such treatment. Prior to discontinuing such treatment, AES/CB shall notify both DER and BESD, and provide them with an opportunity for consultation.~~

~~AES Cedar Bay shall do sufficient bench testing to demonstrate that it can meet the above limit for copper. AES Cedar Bay shall notify DER and BESD of the bench testing, and allow DER and BESD to be present if they so desire to observe the bench testing.~~

~~In addition, AES Cedar Bay shall determine the amount of treatment and removal provided for iron, aluminum and lead by the method of treatment selected for copper.~~

~~A report shall be submitted to DER and BESD summarizing the results of the bench testing of the proposed treatment technique.~~

~~b. Project discharge descriptions - Dewatering water, outfall 005, includes all surficial groundwater extracted during all excavation construction on site for the purpose of installing structures, equipment, etc. discharges to the SKC once through cooling water system at a location to be depicted on an appropriate engineering drawing to be submitted to DER and BESD. Final discharge after treatment is to the St. Johns River. The permittee shall report to BESD the date that construction dewatering is expected to begin at least one week prior to the commencement of dewatering.~~

III.A.13. Mixing Zones - The discharge of the following pollutants shall not violate the Water Quality Standards of Chapter 17-3, F.A.C., beyond the edge of the designated instantaneous mixing zones as described herein. Such mixing zones shall apply when the St. Johns River is in compliance with the applicable water quality standard.

~~The permittee shall report the date construction dewatering commences to the BESD.~~

a. During operation of CBCP for the life of the facility:

~~Iron~~	~~125,600 m^2 (31 acre) mixing zone~~
~~Chlorine~~	~~0 - not measurable in river~~
Temp	230 m^2 (0.065 acre)
pH	1,013 m^2 (0.25 acre)

~~14. Variance to Water Quality Standards - In accordance with the provisions of Sections 402.201 and 403.511(2), F.S., permittees are hereby granted a variance to the Water Quality Standard of Chapter 17-3.121, F.A.C. for iron during operation.~~

~~Such variance shall apply only as the natural background level of the St. Johns River approaches or exceeds the standards. In any event, the discharge from the CBCP shall comply with the effluent limitations set forth in Paragraph III.A.12. At least 90 days prior to start of construction, AES shall submit a bioassay program to assess the toxicity of construction dewatering effluent to the DER for approval. Such program shall be approved prior to start of construction dewatering.~~

~~V.D. Construction Dewatering Effluent~~

~~Maximum daily withdrawals for dewatering for the construction of the railcar unloading facility must not exceed 0.288 million gallons.~~

~~Dewatering for the construction of the railcar unloading facility shall terminate no later than nine months from the start of dewatering.~~

~~Should the permittee's dewatering operation create shoaling in adjacent water bodies, the permittee is responsible for removing such shoaling.~~

~~All offsite discharges resulting from dewatering activities must be in compliance with water quality standards required by DER Chapters 17-3 and 17-4, F.A.C.~~

IX. SOLID WASTE STORAGE AND DISPOSAL

Solid waste produced by the operation of the AESCB facility shall be removed from site and disposed of in a permitted disposal facility, with the exception of bottom ash and fly ash. Bottom ash and fly ash will be pelletized, and either shipped back

to the mine utilizing the trains to deliver the coal, or sold as an additive to concrete. The bottom ash and fly ash shall not be disposed of in a landfill within Duval County. If the permittees decide to dispose of the bottom ash or fly ash by other than returning it to the mine, they shall notify BESD and DER. Prior to removal and disposal of spent lime mud and pond tailings, the permittees shall determine whether those wastes are determined to be hazardous, they shall be disposed of in accordance with Chapter 17-730, F.A.C., after consultation with the DER and BESD. If not hazardous, disposal shall be to a landfill designed to ensure compliance with groundwater quality criteria as contained in Chapters 17-3, and 17-730, F.A.C. All solid wastes disposed of on site shall comply with the provisions of Chapter 17-7, F.A.C. Ground water monitoring in accordance with 17-4, and 17-28, F.A.C. shall be implemented at the lime mud disposal site.

On or before the last day of the first year of commercial operation, and each year of commercial operation thereafter, AES/CB shall report to DER and BESD concerning the quantity of sludge generated by the cooling tower blowdown treatment system and the method of disposal, including name and location of facilities handling, treating, storing, and/or disposing of said sludge waste.

XXV.A. ~~AESCB~~ Use of Water for Cooling Purposes

The CBCP may use either surface water from the Broward or St. Johns River or reclaimed water provided either by the City of Jacksonville or by the Seminole Kraft Papermill as its source of cooling water makeup. The CBCP is currently authorized to use 4.5 mgd of reclaimed water provided by the Seminole Kraft Papermill for cooling purposes.

~~Within six months after issuance of certification, AESCB shall submit to DER an application for a modification containing information concerning the design and operation of the plant cooling system as appropriate for the cooling water source selected. The application shall also be submitted to SJRWMD and BESD, who may report concerning the AESCB cooling water application modification. The AESCB application shall contain all information necessary to demonstrate that operation of the cooling system using either reclaimed or surface water for the preferred cooling water source selected will comply with all relevant non-procedural agency standards, or that AESCB qualifies for a variance. The AESCB application shall also include an analysis of the reasons for the selection of the requested cooling water source over the other preferred alternate sources referred to in the above paragraph. The participating agencies shall respond within 30 days of the receipt of the application modification as to whether or not it contains information sufficient to make a determination as to compliance with non-procedural agency standards. Thereafter, DER shall notify AESCB, BESD, and SJRWMD as to its determination concerning sufficiency. SJRWMD and BESD shall file any reports concerning the application with DER and provide a copy to AESCB within 60 days after DER's determination that the application is~~

~~sufficient. DER shall indicate its approval or disapproval of the selected cooling water system proposal within 90 days of its determination that the application is sufficient. Any modifications of the certification or the conditions of certification including variances, exceptions, or mixing zones shall be made pursuant to the procedures set forth in Section 402.516, Fla. Stat., and/or Fla. Admin. Code Rule 17-17.211.~~

Reclaimed domestic waste water used in the AESCB cooling tower shall be disinfected prior to use. Disinfectant levels in the cooling tower makeup shall be continuously monitored, prior to insertion in the cooling tower. The reclaimed water shall be treated so as to obtain no less than a 1.0 mg/1 free chlorine residual after fifteen (15) minutes' contact time or its equivalent. Chlorination shall occur at a turbidity of 5 Nephelometric Turbidity Units (NTU) or less, unless a lesser degree of disinfection is approved by the Department upon demonstration of successful viral kill.

At least six months prior to beginning commercial operation, AES/CB shall report concerning the actual measured pollutant characteristics of reclaimed water to be obtained from the Seminole Kraft Papermill. Such report shall be based on samples obtained directly from the SKC waste stream to be tied in with the CBCP cooling system, and shall report as to concentrations of iron, aluminum, zinc, copper, cadmium, chromium, arsenic, selenium, antimony, mercury, silver, and lead.

(Metals, pH, any toxins of concern.)

In the report, AES/CB shall also confirm that the certified cooling tower blowdown treatment system will provide a level of treatment necessary to comply with the discharge limitations in condition III.A.7.a. and b.

~~XXVIII. PETROLEUM STORAGE TANKS~~

~~A. AES Cedar Bay shall provide clean-up of the #1 underground diesel fuel storage tank site, which is listed under the EDI program, in accordance with F.A.C. Chapter 17-770. AES shall complete an Initial Remedial Action (IRA) in accordance with Rule 17-770.300, F.A.C., prior to construction dewatering. DER and BESD will receive written notification ten working days prior to initiation of the IRA. AES shall determine the extent of contamination. AES Cedar Bay shall then design and install a pump and treatment system at the site, which will create a reverse hydraulic gradient that will prevent the further spread of the contamination by the dewatering operation. Furthermore, AES Cedar Bay shall submit a Quality Assurance Project Plan (QAPP), a Contamination Assessment Report (CAR) and a Remedial Action Plan (RAP), in accordance with F.A.C. chapter 17-770 to DER for approval with copies to BESD thirty days prior to the start of construction dewatering. AES Cedar Bay shall provide complete site rehabilitation in accordance with F.A.C. Chapter 17-770.~~

B. AES Cedar Bay shall develop a QAPP, CAR, and RAP as required and in accordance with Chapter 17-1700, F.A.C. for the site listed in XXVIII, C and D below, and submit these plans to DER for approval with copies to BESD thirty days prior to the start of construction dewatering.

C. Prior to construction dewatering, at the underground diesel fuel storage tank #2 site, AES Cedar Bay shall:

1. Perform an IRA with F.A.C. Rule 17-770.300.

2. Determine the extent of down gradient contamination and submit that information to BESD, and DER prior to installation of the well described in paragraph C.4 below.

3. Establish a series of groundwater level monitoring wells at intervals of approximately 250 feet from the coal unloading site to the #2 tank for determination of the groundwater dewatering cone of influence. Daily groundwater levels shall be recorded for each of these wells during construction dewatering. A background well with a continuous water level recorder shall be installed, at a site that would not be influenced by the dewatering operations, to determine ambient conditions at the site.

4. Install a monitoring well with a continuous water level recorder which will be used to trigger implementation of the RAP. The well will be located 150 feet down gradient from the boundary of the plume of contamination determined above in XXVII C.2. If the piezometric head in the trigger well drops 6 inches below ambient conditions as compared to the background well, then AES Cedar Bay shall notify DER and BESD of a verified drop of 6 inches or more in the trigger well within three working days and the appropriate portion of the RAP shall be implemented by AES Cedar Bay.

5. AES Cedar Bay shall submit a plan for the location and construction of the monitoring wells described above in paragraph D.4., the DER and BESD for approval. AES Cedar Bay shall submit monthly reports of the groundwater level recordings to dER and BESD.

E. Implementation of the appropriate portion of the RAP shall commence within 14 days of the determination that the construction dewaterings cone of depression will reach any of the contaminated sites.

F. AES Cedar Bay shall monitor the construction dewatering effluent from their treatment system, once a week during dewatering, for the following criteria: Benzene 1 µg/1; Total VOA 50 µg/1; Total Naphthalenes (Total = naphthalenes + methyl naphthalenes) 100 µg/1; and Total Residual Hydrocarbons 5 mg/1, and polynuclear aromatic hydrocarbons, 10 µg/1. If the concentrations of contaminants in the effluent rise above those in the above list,

~~AES Cedar Bay shall take corrective actions to return concentrations to acceptable levels. In monitoring the dewatering effluent for the above contaminants, AES Cedar Bay shall use the methods prescribed in Chapter 17-770.600(8)(b), F.A.C.~~

~~G. If any disagreement arises regarding this condition, the parties agree to submit the matter for an expedited hearing to the DOAH and shall request assignment of the Hearing Officer who has heard this case, if possible, pursuant to 403.5064, F.S. The informal dispute resolution process shall be used.~~

~~H. Nothing in this condition shall affect the eligibility of reimbursement for clean-up of any site under EDI program.~~

~~I. Reinjection or infiltration of groundwater meeting the petroleum contamination clean-up criteria into the same zone from which it was extracted pursuant to an of the approved remedial action plans shall be permitted and is hereby authorized by this condition. The proposed location of the recharge system shall be upgradient of the site and included in the plans for remedial action referenced in XXVIII.A. and B.~~

SS:cjb/1219-4.1

Via Telecopier

September 27, 1990

Mr. Hamilton S. Oven
Chief, Power Plant Siting Group
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Dear Buck:

AES Cedar Bay is continuing negotiations with the City of Jacksonville for the use of sewage treatment re-use water as the source of cooling water makeup. As an alternate, AES Cedar Bay is evaluating the use of Broward River water. In the event that we are unable to finalize the details surrounding the use of re-use water prior to design deadlines for the cooling water system, AES Cedar Bay will install a "worse case" design which will allow the use of either Broward River water or Jacksonville sewage treatment re-use water as the source of cooling tower makeup.

AES Cedar Bay proposes to make the following changes to the circulating water system in order to facilitate the use of Broward River water as the "worse case" cooling water system makeup source. The changes are required to handle the higher flow rates of makeup and blowdown associated with brackish water and to protect the equipment from the high potential of corrosion.

Black & Veatch has developed an option for an alternate circulating water makeup supply system for the AES Cedar Bay project. The option involves furnishing and installing a system to use Broward River water as makeup to the circulating water system instead of Seminole Kraft well water. The option includes:

1. Highly corrosion resistant materials for:

   Condenser -- (Titanium, AL-6XN, or "Sea-Cure" tubing with AL-6XN tube sheets; the current 304 stainless tubes are susceptible to chloride pitting corrosion)
   Cooling Tower
   Auxiliary Cooling Water Heat Exchangers
   Circulating Water Pumps
   Backwash Strainers
   Chemical Feed Equipment
   Associated piping and valves

2. Increased makeup water quantity because of the higher cooling tower blowdown. The makeup and blowdown piping and valve sizes would increase. The existing Seminole Kraft circulating water system (river water intake and discharge) would be used. The system would be sized for 10,000 gpm makeup and 8,000 gpm blowdown representing cycles of concentration in the tower of approximately 1.3.

AES/CedarBay Inc.
1001 North 19th Street • Arlington, Virginia 22209 • (703) 522-1315 • Telecopier – (703) 528-4510

Additional items may be required, including:

Impressed current cathodic protection system
Upgrade of materials for the condenser tube cleaning system
Coated circulating water pipe
Treatment system for cooling tower blowdown

The above includes all basic changes necessary to install a cooling system which is capable of using either reclaimed water or surface water. AES Cedar Bay further proposes to submit detailed information concerning operation of the plant cooling system during post-certification monitoring and review pursuant to the attached proposed amendment to Condition of Certification XXV. This requires DER approval to be obtained prior to beginning operation.

If DER concludes that additional information is necessary to evaluate construction of the cooling system as outlined above, AES Cedar Bay will make every effort to provide it in a timely fashion. We will continue to provide additional details concerning cooling system design as they become available.

Sincerely,

Steve Wolf/sc

Steve Wolf
Project Engineer

SW/sc

Attachment

cc: Betsy Hewitt, FDER -- Tal

bcc: Julie Blunden
Terry Cole, Esq., OHF&C
Dave Sundstrom, AES-KS
Jeff Swain
Kerry Varkonda

NOx EMISSIONS VERSUS LOAD
CIRCULATING FLUIDIZED BED BOILER

This discussion of the effect of boiler load on NOx emissions from CFB boilers is based:

1) Generally upon an understanding of CFB Boiler Technology, and
2) Specifically upon the experiences of the AES Thames Cogeneration Plant.

The author, Paul Stinson, was graduated Magna Cum Laude with a BSChE from Texas A&M University in 1979. He has extensive process engineering experience with refinery, chemical plant, coal liquefaction, and power boilers. He was involved with the design, erection, startup and operation of the AES Thames CFB Boilers, and most recently, served as the Control Room Superintendent, responsible for operations of the AES Thames boilers and electrical generating equipment.

NOx emissions from CFB Boilers are inherently low due to low combustion temperatures, on the order of 1500-1600°F, and due to staging of combustion air. NOx emissions from a particular CFB boiler, burning a particular fuel are affected by the temperature of the combustor, the level of excess air, and the concentration of unreacted lime in the circulating bed. Other variables are generally considered second order effects.

Combustion temperature, excess air, and free lime concentration are all factors that are affected by boiler load. As load is reduced, temperature decreases, excess air increases, and free lime concentration can be decreased dramatically. This latter effect is due to the reduced fuel firing, and hence, reduced need for sulfur removal, and is enhanced by the beneficial effect that higher excess air has upon the sulfur capture reaction.

In general, NOx emissions can be expected to increase somewhat as load is reduced. This is due to the effect of increased oxygen (less staging of combustion air) and the initially high level of free lime. As the excess free lime concentration drops over time, the NOx emissions tend to reduce somewhat. The drop in combustor temperature tends to mostly, but not completely, offset the effect of

excess air as load drops to about 50 percent. Load reductions below this level tend to produce a reduction in NOx emissions as temperatures are reduced still further.

The attached tables provide typical data from the AES Thames boilers. At full load, NOx emissions are generally 0.04-0.06 lbs/MBTU. At 50-60 percent load, the emissions peak at about 0.08-0.10 lbs/MBTU. Further load reductions tend to decrease emissions.

The AES Thames combustor temperature at full load ranges from 1480 to 1550°F. At 50-60 percent load, the temperature is about 100°F lower. At 30 percent load, the temperature is about 1350°F. The AES Shady Point facility reports that NOx emissions are affected very little, if at all, by load reductions. Their actual emission levels are the same as AES Thames.

CFB Boiler manufacturers have tended to be very conservative in setting guarantee levels for NOx emissions. Guarantee levels for units without DeNOx equipment have tended to remain at levels that have previously been approved by permitting agencies. The level of 0.29 lbs/MBTU permitted and guaranteed for the AES Cedar Bay facility is the same as for the AES Thames facility.

The author, therefore, expects no problem in meeting the permitted NOx emissions level with the AES Cedar Bay boilers, regardless of load level.

Date: December 8-9, 1990
Dispatch vs. Load

Boiler 1A

Time	Steam Load, %	NOx (lb/MBTU)	Stack Gas %O2	Comments
2000	103	0.04	3.0	
2100	103	0.03	2.9	
2200	103	0.04	2.8	
2300	70	0.06	8.2	
0000	54	0.03	8.6	Plant @ 50% Electrical Production (90 MW net)
0100	58	0.06	7.9	"
0200	59	0.07	7.9	"
0300	61	0.08	7.7	"
0400	60	0.08	7.9	"
0500	60	0.07	7.8	"
0600	60	0.07	7.7	"
0700	60	0.07	7.6	"
0800	60	0.05	7.7	"
0900	59	0.02	7.7	"
1000	61	0.04	7.3	"
1100	92	0.05	2.4	Ramp Up
1200	104	0.04	2.3	At Full Load

Date: December 14 - 15, 1990
Dispatch vs. NOx

Boiler SG1B

Tier	Steam Load, %	NOx (lb/MBTU)	Stack Gas %O2	Comments
2000	104	0.05	3.9	
2100	104	0.05	3.9	
2200	104	0.05	4.1	
2300	101	0.05	4.6	
0000	78	0.07	8.0	
0100	53	0.06	10.0	Hold for Dispatch
0200	53	0.05	9.4	Hold for Dispatch
0300	36	0.03	10.8	Start Shut Down
0400	4	0.00	12+	Down