AUSLEY & MCMULLEN
ATTORNEYS AND COUNSELORS AT LAW
227 SOUTH CALHOUN STREET
P.O. BOX 391 (ZIP 32302)
TALLAHASSEE, FLORIDA 32301
(850) 224-9115 FAX (850) 222-7560

June 30, 1998

HAND DELIVERED

Ms. Blanca S. Bayo, Director
Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Petition by Tampa Electric Company for Approval of Cost Recovery for a new Environmental Program, the Big Bend Units 1 and 2 Flue Gas Desulfurization System; FPSC Docket No. 980693-EI

Dear Ms. Bayo:

Enclosed for filing in the above docket, on behalf of Tampa Electric Company, are fifteen (15) copies of each of the following:

1. Prepared Direct Testimony and Exhibit (CRB-1) of Charles R. Black. 06852-98

2. Prepared Direct Testimony and Exhibit (TLH-1) of Thomas L. Hernandez. 06853-98

Please acknowledge receipt and filing of the above by stamping the duplicate copy of this letter and returning same to this writer.

Thank you for your assistance in connection with this matter.

Sincerely,

James D. Beasley

JDB/pp
Enclosures

cc: All Parties of Record (w/encls.)

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true copy of the foregoing testimony and exhibits filed on behalf of Tampa Electric Company has been furnished by hand delivery (*) or U. S. Mail on this 30th day of June 1998 to the following:

Ms. Grace A. Jaye*
Staff Counsel
Division of Legal Services
Florida Public Service Commission
2540 Shumard Oak Blvd.
Tallahassee, FL 32399-0850

Mr. John W. McWhirter, Jr.
McWhirter, Reeves, McGlothlin, Davidson, Rief & Bakas, P.A.
Post Office Box 3350
Tampa, Florida 33601

Mr. Joseph A. McGlothlin*
Ms. Vicki Gordon Kaufman
McWhirter, Reeves, McGlothlin, Davidson, Rief & Bakas, P.A.
117 South Gadsden Street
Tallahassee, FL 32301

ATTORNEY

ORIGINAL

TAMPA ELECTRIC

TAMPA ELECTRIC COMPANY

BEFORE THE

FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 980693-EI

TESTIMONY
AND EXHIBIT OF

CHARLES R. BLACK

TAMPA ELECTRIC COMPANY
DOCKET NO. 980693-EI
SUBMITTED FOR FILING 6/30/98

BEFORE THE PUBLIC SERVICE COMMISSION

PREPARED DIRECT TESTIMONY

OF

CHARLES R. BLACK

Q. Please state your name, address and occupation.

A. My name is Charles R. Black. My business address is 702 North Franklin Street, Tampa, Florida 33602. I am Vice President-Energy Supply for Tampa Electric Company

Q. Mr. Black, please furnish a brief outline of your educational background and business experience.

A. I graduated from the University of South Florida in August 1973 with a bachelor of science degree in Engineering, majoring in Chemical Engineering. I am a Registered Professional Engineer in the State of Florida. I began my career with Tampa Electric Company in September 1973 as a staff engineer in the Production Department. Between 1973 and 1989, I held various engineering and management positions in the Production Department, Power Plant Engineering Department, and the Budget Department. In

March of 1989, I joined our affiliated company, TECO Power Services as Director Engineering and Construction. In December of 1990, I was elected Vice President of Engineering and Construction. In December of 1991, I returned to Tampa Electric as Vice President of Project Management. In December 1996 I assumed my present role as Vice President-Energy Supply.

Q. Have you previously testified before this Commission?

A. Yes. I testified in support of the prudence of Polk Unit One in Docket No. 960409-EI.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to demonstrate that the cost estimates associated with the proposed flue gas desulfurization ("FGD") system, and the other project alternatives considered in the economic analysis described by Mr. Hernandez are reasonable. As discussed below, the proposed FGD system will enable Tampa Electric to comply with the SO_2 emission limitations set forth in Phase II of the Clean Air Act Amendments of 1990 ("CAAA").

Q. Have you prepared an exhibit in support of your testimony?

A. Yes I have. My Exhibit No. ____ (CRB-1) consisting of 6 documents, was prepared under my direction and supervision.

Q. Please explain the Phase I and Phase II environmental compliance requirements related to SO_2 emissions created by the CAAA.

A. The Acid Rain Program of the 1990 CAAA set as its primary goal the reduction of annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase program which establishes annual SO_2 tonnage emission limits for fossil fuel-fired power plants. Compliance with Phase I was required by January 1, 1995. Phase I placed initial emission limitations on certain units named in the CAAA.

Tampa Electric has complied with Phase I and this Commission has approved the company's cost of compliance for cost recovery as part of its environmental cost recovery ("ECRC") in docket No. 960688-EI. The purpose of this proceeding is to review the company's plan for compliance with Phase II.

Compliance with Phase II is required by January 1, 2000 and further reduces annual emissions from Phase I plants. Phase II also sets SO_2 emission limits for additional fossil fuel fired plants encompassing more than 2,000 units in all. As such, the program imposes SO_2 emissions limits on existing steam electric units serving generators with an output capacity of greater than 25 MW and all new utility units.

Q. For background purposes, please summarize how Phase I of the CAAA imposed limits on Tampa Electric.

A. Units of Tampa Electric's system affected by Phase I are Big Bend Units 1, 2 and 3. These units were granted a combined total of 80,085 SO_2 allowances. This number defines the maximum SO_2 emissions allowed under this program, without further mitigation measures, for these three units. Each allowance held allows for the discharge of one ton of SO_2 emissions. In addition, Tampa Electric Company voluntarily substituted Big Bend Unit 4 into the Phase I requirements of the CAAA program. As a designated Phase I Substitution Unit, Big Bend 4 was granted a total of 6,400 additional annual allowances during Phase I. This measure provided Tampa Electric with a total of 86,485

Phase I allowances.

Q. How do the Phase II compliance requirements impact Tampa Electric?

A. All current and future Tampa Electric units, except Phillips and existing combustion turbines, are affected by Phase II compliance requirements. In Phase II, Tampa Electric will be allocated 83,882 allowances, thereby reducing the amount of allowances available to the company while increasing the number of units affected. This effectively reduces the amount of SO_2 emissions allowed without further mitigation measures.

Q. How do the limitations in Phase II compare to those in Phase I?

A. As shown in my Document 1, approximately twice the amount of Tampa Electric's generating capacity is covered by Phase II than by Phase I, yet we will receive approximately 2,600 fewer allowances.

Q. Can you briefly describe Tampa Electric's Phase I compliance strategy?

A. Tampa Electric began its CAAA compliance plan in 1990 and sought relevant input from across many areas of the company. In 1994 the SO_2 compliance plan evaluation of Phase I was completed. That plan was to blend fuel with low sulfur coal and purchase SO_2 allowances to meet the CAAA limits. Following the implementation of that plan Tampa Electric engineers, working with EPRI, DOE and others, determined that it would be possible to treat all of the flue gas from Big Bend Unit 3 in the existing FGD system that was currently treating the flue gas from Big Bend Unit 4. This was accomplished in 1995 at a very low cost. This modification, in conjunction with fuel blending and allowance purchases, provided a much lower compliance cost for Phase I than fuel blending and allowance purchases alone.

Q. Has Tampa Electric's Phase I compliance effort been successful to date?

A. Implementation of our plan has been very successful. We have been able to achieve compliance with the CAAA Phase I with high unit availability, efficiency, and reliability. Treating the flue gas from a second unit has allowed us to be flexible in our fuel utilization as well.

Q. How did Tampa Electric determine the options for complying with Phase II of the CAAA?

A. We began this process by compiling a list of viable compliance options for initial screening studies. Options that were not viable were eliminated. These remaining options went through both quantitative and qualitative analysis to screen the options. This process is described in Mr. Hernandez's testimony. These options were compared to the best "non-build" option of fuel blending and allowance purchases at all of Tampa Electric's coal units.

Q. How were the capital and operating costs developed for use in the economic studies for the screening analysis as described in Mr. Hernandez's testimony?

A. The screening process began with an evaluation of adding an FGD system to Gannon Station Units 4,5, and 6. Tampa Electric Company retained an architect engineering firm with considerable expertise with FGD systems to develop a cost estimate for installing one of two different technology FGD systems at that location. Tampa Electric engineers, with experience in design and operation of FGD systems, reviewed these costs and found them to be reasonable. As the screening process continued we looked

at FGD options at Big Bend Station, including a new stand alone FGD system for Big Bend 1&2 or treating the flue gas from Big Bend 2 in the existing FGD system for Big Bend Units 3&4. The costs for these options were determined by Tampa Electric's engineers using the Gannon FGD study cost as the basis for the Big Bend 1&2 stand alone option. The Big Bend 3 FGD integration was used as the basis for the Big Bend 2 integration feasibility assessment. These capital and operating costs estimates were utilized in the economic evaluations.

Q. How did Tampa Electric forecast the fuel and SO_2 allowance prices utilized in the economic studies?

A. Tampa Electric monitors the prices of all fuels and SO_2 allowances on a regular basis. The prices are tracked through numerous periodicals, actual buying experience, and through market information obtained through supply representatives. A forecast of expected fuel prices is developed annually to support the company's planning process. The forecast used in this analysis is the same forecast utilized in the Tampa Electric 1998 Ten Year Site Plan. The development of the forecast includes a review of historical fuel prices compared with new projections obtained from various consultants and agencies including

Energy Information Administration, American Gas Association, Cambridge Energy Research Associates, Resource Data International, and Energy Ventures Analysis. Fuel Pricing publications include: Coal Outlook, Coal Daily, Natural Gas Week, Platt's Oilgram, Oil and Gas Journal, and Pace Petroleum Coke Quarterly.

Q. How did these forecasts impact the base case and FGD case analysis?

A. The base case achieves compliance by switching from high sulfur and medium sulfur coals to low sulfur coals in conjunction with allowance purchases. As we reviewed the forecasts from consultants for high sulfur and low sulfur coal, we determined that our forecast for low sulfur coal was less expensive than the consultant's estimates, and that our forecast for high sulfur coal was more expensive than the consultant's. These comparisons are shown in my Documents 2, Pages 1 and 2. Consequently, the consultants forecasts would favor the FGD option more than the forecasts we used in our cost recovery studies.

Q. The screening process described in Mr. Hernandez's testimony indicated that the Big Bend 1&2 FGD addition was our best Phase II compliance choice. How did Tampa

Electric proceed to ensure their estimates were reasonable?

A. To ensure Tampa Electric's estimated cost of the Big Bend 1&2 FGD system was reasonable, we hired a second experienced architect engineering firm to provide us with a more refined cost estimate of this system. This firm developed a design basis for the FGD system with Tampa Electric's engineers. It then developed a conceptual design with site layouts, arrangement drawings, equipment lists, electric load lists, piping lists and materials of construction. This firm also received vendor quotes for the major equipment and utilized published data or its internal cost databases to come up with an accurate estimate of the cost. This more refined estimate supported the previous costs utilized in the screening analysis. Based upon these two cost studies, which were reviewed by Tampa Electric's engineering personnel experienced in FGD technology, we found the FGD cost estimates to be reasonable. These revised costs were then utilized in the cost effectiveness analyses described in Mr. Hernandez's testimony.

Q. Please describe the proposed FGD system and explain how it operates.

A. An overview of the FGD system is shown in my Document 3. An FGD System, or "scrubber", consists of equipment capable of removing sulfur dioxide from the flue gas generated by the combustion of coal. The flue gas is directed to an absorber tower where it is treated with a slurry spray of limestone and water. The SO_2 in the flue gas is absorbed by the slurry to form an acid which is then neutralized by the dissolved limestone. The reaction of the SO_2 and limestone produces calcium sulfite which is then oxidized by the introduction of air into the reaction tank. The product of this forced oxidation is gypsum which then precipitates out of solution. The resulting gypsum slurry is then dewatered to produce a near dry gypsum cake which is sold as a raw material, predominately to wallboard producers.

Q. What are the estimated capital costs of the new FGD sytem?

A. It is estimated to cost approximately $90 million (including AFUDC). This estimate is based on the conceptual design and the detailed cost estimate performed by an outside consulting firm described previously in my testimony. Tampa Electric added costs that were not included in the detailed estimate and adjusted some of the costs based upon our past large project experience. The

adjusted costs include owner's costs and contingency. My Document 4 sets forth a detailed breakdown of the components of the total capital cost.

Q. What are the estimated annual O & M expenses of the Big Bend 1 and 2 FGD system?

A. Tampa Electric has thirteen years of experience operating the FGD system on Big Bend Units 3 and 4 which is very similar to the technology proposed for the new FGD system. The operations and maintenance requirements for the new FGD system were developed by comparing new equipment requirements to the existing equipment requirements. Cost information gathered from actual operations was obtained for each system area and used to estimate the O&M cost for the new equipment. These present day costs were then escalated to year 2000 dollars.

The annual O & M expense for the FGD system is estimated to be approximately $3.5 million. My Document 5 sets forth a detailed breakdown of the estimated O & M expense for this project. The $3.5 million estimate is stated in year 2000 dollars. Reagent costs were based on limestone costs of $2.1 million and dibasic acid costs of $0.27 million. The remainder amounts to about $1.17 million and consists

of plant O & M. We have assumed that all O&M costs will escalate at a rate of 3% per year.

Q. What assumptions did you make regarding the efficiency and availability of the FGD for Big Bend Units 1 and 2?

A. The FGD case assumes that Big Bend Units 1 and 2 would burn high sulfur coal with treatment at 95% efficiency with a 98% FGD availability. This option results in all coal units at Big Bend Station being fitted with an FGD system. Because Tampa Electric is restricted to a system SO_2 cap, the flue gas treatment of Big Bend Station allows Gannon units to burn a lower cost fuel and still meet the system SO_2 cap. Consequently, fuel savings are realized at both Gannon and Big Bend Stations. In addition, by blending higher sulfur coal at Gannon, those units are able to regain some of the operational derations associated with burning low sulfur coal.

Q. What is Tampa Electric's compliance plan implementation schedule for this project?

A. Tampa Electric will proceed on a very aggressive schedule to place the FGD system in service in June of the year 2000. We are, however, attempting to achieve an even

earlier in service date by continuing to expedite all facets of environmental permitting, engineering and construction. During the short time between the compliance date and the in service date of the new FGD system we will comply with the more stringent CAAA requirements through fuel blending and allowance purchases.

With respect to the permitting schedule, Tampa Electric plans to submit required environmental permit applications in mid-1998. Based on communications with the Department of Environmental Protection, Tampa Electric anticipates the release to initiate construction to be received in September 1998. As shown in my document 6, all project environmental permits should be obtained by December 1999.

Q. Please summarize your testimony.

A. Tampa Electric has a legal obligation to comply with the CAAA. Phase II of the CAAA requires that Tampa Electric reduce its emissions of SO_2 by approximately 50% by January 1, 2000. Tampa Electric has determined the capital and O&M costs of the viable options. These costs were developed with the assistance of professional engineering firms with specific expertise in the design and construction of FGD

systems. Tampa Electric staff have reviewed the cost estimates developed and have determined that these cost estimates are reasonable. The selection of an FGD system for Big Bend Units 1 and 2 will allow Tampa Electric to meet the requirement of the CAAA while maintaining its system capability and availability.

Q. Does this conclude your testimony?

A. Yes

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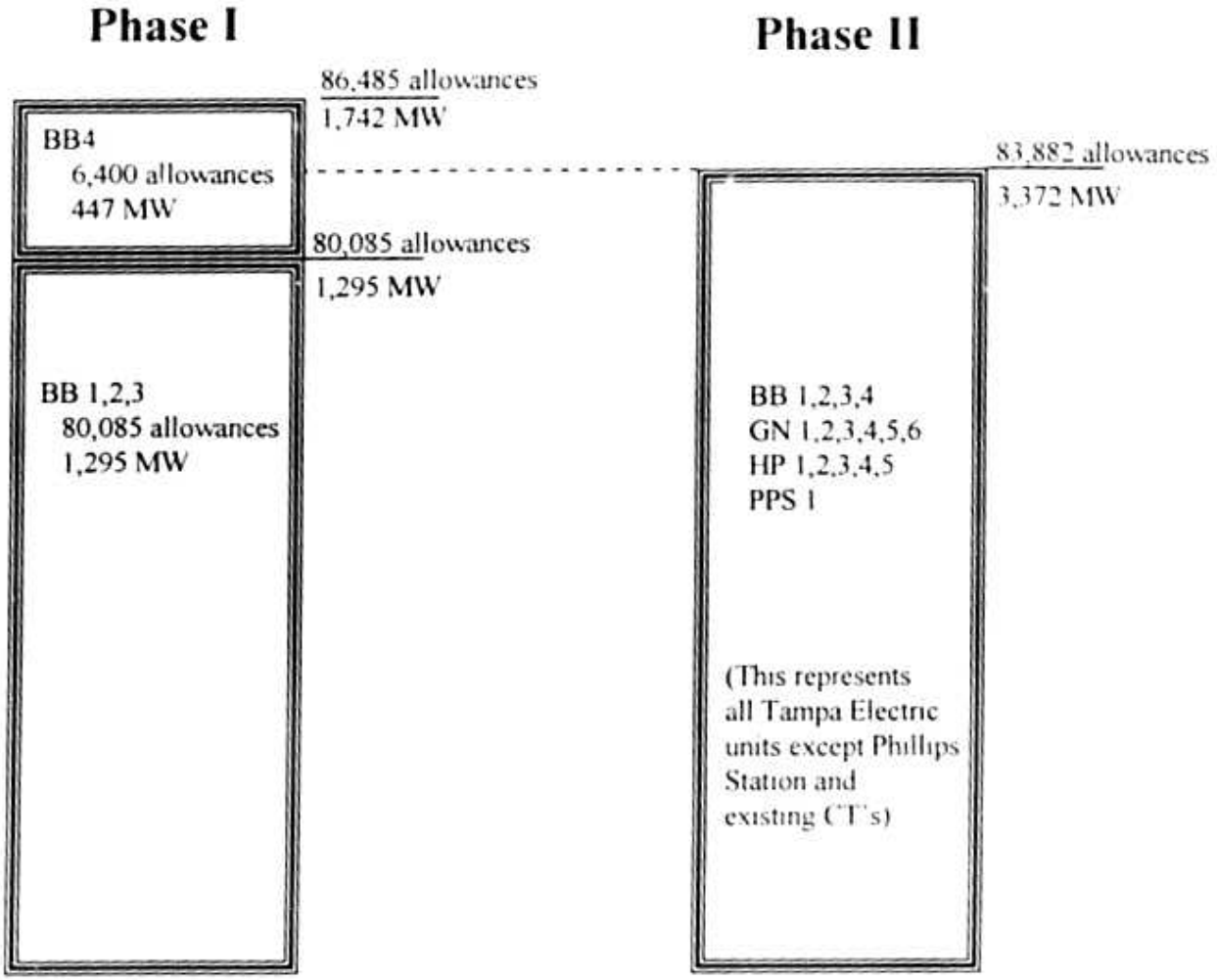
WITNESS: BLACK
EXHIBIT NO._____(CRB-1)

TAMPA ELECTRIC COMPANY

INDEX

TECO
TAMPA ELECTRIC

CAAA SO_2 COMPLIANCE



1

TAMPA ELECTRIC COMPANY
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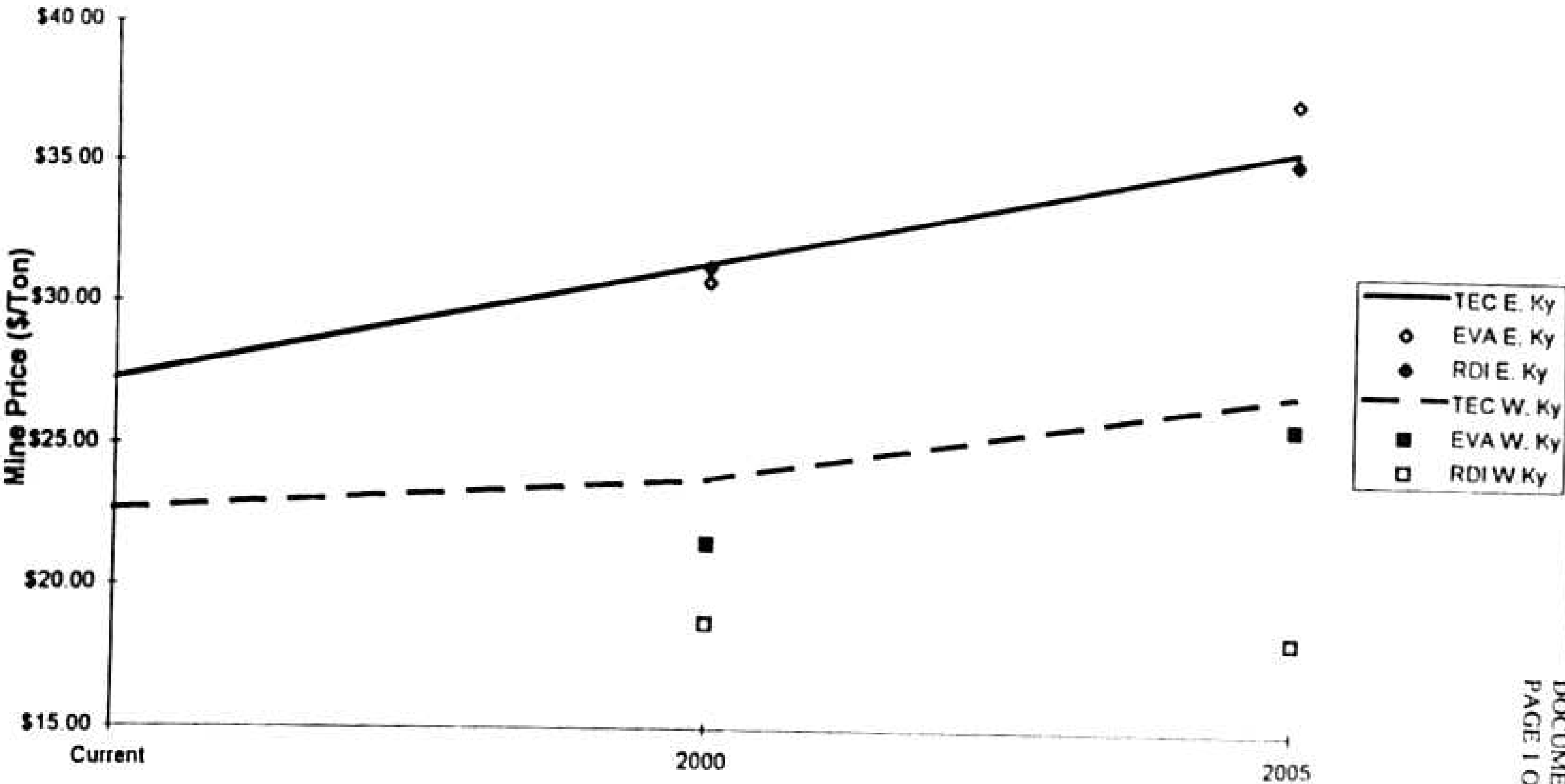
WITNESS: BLACK
EXHIBIT NO. ____ (CRB-1)
DOCUMENT NO. 1
PAGE 1 OF 1

FIGURE 3-3

FORECAST COMPARISON
EAST KENTUCKY vs. WEST KENTUCKY



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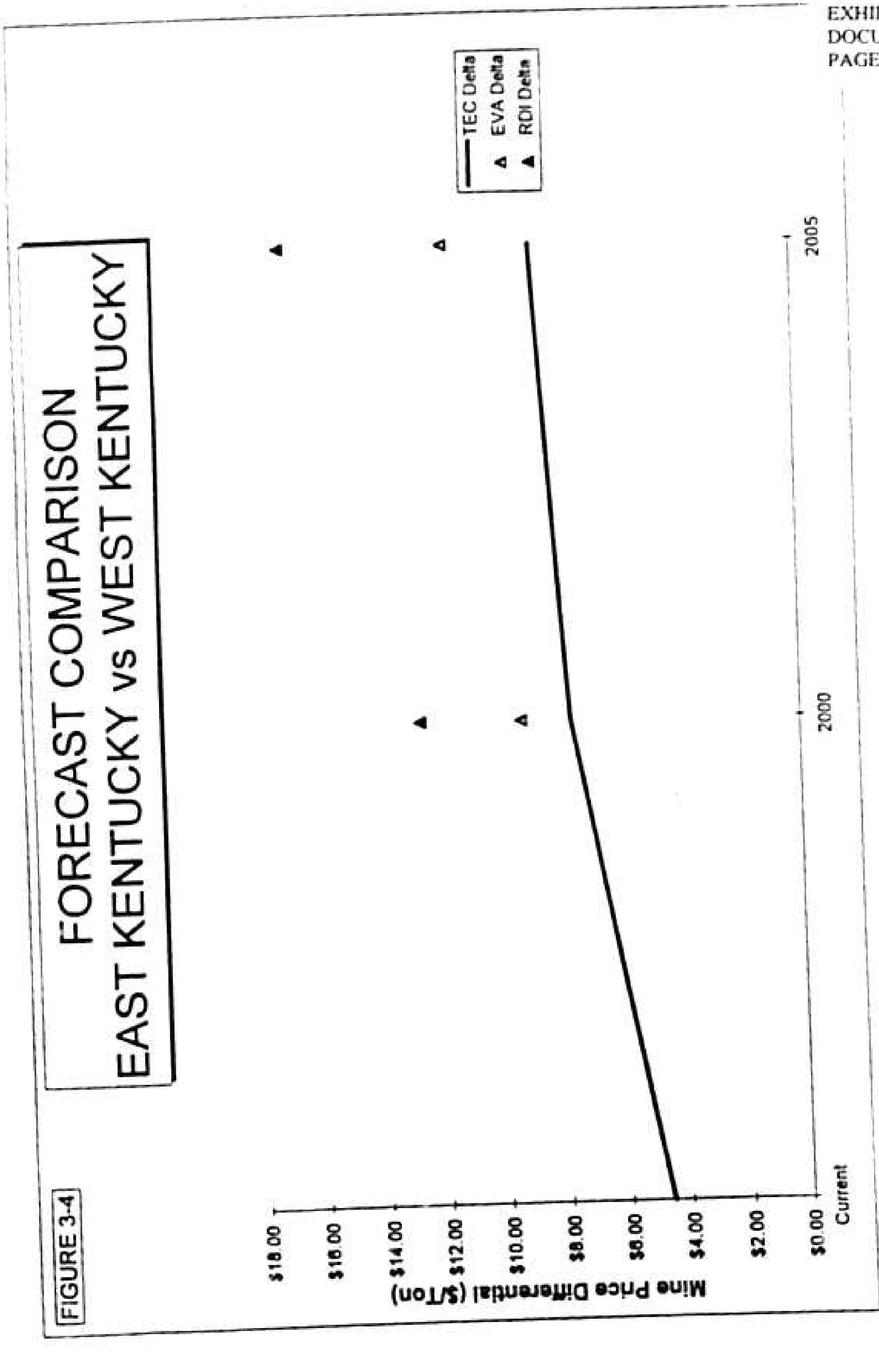
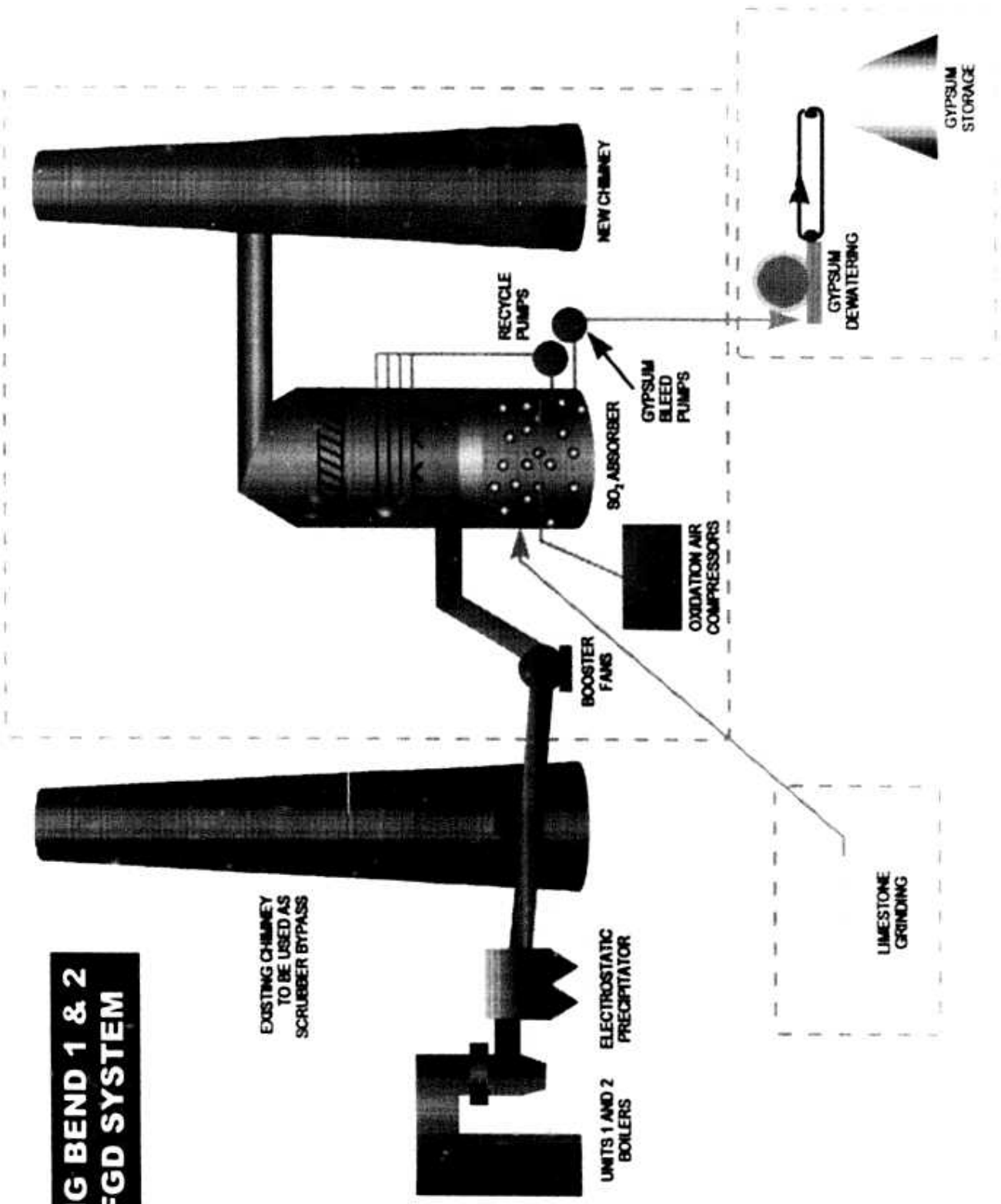



BIG BEND 1 & 2
FGD SYSTEM
EXISTING CHIMNEY
TO BE USED AS
SCRUBBER BYPASS
NEW CHIMNEY
UNITS 1 AND 2
BOILERS
ELECTROSTATIC
PRECIPITATOR
BOOSTER
FANS
RECYCLE
PUMPS
SO_2 ABSORBER
GYPSUM
BLEED
PUMPS
OXIDATION AIR
COMPRESSORS
GYPSUM
DEWATERING
GYPSUM
STORAGE
LIMESTONE
GRINDING

BIG BEND UNITS 1 & 2 FGD PROJECT

DETAILED A/E ENGR. EST

Site Development	$	117,000
Earthwork & Piling		2,169,100
Structural Concrete		8,153,500
Structural Steel		2,699,100
Mechanical Process Equipment		9,032,700
FGD System		25,477,320
Ash Handling System		614,100
Piping		1,371,700
Insulation		179,600
Instrumentation		2,007,800
Electrical		4,766,300
Painting		113,500
Building Architectural		190,500
Craft Indirects-Dewatering		257,500
SUBTOTAL A/E EST.		57,149,720

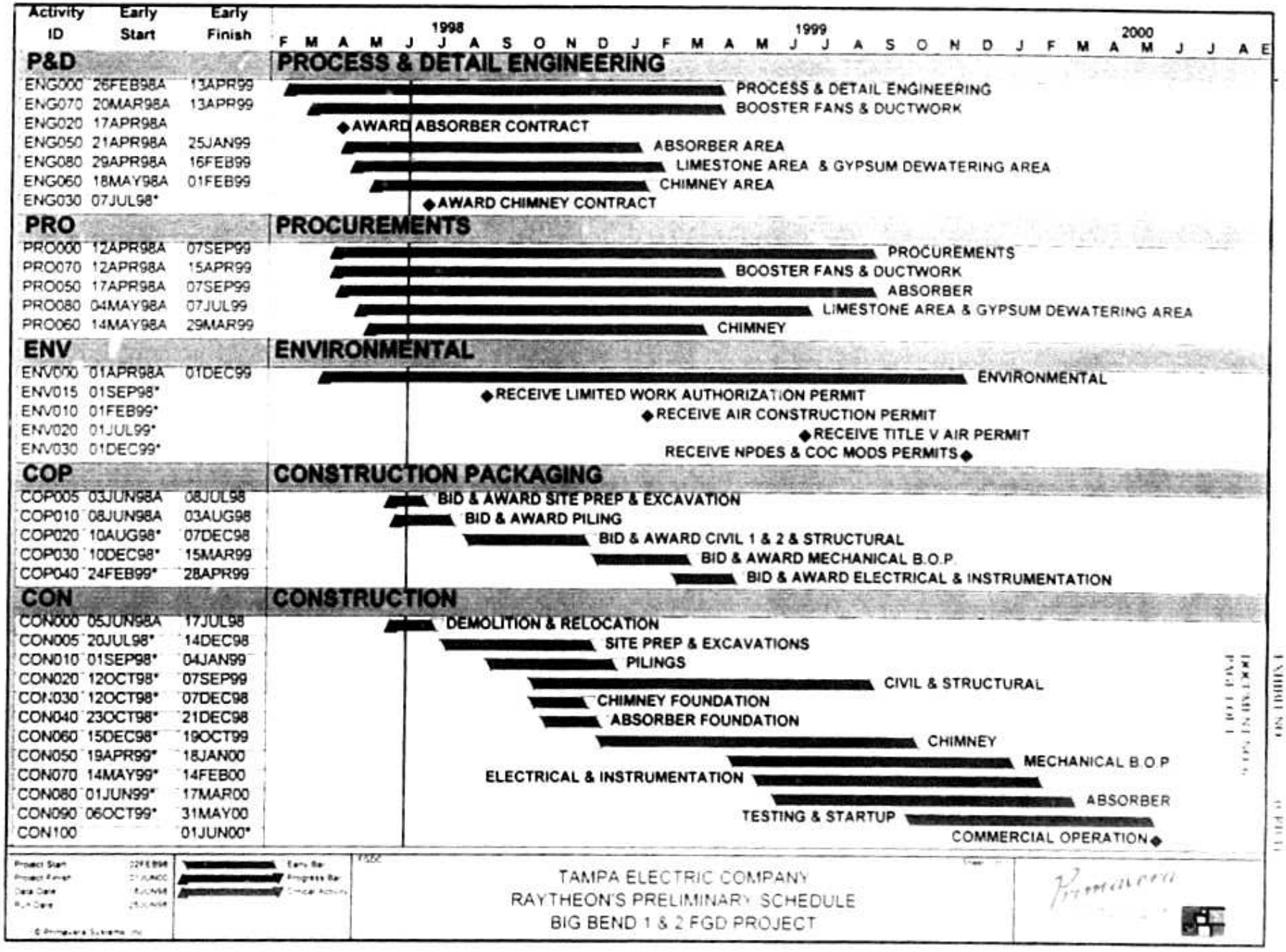
TECO Provided Cost Information

Construction Management		2,708,216
Professional Engineering Services		5,212,152
Owner Controlled Costs		7,299,863
Contingency		2,465,049
Added 2nd Vacuum Filter		1,000,000
County Water Supply		1,000,000
Waste Water System		5,000,000
TOTAL PROJECT W/O AFUDC		81,835,000
AFUDC		7,245,954
TOTAL PROJECT EST.	$	89,080,954

BIG BEND STATION UNITS 1 & 2 FGD SYSTEM

ESTIMATED ANNUAL O&M COSTS

LIMESTONE SYSTEM	$	125,114
ABSORBER SYSTEM		309,339
WASTE HANDLING SYSTEM		93,996
FGD SUPPORT/CONTROLS		7,935
STAFFING (OPERATIONS)		315,346
WATER COSTS		212,180
WASTE WATER TREATMENT		106,090
SUBTOTAL PLANT O&M		1,170,000
LIMESTONE COSTS		2,064,775
DIBASIC ACID COSTS		265,225
SUBTOTAL REAGENTS		2,330,000
TOTAL ANNUAL O&M EXPENSE (YEAR 2000)	$	3,500,000


Activity ID
Early Start
Early Finish
1998
1999
2000
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P&D
PROCESS & DETAIL ENGINEERING
ENG000 26FEB98A 13APR99
PROCESS & DETAIL ENGINEERING
ENG070 20MAR98A 13APR99
BOOSTER FANS & DUCTWORK
ENG020 17APR98A
AWARD ABSORBER CONTRACT
ENG050 21APR98A 25JAN99
ABSORBER AREA
ENG080 29APR98A 16FEB99
LIMESTONE AREA & GYPSUM DEWATERING AREA
ENG060 18MAY98A 01FEB99
CHIMNEY AREA
ENG030 07JUL98*
AWARD CHIMNEY CONTRACT
PRO
PROCUREMENTS
PRO000 12APR98A 07SEP99
PROCUREMENTS
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ABSORBER
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RECEIVE AIR CONSTRUCTION PERMIT
ENV020 01JUL99*
RECEIVE TITLE V AIR PERMIT
ENV030 01DEC99*
RECEIVE NPDES & COC MODS PERMITS
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COP005 03JUN98A 08JUL98
BID & AWARD SITE PREP & EXCAVATION
COP010 08JUN98A 03AUG98
BID & AWARD PILING
COP020 10AUG98* 07DEC98
BID & AWARD CIVIL 1 & 2 & STRUCTURAL
COP030 10DEC98* 15MAR99
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BID & AWARD ELECTRICAL & INSTRUMENTATION
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CONSTRUCTION
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CON070 14MAY99* 14FEB00
ELECTRICAL & INSTRUMENTATION
CON080 01JUN99* 17MAR00
ABSORBER
CON090 06OCT99* 31MAY00
TESTING & STARTUP
CON100 01JUN00*
COMMERCIAL OPERATION
Project Start 02FEB98
Project Finish 01JUN00
Data Date 15JUN98
Run Date 25JUN98
Early Bar
Progress Bar
Critical Activity
TAMPA ELECTRIC COMPANY
RAYTHEON'S PRELIMINARY SCHEDULE
BIG BEND 1 & 2 FGD PROJECT