UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

RECEIVED

NOV 16 1993

Division of Air
Resources Management

4APT-AEB

NOV 10 1993

Mr. Clair H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of Environmental
Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

RE: United States Sugar Corporation, Clewiston, Hendry County, Florida, (PSD-FL-208)

Dear Mr. Fancy:

This is to acknowledge receipt of an application for a Prevention of Significant Deterioration (PSD) permit for the above referenced facility by your letter dated September 22, 1993. The major modification proposed consists of the addition of a new bagasse/fuel oil fired spreader stoker/vibrating grate boiler. As discussed between Mr. Cleve Holladay of your staff and Mr. Stan Kukier of my staff on October 20, 1993, we have reviewed the application as submitted and have the following significant comments:

1. Based on recent Florida BACT determinations for two sugar mill cogeneration facilities, Okeelanta Power Limited Partnership (PSD-FL-196) and Osceola Power Limited Partnership (PSD-FL-197), the applicant should evaluate the feasibility of add-on selective non-catalytic reduction (SNCR) control technology. SNCR add-on controls and significantly lower NO_x emission rate limits, 0.15 lb/mm Btu (Okeelanta) and 0.12 lb/mm Btu (Osceola), have recently been determined BACT for biomass/fossil fuel fired boiler combustion NO_x emissions at both facilities. The applicant's BACT analysis should also include the use of low-sulfur No. 2 fuel oil as a No. 7 boiler SO_2 emission control alternative. Additional information, including a technical and economic evaluation regarding the feasibility of low-sulfur No. 2 fuel oil, should be provided by the applicant. Use of low-sulfur No. 2 fuel oil, as well as a significantly lower SO_2 emission rate limit of 0.05 lb/mm Btu, have also recently been determined BACT for fuel oil boiler combustion SO_2 emissions at both Okeelanta and Osceola facilities. A significantly lower biomass combustion SO_2 emission rate limit of 0.10 lb/mm Btu has also been determined BACT for several boilers at these facilities.

2. A technical and economic analysis regarding the feasibility of electrostatic precipitator (ESP) boiler particulate and beryllium emission controls should also be included in the applicant's BACT analysis. Although the applicant considered ESP control technology to be infeasible for bagasse fuel combustion applications, ESPs with a significantly lower particulate emission rate limit of 0.03 lb/mm Btu have also recently been determined BACT for several new biomass/fossil fuel fired boilers at both Okeelanta and Osceola sugar mills. ESPs at both facilities have a design capture efficiency in excess of 98%. Beryllium is also condensed and captured by ESPs at Okeelanta and Osceola facilities.

3. Fugitive emission calculations should also be provided by United States Sugar Corporation. All bagasse and ash handling fugitive particulate emission sources including truck hauling/loading/unloading, conveyor, transfer, and storage operations, as well as proposed control methods, should be identified. Tables summarizing maximum annual potential fugitive particulate emissions (TPY) should include uncontrolled emission factors and estimated control efficiencies. The basis of the calculations, as well as any assumptions and references, should also be included.

The proposed No. 7 boiler will be subject to the requirements of 40 CFR Part 60, Subpart Db - Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units.

Thank you for the opportunity to review and comment on this application. If you have any questions, please contact Mr. Stan Kukier of my staff at (404) 347-5014.

Sincerely yours,

Alfreda J. Freeman / for

Jewell A. Harper, Chief
Air Enforcement Branch
Air, Pesticides, and Toxics
Management Division

cc: J. Heron
C. Holladay
D. Knowles, SF Dist.
J. Bunyak, NPS
CHF/PL/JB

Florida Department of
Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

October 15, 1993

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Murray T. Brinson
Vice President, Sugar Processing
U.S. Sugar Corporation
P.O. Drawer 1207
Clewiston, Florida 33440

Dear Mr. Murray:

RE: U.S. Sugar Corporation, Clewiston Mill
Boiler No. 7 - AC 26-238006 & PSD-FL-208

The Department has received your application for a permit to construct the referenced Boiler No. 7 facility in Hendry County, Florida. The additional information shown below will be needed before the review of this application can continue:

1. Is this facility generating any electricity? If so, how much (MW)? Is any part of this electricity being sold to the power grid? Please explain.

2. Expand the BACT analysis to include the use of other air pollution control systems for this type of facility. The most recent permit issued by the Department for this type of facility has set a particulate matter (PM/PM_{10}) limit of 0.03 lb/MMBtu when burning biomass (bagasse & wood chips), using an electrostatic precipitator as the control technology. In addition, the nitrogen oxides (NO_x) emission level has been set at 0.06 lb/MMBtu with the use of selective non-catalytic reduction (SNCR) technology. BACT for the sulfur dioxide (SO_2) standard has been set at 0.10 lb/MMBtu (24 hr-average) and at 0.02 lb/MMBtu (annual average) with the burning of No. 2 fuel oil with a maximum of 0.05% sulfur content. The carbon monoxide (CO) BACT emission standard has been set at 0.35 lb/MMBtu (8-hr average). Volatile Organic Compounds (VOC) emissions have been set at 0.06 lb/MMBtu. See attached copy.

3. Estimate the potential emissions (with controls) for Boiler No. 7 for all pollutants, criteria and non-criteria.

4. List the net emission increases or decreases (net contemporaneous change analysis) for each pollutant. This table should include emissions calculated using at least the last two years of actual emissions for each boiler (that is going to be shut down) and the potential emissions (with controls) of the proposed boiler No. 7. If changes in the net increases or decreases of these pollutants lead to additional modeling requirements, please perform the required modeling.

5. Page 8-5 of the application (proposed permit conditions) lists the use of residual oil with a sulfur content of 2.5%. Several applications currently being processed by the Bureau are proposing 0.05% sulfur in No. 2 fuel oil. What is the lowest percent sulfur in No. 2 and No. 6 fuel oil available in your area and what is the cost/MMBtu for each?

6. Estimate the PM/PM_{10} emissions from the fugitive dust sources as a result of this project. There is little information on specific equipment, drawing showing equipment layout, or fugitive dust controls for the amount of bagasse that will be handled at this plant. Please provide drawings of all storage and material handling equipment with notations of how fugitive PM/PM_{10} emissions from hauling the materials to the plant and the disposing of any waste be controlled.

7. How will the heat input by the various fuels be monitored? What parameters of the fuels will be monitored and at what frequency? What test methods will be used? Where will the samples be collected on each fuel used at the proposed facilities? How will this data be used to show compliance with the various SO_2 standards?

8. The PSD report did not include increment-consuming SO_2 emissions from FPL Martin sources in the SO_2 PSD Class I modeling analysis. These sources represent 3,840 lbs/hr of SO_2 emissions. The source inventory in Table 6-4 of the report contained these sources; however, they were not included in the modeling input. The predicted maximum SO_2 PSD Class I impacts in this report were significantly less than the maximum impacts predicted in the Class I analyses submitted with the two most recent applications in the Palm Beach-Hendry County area. Please redo your SO_2 Class I analysis with FPL Martin's emissions included in the modeling input.

9. According to section 6.6.2 of the PSD report, potential receptors in the modeling grid which were located on inaccessible U.S. Sugar Corporation property were not included in the modeling input. What measures does U.S. Sugar take to preclude public access to this portion of its property?

10. Even though the impacts of the project are below the allowable PSD Class I increments, an air quality related values analysis (AQRV) should be done for the Class I Everglades National Park. This analysis must be done for all pollutants emitted by the project in PSD-significant amounts. The AQRV analysis evaluates the potential effects of the project on vegetation, wildlife, aquatic resources and visibility. The analysis must be performed even if the project's impact is less than the National Park Service's recommended significance levels for Class I areas. Depending upon the project's maximum predicted impacts, the analysis may, however, require at the simplest level only a literature review or at the most complex level a deposition analysis using the MESOPUFF long-range transport model in addition to the literature review.

If you have any questions regarding this matter, please write to me or call Teresa Heron, review engineer, or Cleve Holladay, meteorologist, at (904) 488-1344. We will resume processing these applications after receipt of the requested information.

Sincerely,

John Brown

John C. Brown, Jr., P.E.
Administrator
Air Permitting and Standards

JH/TH/bjb

Enclosure: BACT AND RACT Determination for Okeelanta Power L.P.

cc: P. Kroll, PE
D. Knowles, SD
J. Harper, EPA
J. Bunyak, NPS

Is your RETURN ADDRESS completed on the reverse side?

SENDER:
- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:
Mr. Murray T. Brinson
Vice President, Sugar Processing
U.S. Sugar Corporation
P. O. Drawer 1207
Clewiston, FL 33440

4a. Article Number
P 872 562 572

4b. Service Type
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

5. Signature (Addressee)

6. Signature (Agent) J. G. Holligan

8. Addressee's Address (Only if requested and fee is paid)

PS Form **3811**, December 1991 ★U.S. GPO: 1992—323-402 **DOMESTIC RETURN RECEIPT**

Thank you for using Return Receipt Service.

P 872 562 572

Receipt for Certified Mail

No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

UNITED STATES POSTAL SERVICE

Sent to Mr. Murray T. Brinson, U.S. Sugar Corp.	
Street and No. PO Drawer 1207	
P.O., State and ZIP Code Clewiston, FL 33440	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date Mailed: 10-15-93 Permit: AC26-238006 PSD-FL-208	

PS Form **3800**, JUNE 1991

Florida Department of
Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

September 22, 1993

Ms. Jewell A. Harper, Chief
Air Enforcement Branch
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30308

Dear Ms. Harper:

RE: United States Sugar Corporation
Clewiston Mill/Boiler No. 7
Hendry County, PSD-FL-208

The Department has received the above referenced PSD application package. Please review this package and forward your comments to the Department's Bureau of Air Regulation by October 13, 1993. The Bureau's FAX number is (904)922-6979.

If you have any questions, please contact Teresa Heron or Cleve Holladay at (904)488-1344 or write to me at the above address.

Sincerely,

Patricia G. Adams

for C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/pa

Enclosures

Florida Department of
Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

September 22, 1993

Mr. John Bunyak, Chief
Policy, Planning and Permit Review Branch
National Park Service-Air Quality Division
P. O. Box 25287
Denver, CO 80225

Dear Mr. Bunyak:

RE: United States Sugar Corporation
Clewiston Mill/Boiler No. 7
Hendry County, PSD-FL-208

The Department has received the above referenced PSD application package. Please review this package and forward your comments to the Department's Bureau of Air Regulation by October 13, 1993. The Bureau's FAX number is (904)922-6979.

If you have any questions, please contact Teresa Heron or Cleve Holladay at (904)488-1344 or write to me at the above address.

Sincerely,

Patricia G. Adams
for C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/pa

Enclosures

UNITED STATES SUGAR CORPORATION

Post Office Drawer 1207 Clewiston, Florida 33440
Telephone: (813) 983-8121

September 16, 1993

RECEIVED

SEP 17 1993

Division of Air
Resources Management

Mr. C. H. Fancy, P. E.
Chief
Bureau of Air Regulation
Florida Department of Environmental
Protection
2600 Blairstone Road
Tallahassee, Fl. 32399-2400

RE: HENDRY COUNTY - AP
USSC Clewiston

Dear Mr. Fancy:

Enclosed are four copies of our Construction Permit Application for the construction of an additional bagasse/oil boiler for our Clewiston sugar mill - Bagasse Boiler No. 7. The application was prepared by ICF Kaiser Engineers, Inc., and is patterned after the permits issued to our Clewiston Boiler No. 4 (AC 26-80930 and AC 26-144701, as revised). We also enclose a check for $7,500.00 for the application fee.

RECEIVED
MAIL ROOM
1993 SEP 17 AM 10:55

We would appreciate having the opportunity to meet with you and the members of your staff who will be reviewing the application and writing the permit so that we can facilitate the review of the application. As per our conversation with your Mr. Willard Hanks, please let us know when it will be suitable to have a conference with you in Tallahassee.

We are particularly interested in doing whatever we can to facilitate and expedite the review of this application because we need to have this boiler completed by September 1995 so that it will be available for the 1995-96 crop season. We look forward to working with you and ask you to let us know how we can assist you most effectively in reviewing this application.

Sincerely,

UNITED STATES SUGAR CORPORATION

Murray D. Brinson

M. T. Brinson
Vice President, Sugar Processing

MTB:jt
Enclosures

cc: Mr. David Knowles
Mr. Peter Briggs
Mr. Robert Van Voorhees
Mr. Peter Barquin
Mr. Peter Kroll
J. Heron
E. Holladay, EPA
J. Harper, EPA
J. Bunyak, NPS

VENDOR COPY

UNITED STATES SUGAR CORPORATION
CLEWISTON, FLORIDA 33440

INVOICE NUMBER		INVOICE AMOUNT	MEMO
1	APPLICATION FEE	$7,500.00	OTHER - OPERATIONS RELATED

RECEIVED
SEP 17 1993
Division of Air Resources Management

DATE	VOUCHER NUMBER	CHECK NUMBER	BANK NUMBER	GROSS AMOUNT	DISCOUNT AMOUNT	NET AMOUNT DUE
09/15/93	2105-09-93	055893	06	$7,500.00	$0.00	$7,500.00

UNITED STATES SUGAR CORPORATION
CLEWISTON, FLORIDA 33440

CHEMICAL BANK
90 Presidential Plaza
Syracuse, NY 13202
50-943/213

No. 06 055893

DATE	AMOUNT
09/15/93	$*****7,500.00

EXACTLY *****7,500 DOLLARS 00 CENTS

PAY TO THE ORDER OF
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ATT. CASHIER OFFICE
P. O. BOX 3070
TALLAHASSEE , FL 32315-3070

BY ________ AUTHORIZED SIGNATURE

BY ________ AUTHORIZED SIGNATURE

[redacted] [redacted] [redacted]

ATTACHMENT 6

CO Emission Limit Correspondence

For the proposed boiler No. 7, the most appropriate BACT precedent for VOC, CO and NO_x appears to be the permit for Clewiston boiler No. 4, which relies on the inherent design features of the bagasse boiler along with the appropriate operating procedures to ensure that emission will be maintained at the lowest possible level. That permit imposes no requirement for add-on control technology, and that is the approach recommended here for the U.S. Sugar Corporation Clewiston mill boiler No. 7.

5.5 BACT EVALUATION FOR SULFURIC ACID MIST EMISSIONS

Sulfuric acid mist is generated from the emissions of SO_3 when oil is combusted. Sulfur trioxide can further react with water present in the fluegas to form sulfuric acid mist. The control of acid gas emissions is primarily controlled by removing the precursor pollutants from the fluegas with either wet or semi-dry scrubbing processes. Sulfuric acid mist emissions will be therefore be controlled by reducing the amount of sulfur in the stack gases by the following methods discussed previously:

- Installation of a wet impingement scrubber for SO_2 emissions from bagasse combustion

- Use of low-sulfur fuel oil for SO_2 emissions from residual oil combustion

5.6 BACT EVALUATION FOR BERYLLIUM EMISSIONS

Beryllium emissions were estimated using EPA factors for fuel oil combustion and assuming no removal in the scrubbing system, as there are no published factors for beryllium removal efficiency in the scrubber. Beryllium emissions are primarily controlled by removing the gaseous or particulate metal from the fluegas with either wet or semi-dry scrubbing processes. Beryllium emissions will be therefore be controlled for this project by installation of a wet impingement scrubber for PM emissions from fuel oil combustion.

C-4

Florida Department of Environmental Regulation

South District • 2269 Bay Street • Fort Myers, Florida 33901-2896 • 813-332-2667

Bob Martinez, Governor

Dale Twachtmann, Secretary

John Shearer, Assistant Secretary
Philip Edwards, Deputy Assistant Secretary

October 26, 1989

Peter Barquin
U. S. Sugar Corporation
Post Office Drawer 1207
Clewiston, Florida 33440

Re: Hendry County - AP
U. S. Sugar Corporation
Boiler No. 4
AC26-126965 and AO26-144701

Dear Mr. Barquin:

As requested in your recent telephone conversation with David Knowles, we hereby clarify the intent of the specific conditions of the operating permit AO26-144701 for boiler No. 4.

The intent of specific condition No. 8 is that the flue gas pressure drop across the scrubber be measured and recorded once in each 8 hour shift. The pH of the scrubber water shall be measured and recorded once per day.

We request that you test the CO emissions from Boiler #4 using EPA Method 10 during the 1989-1990 crop season. The purpose of the this test is to help us determine a reasonable CO emission factor for boilers of this type. Please notify this office in advance of the date and time of each test.

If you have any questions please call David Knowles.

Sincerely,

Philip R. Edwards
Deputy Assistant Secretary

PRE/DMK/jsw

cc: Williard Hanks

ATTACHMENT 7

CO Emission Test Data

ATTACHMENT A

Application for Renewal of Permit to Operate
Boiler No. 4
U.S. Sugar Corporation - Clewiston Mill

In this application for renewal of the operating permit for Boiler No. 4, U.S. Sugar requests that Specific Conditions 5, 8, and 13 in the current operating permit be revised. The requested changes are summarized as follows:

Specific Condition 5 -	A revision is requested to provide that the limit on burning more than 6,300 gallons of fuel oil in any 3 hour period, which is intended as a limit on emissions, may be exceeded during startup, shutdown or malfunction in accordance with DER Rule 17-2.250, F.A.C.
Specific Condition 8 -	A revision is requested to incorporate the clarification provided by DER on October 26, 1989, with respect to the timing of measurements.
Specific Condition 13 -	U.S. Sugar has completed testing carbon monoxide (CO) emissions from Boiler No. 4 using EPA Method 10 and requests the establishment of a reasonable CO limit, as previously intended by DER. The proposed emission limit and the basis for the limit is provided.

Each of these items are discussed in the following paragraphs.

Specific Condition 5

This condition in the current permit requires that during any 3-hour period, not more than 6,300 gallons of fuel oil shall be burned in all stationary fuel oil burning equipment at the plant. This condition is included in the permit to limit SO_2 emissions. It is requested that this condition be revised to permit excess emissions resulting from startup, shutdown or malfunction, such as when power is lost at the mill. Startup conditions occur during the "grind-in" period (which usually occurs on one day approximately one week prior to the sugar mill startup), during startup of the sugar mill at the beginning of the crop season, and at other times when the mill has been shut down for an extended period (such as during the Christmas holidays). The purpose of the grind-in period is to test major equipment for proper operation. Plant emergencies are very rare, but when they do occur, bagasse feed to the boilers may be interrupted, and it may become necessary to switch to fuel oil.

Excess emissions during these limited and unusual periods are expressly allowed under DER Rule 17-2.250, F.A.C. The rule allows excess emissions from fossil fuel steam generators during such periods "provided that best operational practices to minimize emissions are adhered to and the duration of excess emissions" is minimized. It is readily apparent that this rule was intended to cover precisely the type of situation encountered by U.S. Sugar during startups and other emergencies. Indeed, the rule would apply by its own terms if Specific Condition 5 were expressed as an emission limit rather than a fuel burning limit. Accordingly, we request that Specific Condition 5 be revised to read as follows:

5. During any 3-hour period, not more than 6,300 gallons of fuel oil shall be burned in all stationary fuel oil burning equipment at the plant. Excess fuel oil burning resulting from startup, shutdown, or malfunction of any source shall be permitted provided that best operational practices to minimize emissions are adhered to and the duration of excess emissions shall be minimized. All permits to operate other oil burning equipment at this plant are revised to include this limitation.

Specific Condition 8

DER has clarified the intent of Specific Condition 8 of the current operating permit to required that the flue gas pressure drop across the scrubber be measured and recorded once in each 8-hour shift. Reference letter from Phillip R. Edwards, Deputy Assistant Secretary of DER, to Peter Barquin of U.S. Sugar Corporation, October 26, 1989 (copy enclosed). The letter states further that the pH of the scrubber water shall be measured and recorded once per day. We request that Specific Condition 8 of the permit be revised to reflect these modified requirements.

Specific Condition 13

Specific Condition 13 of the current permit limits CO emissions to 0.25 lb/MMBtu as determined by EPA Method 10. U.S. Sugar has addressed the concern with this condition in a letter addressed to DER dated October 8, 1990.

The concern with the condition is that the 0.25 lb/MMBtu limit was not based on Method 10 testing, but was based instead on EPA emission factors which have proven to be inappropriate as estimates of actual CO emissions from sugar processing mills. Subsequent testing at U.S. Sugar and other sugar mills has demonstrated that the 0.25 lb/MMBtu limit is much too low based on Method 10 testing, as acknowledged by the USEPA Region IV and the DER through correspondence in 1989.

Presented in the attached Table 1 are CO test results for the three mills known to have conducted Method 10 tests. A total of 20 individual test runs have been conducted on Boiler No. 4 at the U.S. Sugar mill in Clewiston. These were all conducted by Air Consulting and Engineering, Inc. Boiler No. 4 is a traveling grate boiler. The average CO emission rate for this boiler, as reflected in the test data, is 5.44 lb/MMBtu. The individual measurements range from 2.2 to 14.9 lb/MMBtu.

In order to determine an acceptable upper CO limit for compliance purposes, a statistical analysis of the test data was performed, using the average test results from each test date, consistent with the manner in which compliance tests are performed. The average test results are shown in Table 2. A frequency distribution for the data is presented in Figure 1. This plot shows that a CO emission level of 9.0 lb/MMBtu would have the probability of being exceeded only about 10 percent of the time. This probability of exceedance is acceptable to U.S. Sugar. Therefore, U.S. Sugar requests an allowable CO emission rate of 9.0 lb/MMBtu for Boiler No. 4.

Table 1. Summary of CO Emission Tests Performed on Bagasse Boilers in Florida Using EPA Method 10

Unit	Boiler Type	Date	Steam Rate (lb/hr)	Heat Input (MMBtu/hr)	Bagasse Firing Rate[a] (TPH wet)	CO Emissions lb/hr	CO Emissions lb/MMBtu	CO Emissions lb/ton,wet
U.S. Sugar Bryant								
Boiler 5	Vibrating Grate	02/16/89	256,928	577	80.14	2,586.9	4.48	32.28
Boiler 5	Vibrating Grate	02/17/89	249,228	561	77.92	2,658.0	4.74	34.11
Boiler 5	Vibrating Grate	02/17/89	249,480	562	78.06	1,693.3	3.01	21.69
						Max. =	4.74	34.11
						Avg. =	4.08	29.36
Osceola Farms								
Boiler 3	Fuel Cell	01/17/89	NA	NA	NA	NA	3.07	22.10
Boiler 3	Fuel Cell	12/05/89	NA	NA	NA	NA	0.81	5.83
Boiler 3	Fuel Cell	01/24/90	NA	NA	NA	NA	3.14	22.61
Boiler 6	Traveling Grate	01/16/89	NA	NA	NA	NA	5.42	39.02
Boiler 6	Traveling Grate	11/15/89	NA	NA	NA	NA	5.48	39.46
Boiler 6	Traveling Grate	02/02/90	NA	NA	NA	NA	5.93	42.70
						Max. =	5.93	42.70
						Avg. =	3.98	28.62
U.S. Sugar - Clewiston								
Boiler 4	Traveling Gate	02/20/90	308,636	691.7	96.07	1,940	2.80	20.19
Boiler 4	Traveling Gate	02/20/90	306,666	690.3	95.88	1,520	2.20	15.85
Boiler 4	Traveling Gate	02/20/90	310,298	698.8	97.06	2,240	3.20	23.08
Boiler 4	Traveling Gate	02/15/91	289,091	624.9	86.79	4,760	7.62	54.84
Boiler 4	Traveling Gate	02/15/91	291,200	629.5	87.43	2,710	4.30	31.00
Boiler 4	Traveling Gate	02/18/91	288,358	622.8	86.50	2,430	3.90	28.09
Boiler 4	Traveling Gate	02/18/91	285,224	616.4	85.61	2,640	4.28	30.84
Boiler 4	Traveling Gate	02/18/91	302,647	653.3	90.74	2,060	3.16	22.70
Boiler 4	Traveling Gate	02/19/91	290,769	627.9	87.21	4,430	7.05	50.80
Boiler 4	Traveling Gate	02/19/91	294,583	637.1	88.49	3,400	5.33	38.42
Boiler 4	Traveling Gate	02/19/91	293,382	633.5	87.99	2,480	3.92	28.19
Boiler 4	Traveling Gate	02/22/91	300,000	647.9	89.99	4,900	7.56	54.45
Boiler 4	Traveling Gate	02/22/91	293,382	634.2	88.08	9,450	14.90	107.28
Boiler 4	Traveling Gate	01/07/92	293,425	613.6	85.22	3,200	5.22	37.55
Boiler 4	Traveling Gate	01/07/92	282,800	591.3	82.13	6,270	10.60	76.35
Boiler 4	Traveling Gate	01/08/92	299,178	623.2	86.56	2,030	3.26	23.45
Boiler 4	Traveling Gate	01/08/92	297,973	621.5	86.32	3,160	5.09	36.61
Boiler 4	Traveling Gate	01/08/92	300,811	627.4	87.14	3,540	5.64	40.62
Boiler 4	Traveling Gate	01/09/92	302,055	630.0	87.50	2,770	4.40	31.66
Boiler 4	Traveling Gate	01/09/92	295,135	615.8	85.53	2,710	4.40	31.69
						Max. =	14.90	107.28
						Avg. =	5.44	39.18

Note: lb/hr = pounds per hour.
lb/MMBtu = pounds per million British thermal units.
lb/ton = pounds per ton.
MMBtu/hr = million British thermal units per hour.
NA = not available.
TPH = tons per hour.

[a] Calculated from reported heat input rate, assumed 3,600 Btu/lb average heat content for wet bagasse.

Table 2. Summary of CO Test Averages, U.S. Sugar Clewiston Boiler No. 4

Test Date	Number of Runs	Average CO Emissions (lb/MM Btu)
February 20, 1990	3	2.73
February 15, 1991	2	3.97
February 18, 1991	3	3.78
February 19, 1991	3	5.43
February 22, 1991	2	11.23
January 7, 1992	2	7.91
January 8, 1992	3	4.66
January 9, 1992	2	4.40

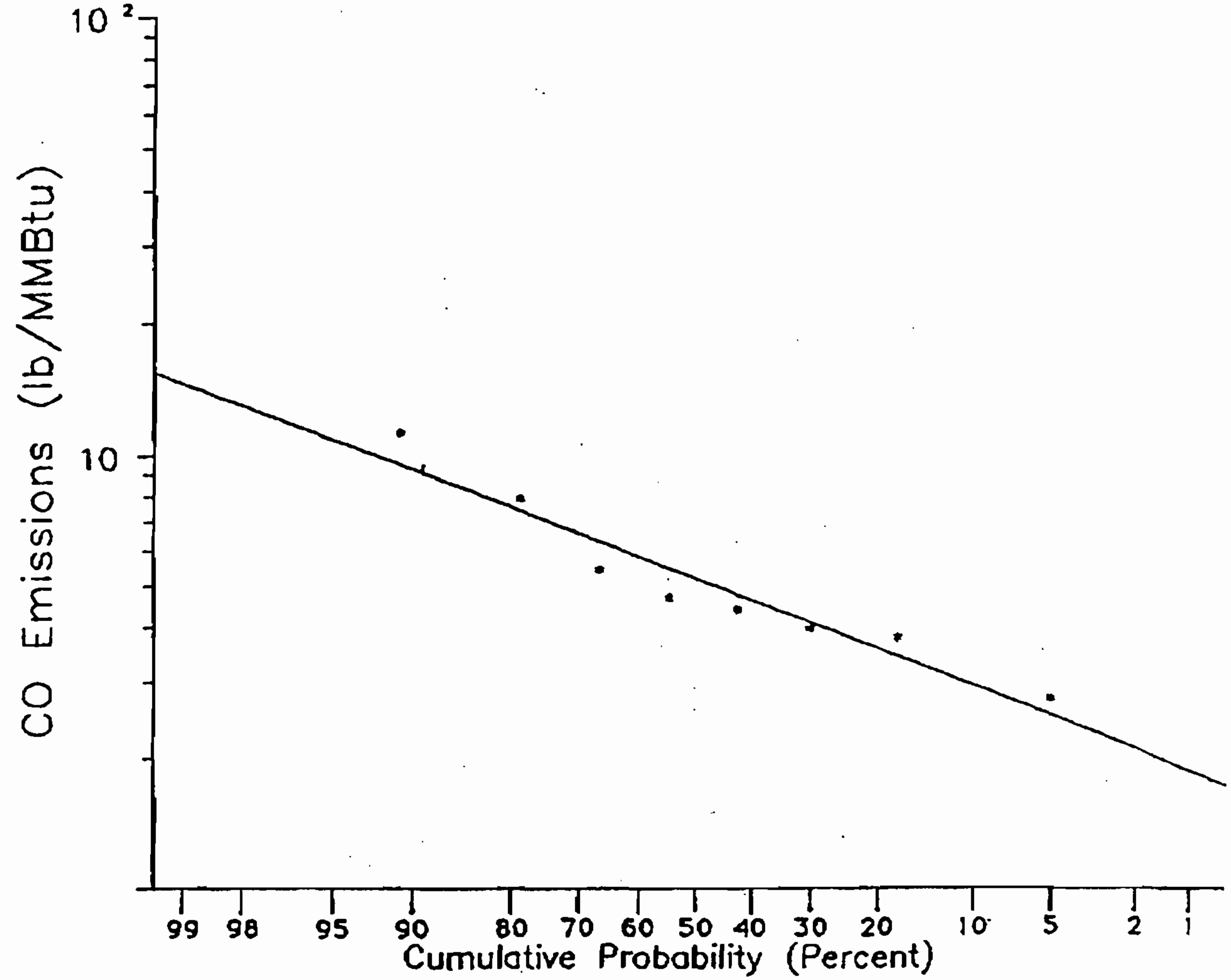


Figure 1 FREQUENCY DISTRIBUTION OF CO TEST DATA, CLEWISTON BOILER NO. 4

KBN

ATTACHMENT C

Application for Renewal of Permit to Operate

Boiler No. 4

U.S. Sugar Corporation - Clewiston Mill

Because the underlying assumptions about carbon monoxide emission rates have proven to be erroneous, we have not complied with Specific Condition 13 of the permit. The inappropriateness and inapplicability of this condition has been recognized and acknowledged by the Department in correspondence with U.S. Sugar. Reference the letter from Philip Edwards of DER to Peter Barquin of U.S. Sugar, dated October 26, 1989. Accordingly, U.S. Sugar has conducted testing pursuant to instructions from the Department to provide the basis for establishing reasonable CO emissions levels for this boiler. The results of that testing are included in Attachment A of this application, and U.S. Sugar is requesting a revision of Specific Condition 13.

In addition, it has not always been possible to complete testing in accordance with the dates specified in the specific conditions of this permit. On those occasions when testing would not be completed within the specified time period, U.S. Sugar has advised the Department of the specific date scheduled for testing and has obtained authorization to complete testing on the alternative date, allowing an opportunity for witnessing by the Department.

ATTACHMENT 8

VOC BACT Analysis

5.4 BACT EVALUATION FOR CO AND VOC EMISSIONS

In this section, the available control technologies capable of reducing CO and VOC emissions produced from firing bagasse and residual oil will be identified and evaluated. Potential application of these technologies as BACT for the proposed spreader-stoker boiler, rated on oil at 255 MM Btu/hr, is discussed. Table 5-8 is a summary of the potential CO and VOC control technologies presented in this section.

The EPA BACT/LAER clearinghouse has no BACT determinations for CO or VOC emission from bagasse combustors or residual oil combustion in boilers. Historically, BACT and LAER emission limits for CO and VOC on bagasse and oil-fired boilers have been based on the use of good combustion practices, rather than add-on control systems.

In bagasse-fired boilers, the fuel characteristics and the combustion practices result in CO and VOC emissions that are somewhat high, relative to fossil-fuel fired boilers. Improving combustion would likely require improving fuel quality (e.g., lowering bagasse moisture content through drying), which would make use of this waste fuel uneconomical and result in higher fossil fuel usage. The use of FGR could theoretically reduce CO and VOC emissions by reburning a portion of the VOCs in the recirculated exhaust. The overall effectiveness of fluegas recirculation would be limited because:

- The extremely high particulate loading of the combustion gas and the abrasive nature of the flyash would make this system very unreliable
- This has never been applied to a bagasse combustor
- This technology would not be economically feasible, per the analysis done for NO_x control

Post-combustion VOC controls have not been applied to bagasse-fired boilers. Such common techniques as direct-flame incineration, catalytic oxidation, and carbon absorption are also inappropriate technologies for bagasse boilers for the same reasons as above.

The only technically feasible CO and VOC control technology for bagasse-fired boilers is good combustion practices.

Because of their utility in reducing CO and VOC emissions, along with its success record in the sugar industry, **good combustion practices are proposed as BACT for emissions for the proposed boiler No. 7 when firing bagasse or oil.**

Table 5-8

Summary of Potential CO and VOC control Technologies[1]

Control Technology	Typical Effic. (% CO)	Typical Effic. (% VOC)	In Service On Bagasse Combustors?	In Service On Other Combustion Sources?	Technically Feasible For This Combustor?
Direct-flame Oxidation	90-99	90-99	No	Yes	No[2]
Catalytic Oxidation	90-95	90-95	No	Yes	No[3]
Fluegas Recirculation	30-50%	30-50%	No	No	Yes[4]
Good Combustion Practices	15-50	15-50	Yes	Yes	Yes

Notes:

[1] Source: Air Pollution Engineering Manual, AWMA, 1992.

[2] Abrasive Particulate loading to high in combustor.

[3] Same as above.

[4] See discussion under NO_x control.

For the proposed boiler No. 7, the most appropriate BACT precedent for VOC, CO and NO_x appears to be the permit for Clewiston boiler No. 4, which relies on the inherent design features of the bagasse boiler along with the appropriate operating procedures to ensure that emission will be maintained at the lowest possible level. That permit imposes no requirement for add-on control technology, and that is the approach recommended here for the U.S. Sugar Corporation Clewiston mill boiler No. 7.

5.5 BACT EVALUATION FOR SULFURIC ACID MIST EMISSIONS

Sulfuric acid mist is generated from the emissions of SO_3 when oil is combusted. Sulfur trioxide can further react with water present in the fluegas to form sulfuric acid mist. The control of acid gas emissions is primarily controlled by removing the precursor pollutants from the fluegas with either wet or semi-dry scrubbing processes. Sulfuric acid mist emissions will be therefore be controlled by reducing the amount of sulfur in the stack gases by the following methods discussed previously:

- Installation of a wet impingement scrubber for SO_2 emissions from bagasse combustion

- Use of low-sulfur fuel oil for SO_2 emissions from residual oil combustion

5.6 BACT EVALUATION FOR BERYLLIUM EMISSIONS

Beryllium emissions were estimated using EPA factors for fuel oil combustion and assuming no removal in the scrubbing system, as there are no published factors for beryllium removal efficiency in the scrubber. Beryllium emissions are primarily controlled by removing the gaseous or particulate metal from the fluegas with either wet or semi-dry scrubbing processes. Beryllium emissions will be therefore be controlled for this project by installation of a wet impingement scrubber for PM emissions from fuel oil combustion.

ATTACHMENT 9

Tables 2-3, 2-4, 2-5 and 2-6

Table 2-3
Clewiston Mill Potential Annual Emissions

FUEL OIL COMBUSTION

	Avg. MMBtu/hr	Day/yr	Mgal/yr	PM	SO2	NOx	CO	VOC
Boiler No.1	3.49	160	89.23	0.67	17.51	2.45	0.22	0.01
Boiler No.2	3.38	160	86.51	0.65	16.98	2.38	0.22	0.01
Boiler No.3	1.91	160	48.97	0.37	9.61	1.35	0.12	0.01
Boiler No.4	1.93	160	49.33	0.37	5.81	1.36	0.12	0.01
Boiler No.7 crop	2.01	160	51.54	0.39	2.02	1.42	0.13	0.01
Boiler No.7 off	255	69	2,810	21.08	110.29	77.28	7.03	0.39
Total TPY			3,136	23.5	162.2	86.2	7.8	0.4

BAGASSE COMBUSTION

	Avg. MMBtu/hr	Day/yr	Wet Feed TPY	PM	SO2	NOx	CO	VOC
Boiler No.1	415	160	199,054	199.1	49.8	119.4	7,166	199.1
Boiler No.2	402	160	192,982	193.0	48.2	115.8	6,947	193.0
Boiler No.3	220	160	105,569	126.7	26.4	63.3	3,800	105.6
Boiler No.4	603	160	289,384	173.6	192.2	346.9	10,418	246.0
Boiler No.7 crop	630	160	302,341	181.4	200.8	346.9	10,884	257.0
Boiler No.7 off	450	136	183,564	110.1	121.9	294.9	5,683	156.0
Total TPY			1,272,894	984	639	1,287	44,899	1,157

TOTAL COMBUSTION EMISSIONS

	Avg. MMBtu/hr	PM	SO2	NOx	CO	VOC
Boiler No.1	418	200	67	122	7,166	199
Boiler No.2	405	194	65	118	6,948	193
Boiler No.3	222	127	36	65	3,801	106
Boiler No.4	605	174	198	348	10,418	246
Boiler No.7	493	313	435	721	16,575	413
Total TPY		1,007	801	1,374	44,907	1,157

Table 2-4
Clewiston Mill Potential Emissions (24-hour case)

Fuel Oil Combustion

	MMBtu/hr Avg.		Mgal/yr	PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	103.5		0.69	10.4	270.8	38.0	3.45	0.19	72.000
Boiler No.2	94.5		0.63	9.5	247.3	34.7	3.15	0.18	65.739
Boiler No.3	57.0		0.38	5.7	149.2	20.9	1.90	0.11	41.044
Boiler No.4	0.0		0.00	0.0	0.0	0.0	0.00	0.00	0
Boiler No.7	0.0		0.00	0.0	0.0	0.0	0.00	0.00	0
Total lb/hr			**1.70**	**25.5**	**667.3**	**93.5**	**8.50**	**0.48**	**178,783**

Bagasse Combustion

	MMBtu/hr Avg.		Wet Feed Ton/yr	PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	341		42.6	85.2	21.3	51.1	3,067	85.2	163.000
Boiler No.2	354		44.2	88.5	22.1	53.1	3,185	88.5	169261
Boiler No.3	190		23.7	56.9	11.9	28.5	1,708	47.4	93.956
Boiler No.4	707		88.3	106.0	117.3	180.7	6,359	150.2	335,000
Boiler No.7	738		92.3	110.7	122.5	180.7	6,644	156.9	350.000
Total lb/hr			**291**	**447**	**295**	**494**	**20,964**	**528**	**1,111,217**

Total Hourly Emissions

	MMBtu/hr Avg.		PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	444		96	292	89	3,071	85	235.000
Boiler No.2	448		98	269	88	3,188	89	235.000
Boiler No.3	247		63	161	49	1,710	48	135.000
Boiler No.4	707		106	117	181	6,359	150	335.000
Boiler No.7	738		111	123	181	6,644	157	350.000
Total lb/hr			**473**	**962**	**588**	**20,973**	**529**	**1,290,000**

Table 2-5
Clewiston Mill Potential Emissions (3-hour case)

Fuel Oil Combustion

	MMBtu/hr Ave.		Mgal/yr	PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	122.3		0.82	12.2	320.0	44.8	4.08	0.23	85,078
Boiler No.2	120.0		0.80	12.0	314.0	44.0	4.00	0.22	83,478
Boiler No.3	72.8		0.49	7.3	190.5	26.7	2.43	0.14	52,421
Boiler No.4	0.0		0.00	0.0	0.0	0.0	0.00	0.00	0
Boiler No.7	0.0		0.00	0.0	0.0	0.0	0.00	0.00	0
Total lb/hr	**315.1**		**2.10**	**31.5**	**824.5**	**115.5**	**10.50**	**0.59**	**220,978**

Bagasse Combustion

	MMBtu/hr Ave.		Wet Feed Ton/yr	PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	313		39.2	78.4	19.6	47.0	2,821	78.4	149,922
Boiler No.2	317		39.6	79.2	19.8	47.5	2,851	79.2	151,521
Boiler No.3	167		20.9	50.0	10.4	25.0	1,501	41.7	82,579
Boiler No.4	707		88.3	106.0	117.3	192.4	6,359	150.2	335,000
Boiler No.7	738		92.3	110.7	122.5	192.4	6,644	156.9	350,000
Total lb/hr			**280**	**424**	**290**	**504**	**20,177**	**506**	**1,069,021**

Total Hourly Emissions:

	MMBtu/hr Ave.		PM	SO2	NOx	CO	VOC	Steam Lb/hr
Boiler No.1	436		91	340	92	2,825	79	235,000
Boiler No.2	437		91	334	92	2,855	79	235,000
Boiler No.3	240		57	201	52	1,504	42	135,000
Boiler No.4	707		106	117	192	6,359	150	335,000
Boiler No.7	738		111	123	192	6,644	157	350,000
Total lb/hr			**456**	**1,114**	**620**	**20,188**	**507**	**1,289,999**

Table 2-6
Clewiston Mill Air Toxics Emissions

POLLUTANT	Annual Emission TPY	24-hour Emission lb/hr	3-hour Emission lb/hr
Antimony	0.00519	0.00593	0.00732
Arsenic	0.00424	0.00485	0.00599
Barium	0.01495	0.01707	0.02109
Beryllium	0.00094	0.00107	0.00132
Bromine	0.00156	0.00178	0.00220
Cadmium	0.00351	0.00400	0.00495
Chromium	0.00469	0.00536	0.00662
Chromium (IV)	0.00094	0.00107	0.00066
Cobalt	0.02621	0.02993	0.03698
Copper	0.06254	0.07140	0.08823
Fluoride	0.00140	0.00160	0.03781
Formaldehyde	0.09046	0.10328	0.12762
Hydrogen Chloride	0.14222	0.16238	0.20065
Lead	0.00625	0.00714	0.00882
Manganese	0.00581	0.00663	0.00819
Mercury	0.00071	0.00082	0.00101
Molybdenum	0.01090	0.01245	0.01538
Nickel	0.28142	0.32130	0.39703
Phosphorus	0.01298	0.01482	0.01831
Selenium	0.00831	0.00948	0.01172
Tin	0.07371	0.08415	0.10399
Zinc	0.01495	0.01707	0.02109

ATTACHMENT 10

Revised Tables 3-3, H-1 and H-2

Table 3-3
PSD Source Applicability Analysis for Clewiston Boiler No. 7

Regulated Pollutant	Baseline[1] Emissions (TPY)	Boilers No. 1-4 and 7 Proposed Project Emissions (TPY)	Net Change (TPY)	Significant Emission Rate (TPY)	PSD Applies
Particulate (TSP)	750	1,007	257	25	Yes
Particulate (PM10)	750	1,007	257	15	Yes
Sulfur Dioxide	366	801	435	40	Yes
Nitrogen Oxides	709	1,374	665	40	Yes
Carbon Monoxide	28,425	44,907	16,482	100	Yes
VOC	837	1,157	320	40	Yes
Lead	0.00058	0.00683	0.00625	0.6	No
Mercury	0.00007	0.00078	0.00071	0.1	No
Beryllium	0.00009	0.00102	0.00093	0.0004	Yes
Fluorides	0.00013	0.00153	0.00140	3	No
Sulfuric Acid Mist	37	80	43	7	Yes
Total Reduced Sulfur	--	--	0	10	No
Asbestos	--	--	0	0.007	No
Vinyl Chloride	--	--	0	0	No

[1] See Attachment H for the derivation of baseline emissions.

TABLE H–1. ACTUAL EMISSIONS FOR BOILERS No. 5 AND 6, 1991–1992

	Activity Factor TPY Wet Feed	PM Emission Ton/yr	SO2 Emission Ton/yr	NOx Emission Ton/yr	CO Emission Ton/yr	VOC Emission Ton/yr
Boiler No.5	42,522	26.7	0.0	25.5	42.5	42.5
Boiler No.6	50,458	28.6	0.0	30.2	50.5	50.5
Total TPY	92,980	55.3	0.0	55.7	93.0	93.0

TABLE H-2. CLEWISTON MILL PSD BASELINE ANNUAL EMISSIONS (TON/YEAR)

FUEL OIL COMBUSTION

	Avg. MMBtu/hr	Day/yr	Mgal/yr	PM	SO2	NOx	CO	VOC
Boiler No.1	3.49	160	89.23	0.67	17.51	2.45	0.22	0.01
Boiler No.2	3.38	160	86.51	0.65	16.98	2.38	0.22	0.01
Boiler No.3	1.91	160	48.97	0.37	9.61	1.35	0.12	0.01
Boiler No.4	1.93	160	49.33	0.37	5.81	1.36	0.12	0.01
Total TPY			274	2.1	49.9	7.5	0.7	0.0

	Be	Fl	Pb	Hg
Boiler No.1	2.81E-05	4.20E-05	1.87E-04	2.14E-05
Boiler No.2	2.73E-05	4.07E-05	1.82E-04	2.08E-05
Boiler No.3	1.54E-05	2.30E-05	1.03E-04	1.18E-05
Boiler No.4	1.55E-05	2.32E-05	1.04E-04	1.18E-05
Total TPY	8.63E-05	1.29E-04	5.76E-04	6.58E-05

BAGASSE COMBUSTION

	Avg. MMBtu/hr	Day/yr	Wet Feed TPY	PM	SO2	NOx	CO	VOC
Boiler No.1	415	160	199,054	199.1	49.8	119.4	7,166	199.1
Boiler No.2	402	160	192,982	193.0	48.2	115.8	6,947	193.0
Boiler No.3	220	160	105,569	126.7	26.4	63.3	3,800	105.6
Boiler No.4	603	160	289,384	173.6	192.2	346.9	10,418	246.0
Boiler No.5	97	147	42,522	26.7	0.0	25.5	42.5	42.5
Boiler No.6	112	151	50,458	28.6	0.0	30.3	50.5	50.5
Total TPY			879,968	748	317	701	28,425	837

TOTAL COMBUSTION EMISSIONS

	Avg. MMBtu/hr		PM	SO2	NOx	CO	VOC
Boiler No.1	418		200	67	122	7,166	199
Boiler No.2	405		194	65	118	6,948	193
Boiler No.3	222		127	36	65	3,801	106
Boiler No.4	605		174	198	348	10,418	246
Boiler No.5	97		27	0	26	43	43
Boiler No.6	112		29	0	30	51	50
Total TPY			750	366	709	28,425	837

ATTACHMENT 11

Precautions to Minimize Dust Emissions

Reasonable Precautions Taken To Date At US Sugar Clewiston Mill To Minimize Dust Emissions From Bagasse

To minimize fugitive or unconfined emissions from bagasse handling in conveyors and storage systems, U.S. Sugar Corporation has taken the following reasonable precautions at its Clewiston mill:

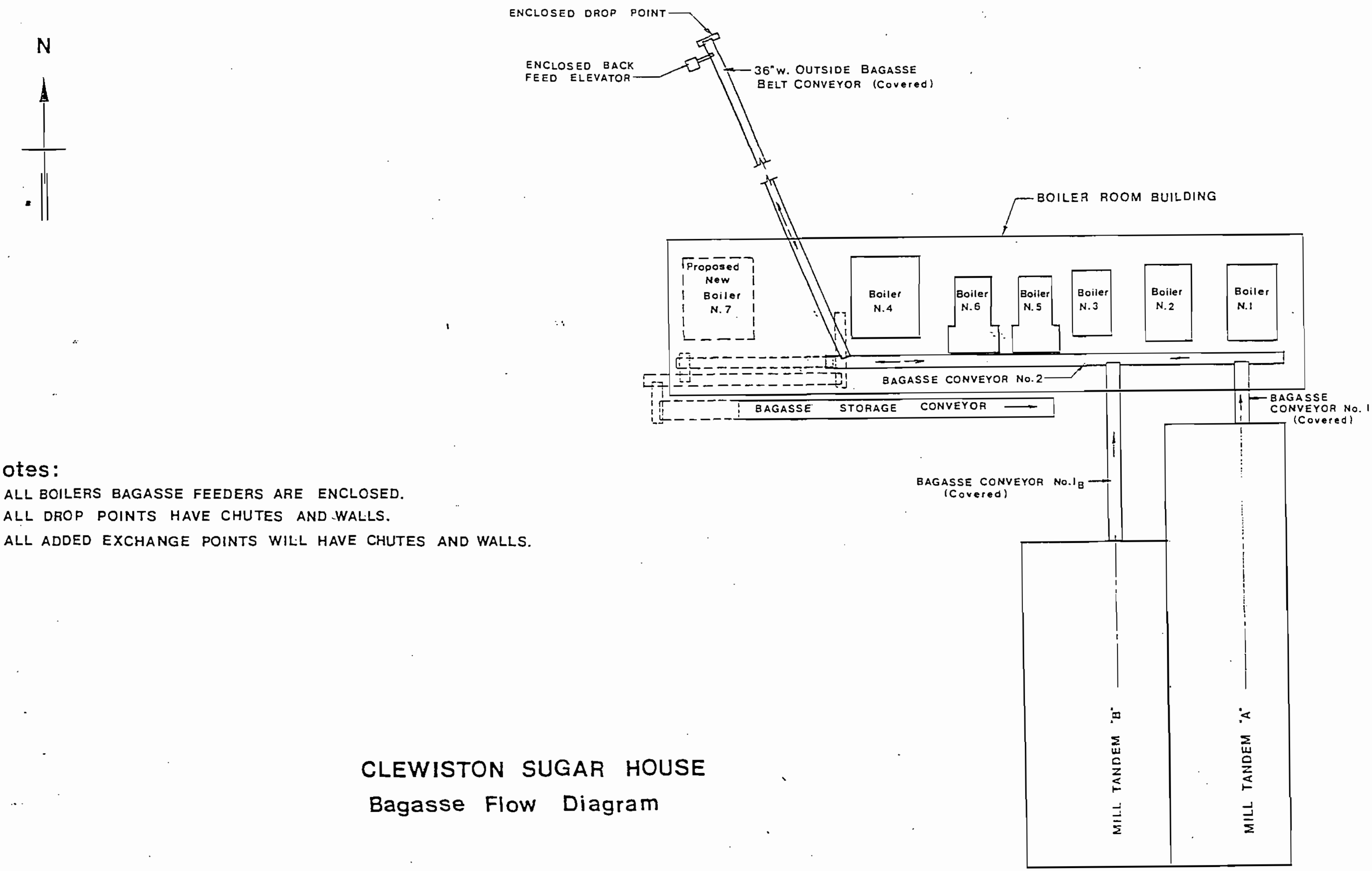
1. Belt Conveyors - Belt conveyors, or that portion of belt conveyors used for bagasse handling and located outside of mill buildings, are enclosed or properly covered with seals.

2. Drag Conveyors - Drag conveyors, or that portion of drag conveyors used for bagasse handing and located outside of mill buildings, are equipped with sideboards or other structures to enclose or cover the sides of the conveyor.

3. Transfer Points - All transfer points, or conveyor systems (belt or drag) used for bagasse handling and located outside of mill buildings, are enclosed or covered.

4. End of Conveyor - The drop point at the end of any bagasse handling conveyor system is designed and equipped with either: (1) Devices that will reduce the distance of free fall from the drop point (such as boot and chute arrangement with a canvas or similar material "split skirt"), or (2) A windbreaker system that will protect the drop point from wind.

5. Payloader Drop Point to Backfeed - The drop point for payloaders to backfeed the bagasse conveyor/elevator system is located inside an enclosure with walls and roof to provide a windbreak.

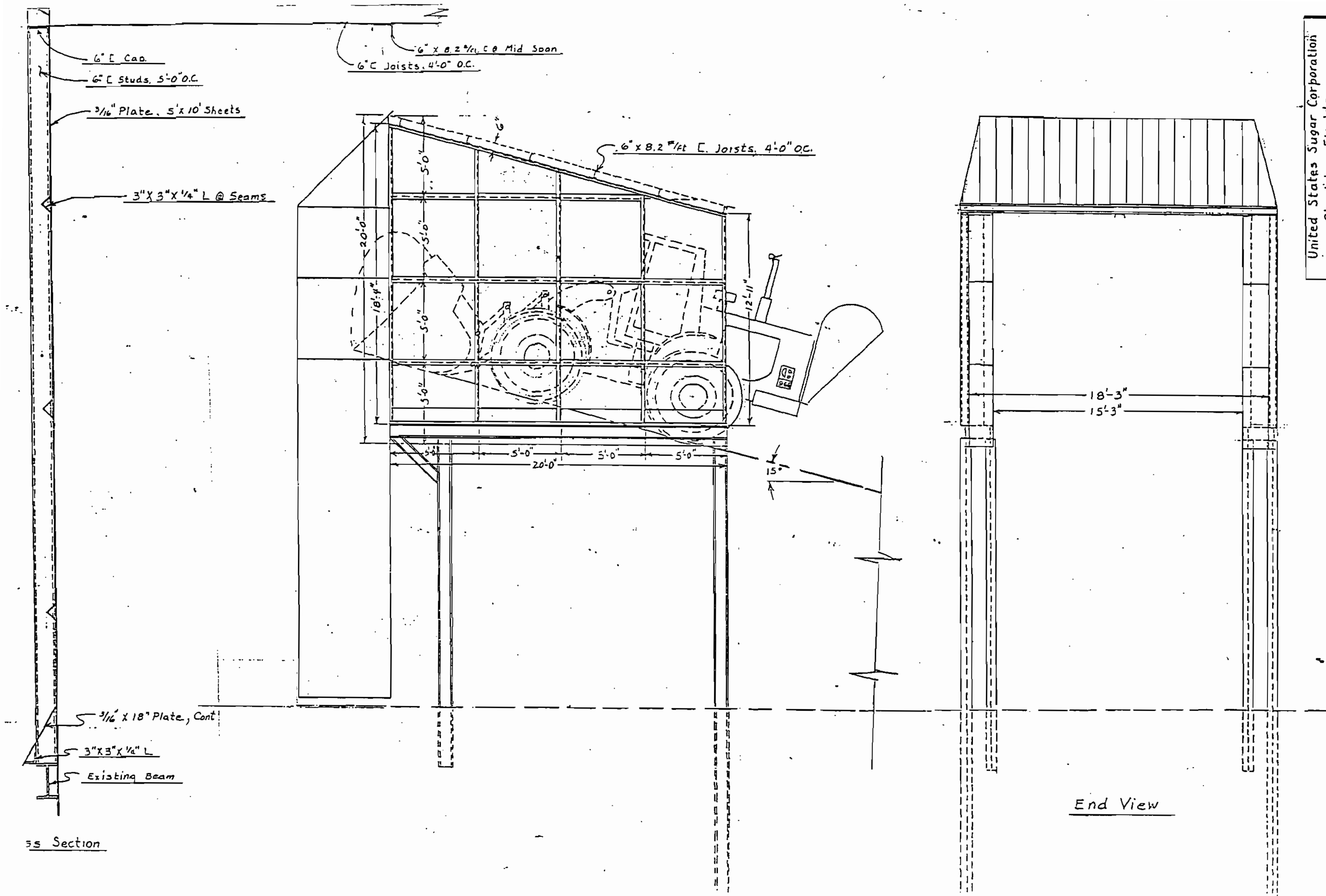


Notes:

1. ALL BOILERS BAGASSE FEEDERS ARE ENCLOSED.
2. ALL DROP POINTS HAVE CHUTES AND WALLS.
3. ALL ADDED EXCHANGE POINTS WILL HAVE CHUTES AND WALLS.

CLEWISTON SUGAR HOUSE

Bagasse Flow Diagram



United States Sugar Corporation
Clewiston, Florida

Hood For Bagasse Back Feed Conv.
Clewiston Sugar House

Dr. By: BJB,A.	Scale: 1/4"=1'-0"	Date: 1/20/86

Dr. No. CL-4-06-86188

ICF KAISER
ENVIRONMENT & ENERGY GROUP

ICF Kaiser Engineers, Inc.
Four Gateway Center
Pittsburgh, PA 15222-1207
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Bureau of
Air Regulation

December 22, 1993

Mr. John C. Brown, Jr., P.E.
Administrator, Air Permitting and Standards
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: US Sugar Corporation, Clewiston Mill
Boiler No. 7 - AC 26-238006 & PSD-FL-208

Dear Mr. Brown:

On behalf of the United States Sugar Corporation (US Sugar), we submit the following information and the enclosed materials in response to the Department's October 15, 1993, request for additional information relating to US Sugar's application for a construction permit for Boiler No. 7 at its Clewiston Mill.

We appreciate the opportunity that the Department provided for representatives of US Sugar to meet on Friday, December 10, with the members of your staff and others in the Department who will be involved in reviewing the permit application for this boiler. That meeting allowed us to gain a better understanding of the specific types of information that the Department needs and how we can work most effectively with your staff to facilitate an expeditious review of this application. We especially appreciate the willingness expressed by your staff to work with us in an effort to meet our timetable for the construction and start-up of this boiler.

As discussed at the meeting, we will be submitting our responses to the Department's requests for information in whatever order the responses are completed. As a first step, this letter provides our responses to the Department's requests for information Nos. 8, 9, and 10. This includes responses to all of the requests for information that relate primarily to the application's "air quality impact analysis" and the "additional impact analysis." These responses are being forwarded directly to Teresa Heron and Cleve Holladay for their initial review, because we were told that they have the most direct responsibility for those portions of the application.

Responses to the Department's remaining requests for information will be forwarded as completed. For convenience in reviewing these responses, the Department's requests for information are presented in *italics*, and US Sugar's responses are presented in normal typeface.

8. *The PSD report did not include increment-consuming SO_2 emissions from FPL Martin sources in the SO_2 PSD class I modeling analysis. These sources represent 3,840 lbs/hr of SO_2 emissions. The source inventory in Table 6-4 of the report contained these sources; however, they were not included in the modeling input. The predicted maximum SO_2 PSD Class I impacts in this report were significantly less than the maximum impacts predicted in the Class I analyses submitted with the two most recent applications in the Palm Beach-Henry County area. Please redo your SO_2 Class I analysis with FPL Martin's emissions included in the modeling input.*

Per your request, we redid the SO_2 Class I analysis with FPL Martin's emissions included in the modeling input. The inclusion of this source (which is more than 100 km from the Everglades) in the PSD Class I modeling analysis for SO_2 does not change the conclusion: in all cases, predicted impacts are below the allowable PSD Class I increments. The proposed facility with other increment-consuming sources will therefore meet the allowable PSD increments in the Class I area. The PSD Class I modeling results are presented in the enclosed revised Tables 6-13 through 6-15 in Attachment 1, along with a drawing of southern Florida (Attachment 2) which shows the following:

- Locations of sources and Class I area receptors used in the modeling;
- The ambient impact at each receptor;
- Identification of the receptor which experienced the highest-second-highest (HSH) impact for each of the five years of meteorological data; and
- The relative contribution of the sources with significant impacts

Note that the US Sugar boiler No. 7 does not contribute a meaningful amount (less than 1% of the total) to the Class I receptor HSH impacts for any of the five years of meteorological data. The relative contribution of boiler No. 7 for each year is as follows:

- 1985: 0.34%
- 1986: 0.76%
- 1987: 0.49%
- 1988: 0.00%
- 1989: 0.68%

There are some differences between the analysis performed in conjunction with this application and that performed in conjunction with the Okeelanta Power application. We used the most recent meteorological data which was available (from 1985-1989), whereas Okeelanta Power used data from the 1982-1986 period. In addition, our analysis for Clewiston boiler No. 7 used an inventory of sources different from that used by Okeelanta Power, due to the dissimilar significant impact areas and facility UTM coordinates.

9. *According to section 6.6.2 of the PSD report, potential receptors in the modeling grid which were located on inaccessible U.S. Sugar Corporation property were not included in the modeling input. What measures does U.S. Sugar take to preclude public access to this portion of its property?*

The referenced text from Section 6.6.2 was directed only to the modeling for the 8-hour CO emission impact. The potential receptors located on US Sugar property are in the rectangular area (highlighted in yellow and marked as ABCD) indicated on the drawing in Attachment 3 as being in the immediate vicinity of the Clewiston mill and bounded by the heavy black line. More specifically, the south, west, north and east boundaries of this area are approximately 300, 350, 400, and 1550 meters, respectively, from the proposed boiler No. 7 stack.

As shown on that attached drawing, US Sugar precludes public access to its Clewiston mill property through the use of cyclone fences, secured gates, and canals. The portion of the property line extending east from the northwest corner of the US Sugar property to the mill's main access point is protected by a six-foot-high cyclone fence. This portion of the property line is adjacent to the road that connects Harlem with Clewiston. The only two access points through this fence are protected by manned security gates. The remainder of the inaccessible property is surrounded by canals. Access points across the canals are protected by gates and a roving security patrol. Additional security is provided by the vast tracts of US Sugar land located south and east of the mill and a roving security patrol. Thus, US Sugar has taken adequate measures to preclude public access to the portion of its property on which the potential receptors are located on.

10. *Even though the impacts of the project are below the allowable PSD Class I increments, an air quality related values analysis (AQRV) should be done for the Class I Everglades National Park. This analysis must be done for all pollutants emitted by the project in PSD-significant amounts. The AQRV analysis evaluates the potential effects of the project on vegetation, wildlife, aquatic resources and visibility. The analysis must be performed even if the project's impact is less than the National Park Service's recommended significance levels for Class I areas. Depending upon the project's maximum predicted impacts, the analysis may, however, require at the simplest level only a literature review or at the most complex level a deposition analysis using the MESOPUFF long-range transport model in addition to the literature review.*

The Additional Impacts Analysis presented in Revision 0 of Section 7.0 on pages 7-1 through 7-6 applied to both the PSD Class I area (Everglades National Park) and the significant impact area. The literature review that we conducted for this section is roughly equivalent to what was provided by Okeelanta Power although that project's impact exceeded the allowable PSD Class I increment for SO_2, and the impact for boiler No. 7 did not exceed the allowable Class I increment (see Attachment 1 which shows the results of the revised PSD Class I increment analysis). We have, however, rewritten Section 7.0 to clarify the above points and present it (along with a revised Section 9.0) here as Attachment 4.

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We believe that the information provided in this response will satisfy your needs for additional information on these items. Please contact me at (412) 497-2024 or Bob Van Voorhees at (202) 508-6014 if you have any questions about the information provided in these responses. We look forward to working with you and your staff to assist in your review and approval of this permit application.

Very truly yours,

Peter J. Kroll

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ATTACHMENT 1

Revised Modeling Results

Table 6-13
Predicted Short-Term Crop Season Impacts
for the PSD Class I Increment Analysis

Pollutant	Averaging Time	Year	Predicted Impact ($\mu g/m^3$)	Allowable Increment ($\mu g/m^3$)
SO_2	3-Hour	1985	22.1	25
		1986	16.4	
		1987	14.8	
		1988	15.9	
		1989	16.0	
	24-Hour	1985	3.82	5
		1986	3.30	
		1987	2.61	
		1988	3.05	
		1989	3.13	
TSP/PM10[1]	24-Hour	1985	2.60	10/8
		1986	2.45	
		1987	1.89	
		1988	2.12	
		1989	2.09	

Note:

1 Reported TSP/PM10 impacts are the maximum predicted impacts. PM10 increments become effective June 1994.

Table 6-14
Predicted Short-Term Off-Season Impacts
for the PSD Class I Increment Analysis

Pollutant	Averaging Time	Year	Predicted Impact ($\mu g/m^3$)	Allowable Increment ($\mu g/m^3$)
SO_2	3-Hour	1985	19.2	25
		1986	18.5	
		1987	14.9	
		1988	16.3	
		1989	20.4	
	24-Hour	1985	3.76	5
		1986	3.39	
		1987	2.84	
		1988	3.58	
		1989	2.77	
TSP/PM10[1]	24-Hour	1985	2.88	10/8
		1986	3.44	
		1987	1.63	
		1988	1.69	
		1989	1.94	

Note:

1 Reported TSP/PM10 impacts are the maximum predicted impacts. PM10 increments become effective June 1994.

Table 6-15
Predicted Annual Impacts
for the PSD Class I Increment Analysis

Pollutant	Averaging Time	Year	Predicted Impact ($\mu g/m^3$)	Allowable Increment ($\mu g/m^3$)
SO_2	Annual	1985	0.373	2
		1986	0.389	
		1987	0.339	
		1988	0.384	
		1989	0.336	
TSP/PM10[1]	Annual	Maximum	0.0335	5/4
		HSH	0.0326	
		HTH	0.0309	
		H4H	0.0301	
		H5H	0.0297	
		H6H	0.0292	
NO_2	Annual	1985	0.140	2.5
		1986	0.139	
		1987	0.133	
		1988	0.172	
		1989	0.169	

Note:

1 Reported TSP/PM10 impacts are maximum through highest-sixth-highest (H6H) impacts for the 1984-1989 period. PM10 increments become effective June 1994.

ATTACHMENT 2

Drawing of Sources and Receptors

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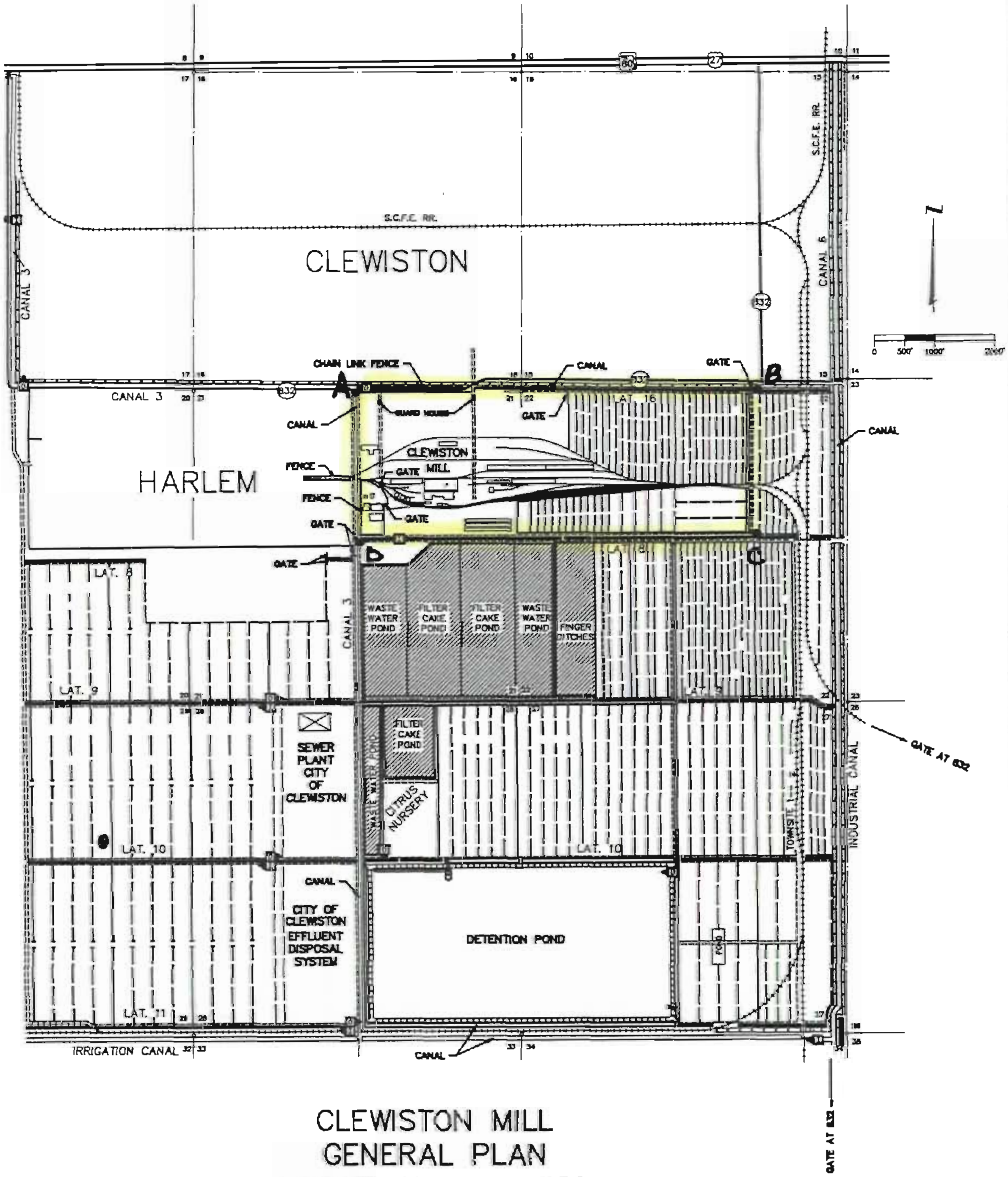
ATTACHMENT 3

Drawing of Inaccessible Property



CLEWISTON MILL
GENERAL PLAN
LOCATION OF GATES

CMGATES1.DWG

Table 4. PSD Class II Increment Analysis

Pollutant	Averaging Time	Max. Predicted Impact (ug/m^3)	Allowable Increment (ug/m^3)
SO_2	Annual	3.96	20
	24-hour	36.7	91
	3-hour	203	512
NO_2	Annual	2.24	25

Table 5. PSD Class I Increment Analysis

Pollutant	Averaging Time	Max. Predicted Impact (ug/m^3)	Allowable Increment (ug/m^3)
SO_2	Annual	0.39	2
	24-hour	3.82	5
	3-hour	22.1	25
NO_2	Annual	0.17	2.5

Table 6. Ambient Air Quality Impact

Pollutant	Averaging Time	Modeled Sources Impact (ug/m^3)	Background Conc. (ug/m^3)	Total Impact (ug/m^3)	Florida AAQS (ug/m^3)
SO_2	Annual	26	8	34	60
	24-hour	173	21	194	260
	3-hour	440	53	493	1,300
NO_2	Annual	11	26	37	100

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ATTACHMENT 4

Revised Sections 7 and 9

ATTACHMENT 1

7.1 IMPACTS ON SOILS AND VEGETATION

7.1.1 General

7.1.1.1 Vicinity of Clewiston Mill

The U.S. Sugar Clewiston mill is less than 5 km southwest of Lake Okeechobee and approximately 101 km north of the Everglades National Park (ENP). The major crops grown in the vicinity of the site are sugar cane, vegetables, and some pasture grasses. Maximum annual concentrations of criteria pollutants are predicted to occur approximately 11-100 km from the source (see Table 6-6).

As described in the air quality impact analysis (Section 6.0), the maximum predicted PM, SO_2, NO_x and CO concentrations in the vicinity of the site as a result of the proposed project are predicted to be well below the associated AAQS. The AAQS are designed to protect both the public health (primary standards) and welfare (secondary standards), including effects upon soils and vegetation. The impact of the proposed project is also well below the allowable PSD Class II increments. Therefore no detrimental effects on soils or vegetation should occur in this area.

7.1.1.2 PSD Class I Area

As discussed in Section 6.0, the impact of the proposed project is well below the allowable PSD Class I increments. Therefore there should be no significant ecological effects of the proposed project on the ENP.

The proposed facility's impact on Air Quality Related Values (AQRV) in the ENP are discussed in the following sections. Attachment Q presents a recent AQRV analysis done by the National Park Service. The impact levels discussed in the AQRV analysis are all considerably higher than the impact of the proposed US Sugar project.

ENP is a subtropical preserve comprised of mangrove and saltmarsh, prairie, and pineland. Small islands of tropical hardwood hammock, evergreen temperate swamp, and cypress swamp are interspersed among the larger vegetation communities. Soils consist primarily of histosols and shallow entisols over limestone substrate. Red, black, and white mangroves occupy most of the coastline.

The seasonally inundated prairie is the largest vegetation community in the park. This wetland is dominated by sawgrass, muhlygrass, and bluestem, growing on thin marl. Calcareous marl is the predominant soil in the prairies.

The pinelands occur on a rough limestone with very little soil development. The single canopy tree in the pinelands is the South Florida slash pine. The understory is diverse, and includes tropical hardwoods and herbaceous species endemic to South Florida. The hardwood hammocks occur on small areas of ground higher than the surrounding prairie. Dominant species include gumbo-limbo, poisonwood, buckthorn, strangler fig, and pigeon-plum. Epithytic orchids and bromeliads are frequent.

The temperate swamp hardwoods lie on a peat substrate and are dominated by redbay, wax myrtle, sweetbay, and dahoon; ferns are common. Both bald cypress and pond cypress occur in the park. The understory of cypress-dominated communities is typically open and contains many of the same species found in the hardwood communities. Ferns dominate the ground layer, and the substrate is peat or peaty marls. Bark-dwelling lichens are abundant in hardwood and cypress hammocks.

This combination of plant community types and mixture of fresh and salt water provides habitat for a wide variety of animal life. In addition to serving as a critical stopover point for migrating birds, ENP is home to animals such as the endangered American crocodile, wood stork, and Florida panther.

7.1.2 Impacts on Vegetation

7.1.2.1 Sulfur Dioxide

General

The maximum predicted cumulative annual concentrations of SO_2 in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 34.0 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Sulfur is a plant nutrient which is normally taken up as sulfate ions by the roots. When sulfur dioxide in the atmosphere enters the foliage through pores in the leaves, it reacts with water in the leaf interior to form sulfite ions. Sulfite ions are highly toxic, and they interact with enzymes, compete with normal metabolites, and interfere with a variety of cellular functions (Horsman and Welburn, 1976). However, sulfite is oxidized to sulfate ions within the leaf. These sulfate ions can then be used by the plant as a nutrient. Small amounts of sulfite can be oxidized in the plant before they induce harmful effects.

SO_2 at elevated levels in the ambient air has long been known to cause injury to plants. Acute SO_2 injury usually develops within a few hours or days of exposure. Symptoms include marginal, flecked, and/or intercostal necrotic areas that initially appear water-soaked and dullish green. This type of injury generally occurs to younger leaves. Chronic injury usually is evident by signs of chlorosis, bronzing, premature senescence, reduced growth, and possible tissue necrosis (EPA, 1982).

Many studies have been conducted to determine the effects of high-concentration, short-term SO_2 exposure on vegetation. Sensitive plants include ragweed, legumes, blackberry, southern pine, and red and black oak. These species are potentially injured by 3-hour exposure to SO_2 concentrations ranging from 790-1,570 $\mu g/m^3$. Intermediate plants include locust and sweetgum; these species can be injured by 3-hour exposure to SO_2 concentrations ranging from 1,570-2,100 $\mu g/m^3$. Resistant species, which are not injured at concentrations below 2,100 $\mu g/m^3$ for 3 hours, include white oak and dogwood (EPA, 1982). A study of native Floridian vegetation species (Woltz and Howe, 1991) demonstrated that pine, cypress, oak, and mangrove exposed to 1,300 $\mu g/m^3$ SO_2 for 8 hours were not visibly damaged.

A recent study (Granat and Hallgren, 1992) considered the effects of low-concentration, long-term exposure of SO_2 on a pine forest by exposing the trees to 14-20 $\mu g/m^3$ of SO_2 over a long period. No adverse effects were reported; this study verified previous findings that forests have the capacity to take up wet-deposited sulfur compounds at low concentrations over long periods. Taylor and Bell (1988) evaluated exposure of grasses to SO_2 and reported similar results of no adverse effects at low concentrations over long periods.

No information is available on the sensitivity of sugar cane to SO_2. There has been no discernible damage to cane surrounding the present facilities. Table 7-1 presents concentrations of SO_2 known to adversely affect grasses which have been tested. Concentrations of SO_2 which affect sweet corn and tomatoes are also provided in Table 7-1, since these crops are grown in the region. Orchard grass exhibited reduced growth at concentrations approximating the predicted annual average, but all other species were adversely affected at SO_2 doses much higher than those predicted.

Class I Area

Vegetation in the ENP were sampled to determine any effects from sulfur. The vegetation sampled included Brazilian-pepper bush, Australian-pine, buttonwood, and sawgrass. The tests showed that elemental concentrations in vegetation were not elevated above background levels (Gough, et al, 1986).

Populations of three common epiphytic bromeliads were monitored at five locations within the ENP. Sulfur concentrations in the three species were elevated by a factor of two or three over those in control areas, indicating that sulfur is being accumulated from the atmosphere. It is not known at what levels sulfur may damage bromeliads (Benzing, 1983).

Four species of bromeliads and two species of orchids were exposed to six hours of SO_2 at 0, 857, 1,714 and 3,428 $\mu g/m^3$. All were resistant or able to recover from the acute exposures. Carbon fixation mechanism activity was temporarily suppressed in a few instances, particularly in one type of bromeliad (Benzing, et al).

7.1.2.2 Nitrogen Oxides

The maximum predicted cumulative annual concentrations of NO_x in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 37.1 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

No information is available on the sensitivity of sugar cane to NO_x; however, Ashenden (1979) reported no effect on orchard grass after exposure to 127 $\mu g/m^3$ NO_2 for 20 weeks. Taylor and Bell (1988) evaluated exposure of grasses to NO_x and reported similar results of no adverse effects at low concentrations over long periods.

Fumigation of plants of five species: the kidney bean, tomato, radish, sunflower, and spinach with greater than 10,000 $\mu g/m^3$ of NO_2 in daylight caused no injury, while some injuries to leaves in darkness was reported for the kidney bean (Shimazaki et al., 1992). NO_2 was absorbed by the plant leaves in the dark. The level of accumulated NO_2^- was decreased by light much more rapidly in spinach leaves than in those of the kidney bean, with much less injury to spinach leaves than to those of the kidney bean leaves.

The above concentrations are much greater than that expected from the proposed facility, and thus no adverse impacts on vegetation from NO_x are expected.

7.1.2.3 Particulate Matter

The maximum predicted cumulative annual concentrations of PM10 in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 38.9 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Plants are adversely affected by particulate matter only at grossly high concentrations that result in surface depositions of 1 to 4 g/m^2/day (Lerman and Darley, 1975). Surface deposition from the predicted maximum levels of particulates would be a small fraction of the levels known to impact plant growth and will have no significant effect on vegetation in the region of the site. The particulate matter emissions control equipment at the Clewiston mill will effectively capture a large portion of the PM10 in the exhaust gas streams of the boilers.

7.1.2.4 Carbon Monoxide

The maximum predicted cumulative annual concentration of carbon monoxide in the ENP due to the proposed boiler No. 7 was not calculated, as there are no PSD increments or annual AAQS for CO. The point of maximum impact for CO emissions due to the proposed boiler No. 7 is 30 km from the boiler, or approximately 70 km from the ENP. The maximum predicted cumulative increase in the 8-hour average concentration of CO at this remote location due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources was 6,400 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Carbon monoxide can be absorbed and metabolized photosynthetically by plants (U.S. EPA, 1979). Chronic effects on plant growth, yield, and reproduction may occur at exposures in excess of 1,150,000 $\mu g/m^3$, while visible effects may occur only at much greater exposures (U.S. EPA, 1979). These levels are much greater than those for wildlife and several orders of magnitude greater than the levels expected from the proposed facility.

7.1.2.5 Ozone

The maximum predicted cumulative annual concentration of NO_x (an ozone precursor) in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 37.1 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

The maximum predicted cumulative annual concentration of VOCs (also an ozone precursor) in the Palm Beach ozone nonattainment area due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources was 19.6 $\mu g/m^3$.

Research on slash pine seedlings showed reduced growth due to chronic ozone concentrations, with concentrations ranging from 42 to 200 $\mu g/m^3$ (Hogsett, et al, 1985). Note that there is not a direct relationship between VOC ambient concentration and ozone ambient concentration.

7.1.3 Impacts on Soils

The soils of the ENP are generally classified as histosols or entisols. Histosols (peat soils) are organic and have extremely high buffering capacities based on their cation exchange capacity (CEC), base saturation, and bulk density. Therefore, they would be relatively insensitive to atmospheric inputs. The entisols are shallow sandy soils overlying limestone, such as the soils found in the pinelands. The direct connection of these soils with subsurface limestone tends to neutralize any acidic inputs. Moreover, the groundwater table is highly buffered due to the interaction with subsurface limestone formations which results in high alkalinity [as calcium carbonate ($CaCO_3$)].

The potential and hypothesized effects of atmospheric deposition of SO_2 and NO_x include:

- Increased soil acidification
- Alteration in cation exchange
- Loss of base cations
- Mobilization of trace metals

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil CEC, is important in determining how a soil responds to atmospheric inputs.

Organic soils can adsorb SO_2, sulfates, and NO_x with little change in pH. Deposition of these gases can increase the acidity of sandy soils; however, the low concentrations resulting from the proposed source will have a negligible effect on soil pH. Soils in this area that are utilized for agriculture are commonly amended with lime, thus any tendency towards lower pH would be neutralized. Area crops may benefit from the additional sulfur and nitrogen in the soil.

The relatively low sensitivity of the soils to acid inputs coupled with the extremely low ground-level concentrations of contaminants projected for the facility emissions precludes any significant impact on soils.

7.1.4 Impacts on Wildlife

A wide range of physiological and ecological effects to fauna has been reported for gaseous and particulate pollutants (Newman, 1980; Newman and Schreiber, 1988). The most severe of these effects have been observed at concentrations above the secondary ambient air quality standards. Physiological and behavioral effects have been observed in experimental animals at or below these standards. No observable effects to fauna are expected at concentrations below the values reported in Table 7-1.

The major air quality risk to wildlife in the United States is from continuous exposure to pollutants above the national ambient air quality standards. This occurs in non-attainment areas, e.g., Los Angeles Basin. Risks to wildlife also may occur for wildlife living in the vicinity of an emission source that experiences frequent upsets of episodic conditions resulting from malfunctioning equipment, unique meteorological conditions, or startup operations (Newman and Schreiber, 1988). Under these conditions, chronic effects (e.g., particulate contamination) and acute effects (e.g., injury to health) have been observed (Newman, 1980).

The following sections discuss the lowest threshold values for observed effects on wildlife from exposure to SO_2, NO_x, CO and PM-10. These threshold values are several orders of magnitude greater than the maximum predicted concentrations for the Class I area. Therefore, it is expected that there will be no effects on wildlife AQRVs resulting from the modeled SO_2, NO_x, CO and PM-10 emissions or the ambient concentration in the potential impact area. These results are considered typical and representative of the risk from other air pollutants predicted to be emitted from the facility, and no effects on wildlife AQRVs are expected from any such other pollutants.

7.1.4.1 Sulfur Dioxide

The most sensitive effects of chronic exposure of mammals to SO_2 have generally been effects on pulmonary morphology and function. Changes in pulmonary morphology are a thickening of the mucous layer of the trachea and a hypertrophy of goblet cells and mucous glands, which resembles the pathology of chronic bronchitis in humans. These effects have been observed for rats exposed to 10 ppm (2,620 $\mu g/m^3$) SO_2 for 18 to 67 days (Dalhamn, 1956). A related effect, slowing of tracheal mucous transport, has been observed for dogs exposed daily to 1 ppm (2,620 $\mu g/m^3$) of SO_2 daily for a year (Hirsch et al., 1975), and rats receiving a daily minimum exposure of 0.1 ppm (262 $\mu g/m^3$) SO_2 for a total of 70 to 170 hours (Ferin and Leach, 1973). The basic change in pulmonary function is a measurable increase in flow resistance as a result of a mild degree of bronchial constriction. However, no increase in flow resistance was observed in guinea pigs that were exposed continuously to 0.13 to 5.72 ppm (341 to 14,986 $\mu g/m^3$) of SO_2 for a year or monkeys that were exposed continuously to 0.14 to 1.28 ppm (367 to 3,354 $\mu g/m^3$). Other examples of reported effects of sulfur dioxide on wildlife at concentrations below AAQS are shown in Table 7-2. These levels are one order of magnitude or more above the predicted maximum cumulative annual ambient concentrations of SO_2 that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.2 Nitrogen Oxides

Nitrogen dioxide is a deep lung irritant, and the most sensitive effects of exposure to NO_2 are changes in pulmonary morphology. Damage to cells in the lungs of rats was observed for exposure to 1 ppm (1,880 $\mu g/m^3$) of NO_2 for one hour and 0.5 ppm (940 $\mu g/m^3$) of NO_2 for four hours, but the damage was repaired by the animals within 24 hours. More prolonged alterations in lung collagen occurred in rabbits that were exposed to 0.25 ppm (470 $\mu g/m^3$) of NO_2 daily for 4 hours for 6 days (Mueller and Hitchcock, 1969). Primary lesions in the alveoli occurred in squirrel monkeys that were exposed to a minimum of 10 ppm (18,800 $\mu g/m^3$) of NO_2 for 2 hours (Henry et al., 1969). At this concentration, there were many septal breaks and the alveoli were markedly expanded. Rats grew normally and survived for their natural life-spans in atmosphere containing a minimum of 0.8 ppm (1500 $\mu g/m^3$) NO_2, although they exhibited moderate tachypnea (i.e. increased breathing rate) but without apparent distress (Freeman et al., 1972). These levels are more than an order of magnitude greater than the predicted maximum cumulative annual ambient concentrations of NO_x that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.3 Particulate Matter (PM-10)

Little data was found on PM-10 animal studies, but national ambient air quality standards for PM-10 are a 24-hour standard of 150 $\mu g/m^3$ and an annual standard of 50 $\mu g/m^3$. Studies have found acute effects of particulate pollution on lung function in human children after air pollution episodes where maximal 24-hour mean particulate concentrations were 312 $\mu g/m^3$ (Ohio: Dockery et al., 1989) and 200 $\mu g/m^3$ (Netherlands: Dassen et al., 1986). These levels are more than an order of magnitude greater than the predicted maximum cumulative annual concentrations of PM10 in the ENP from the the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.4 Carbon Monoxide

Carbon monoxide is classed as a chemical asphyxiant, because it binds with hemoglobin and reduces the oxygen-transporting capacity of the blood. The effects of chronic exposure to CO may result from myocardial or nervous damage (U.S. EPA, 1979). Dogs that were exposed to 115 mg/m^3 CO continuously or intermittently, 7 days a week for 6 to 11 weeks, exhibited abnormal electrocardiograms (EKGs) and cardiac muscle degeneration (Lewey and Drabkin, 1944; Ehrich et al., 1944; Lindenberg et al., 1962; Preziosi et. al., 1970). Dogs that were exposed to 58 mg/m^3 CO, 7 days a week for 3 months in one study exhibited no effect (Musselman et al., 1959), while in another study lasting 11 weeks, they exhibited abnormal EKGs (Lindenberg et al., 1962). Cynomolgus monkeys that were exposed to 23 or 77.5 mg/m^3 for 22 hours a day, 7 days a week for 2 years) did not exhibit any cardiac effects. Lewey and Drabkin demonstrated alterations in gait in dogs exposed for 11 weeks to 115 mg/m^3 CO, but Musselman et al. found no effect on activity levels of rats exposed to 58 mg/m^3 for 3 months. These levels are orders of magnitude greater than the predicted maximum cumulative annual concentrations of CO that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.5 Other Pollutants

Florida panther and raccoon tissue samples were collected throughout southern Florida and analyzed for mercury content. The results indicated that some panthers had higher tissue mercury levels due to bioaccumulation, and suggested the panthers were picking up the mercury through the food chain (e.g., raccoons and alligators) (Roelke, 1991).

7.2 IMPACTS ON VISIBILITY

The visibility analysis required by PSD regulations under Additional Impact Analysis is distinct from that required for Class I areas. This visibility impairment analysis is concerned with impacts that occur within the significant impact area of the proposed project.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the Workbook for Plume Visual Impact Screening and Analysis (EPA, 1992). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. Model input and output results are presented in Tables 7-3 through 7-6. The total PM, NO_x, and sulfuric acid mist emissions from the proposed facility, as presented in Section 3.4, were used as input to the model. The site-specific values for ambient ozone concentration and standard visual range for each the four seasons was based on that measured at the ENP and provided in the AQRV analysis.

As indicated, the maximum visibility impacts caused by the facility do not exceed the screening criteria. As a result, there is no significant impact upon visibility predicted in the significant impact area or for the ENP Class I area.

7.3 IMPACTS DUE TO ASSOCIATED POPULATION GROWTH

There will be a small number of temporary construction workers during construction. There will be no new permanent employees at the Clewiston Mill associated with the operation of boiler No. 7. With no associated industrial, commercial, or residential growth, there will thus be no growth-related air pollution impacts in the area due to the project.

Table 7-1

Lowest Doses of SO_2 Reported to Affect Growth of Sweet Corn, Tomato, and Some Grasses

Species	Lowest SO_2 Dose Known to Affect Species, ($\mu g/m^3$)	Reference
Rye Grass	367 for 131 days reduced growth	Ayazloo and Bell, 1981
Orchard Grass	37-62 for 72 days reduced growth	Crittenden and Read, 1979
Oats	1,048 for 3 hours four times during life cycle reduced growth	Heck and Dunning, 1978
Sweet Corn	812 for 7 days causes chlorosis, but no yield effects	Mandl et al., 1975
Tomato	1,258 for 5 hours on each of 57 days reduced growth	Kohut et al., 1982

Table 7-2

Examples of Reported Effects of Sulfur Dioxide on Wildlife at Concentrations Below National Secondary Ambient Air Quality Standards

Reported Effect	Concentration ($\mu g/m^3$)	Exposure
Respiratory stress in guinea pigs	427 to 854	1 hour
Respiratory stress in rats	267	7 hours/day; 5 day/week for 10 weeks
Decreased abundance in deer mice	13 to 157	Continually for 5 months

TABLE 7-3
Visual Effects Screening Analysis for
Source: USSC Clewiston (Winter)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G	/S
NOx (as NO2)	24.19	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.50	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00045 ppm
Background Visual Range:	43.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.344	.05	.003
SKY	140.	84.	102.0	84.	2.00	.069	.05	-.003
TERRAIN	10.	84.	102.0	84.	2.00	.091	.05	.001
TERRAIN	140.	84.	102.0	84.	2.00	.023	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	95.2	104.	2.00	.358	.05	.004
SKY	140.	65.	95.2	104.	2.00	.068	.05	-.003
TERRAIN	10.	55.	91.3	114.	2.00	.118	.05	.001
TERRAIN	140.	55.	91.3	114.	2.00	.030	.05	.001

TABLE 7-4
Visual Effects Screening Analysis for
Source: USSC Clewiston (Spring)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G	/S
NOx (as NO2)	24.19	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.50	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00061 ppm
Background Visual Range:	47.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability: 6	
Wind Speed: 1.00 m/s	

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.413	.05	.004
SKY	140.	84.	102.0	84.	2.00	.091	.05	-.004
TERRAIN	10.	84.	102.0	84.	2.00	.125	.05	.001
TERRAIN	140.	84.	102.0	84.	2.00	.030	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	95.2	104.	2.00	.441	.05	.004
SKY	140.	65.	95.2	104.	2.00	.096	.05	-.004
TERRAIN	10.	55.	91.3	114.	2.00	.161	.05	.002
TERRAIN	140.	55.	91.3	114.	2.00	.040	.05	.001

TABLE 7-5
Visual Effects Screening Analysis for
Source: USSC Clewiston (Summer)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G /S
NOx (as NO2)	24.19	G /S
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4	.50	G /S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00040 ppm
Background Visual Range:	59.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.559	.05	.006
SKY	140.	84.	102.0	84.	2.00	.133	.05	-.006
TERRAIN	10.	84.	102.0	84.	2.00	.251	.05	.003
TERRAIN	140.	84.	102.0	84.	2.00	.055	.05	.002

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	40.	84.1	129.	2.00	.620	.05	.007
SKY	140.	40.	84.1	129.	2.00	.122	.05	-.006
TERRAIN	10.	50.	89.1	119.	2.00	.320	.05	.003
TERRAIN	140.	50.	89.1	119.	2.00	.074	.05	.003

TABLE 7-6
Visual Effects Screening Analysis for
Source: USSC Clewiston (Fall)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G	/S
NOx (as NO2)	24.19	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.50	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00047 ppm
Background Visual Range:	63.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.628	.05	.007
SKY	140.	84.	102.0	84.	2.00	.162	.05	-.006
TERRAIN	10.	84.	102.0	84.	2.00	.301	.05	.003
TERRAIN	140.	84.	102.0	84.	2.00	.064	.05	.002

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	35.	81.0	134.	2.00	.704	.05	.008
SKY	140.	35.	81.0	134.	2.00	.141	.05	-.007
TERRAIN	10.	50.	89.1	119.	2.00	.384	.05	.004
TERRAIN	140.	50.	89.1	119.	2.00	.087	.05	.003

7.1 IMPACTS ON SOILS AND VEGETATION

7.1.1 General

7.1.1.1 Vicinity of Clewiston Mill

The U.S. Sugar Clewiston mill is less than 5 km southwest of Lake Okeechobee and approximately 101 km north of the Everglades National Park (ENP). The major crops grown in the vicinity of the site are sugar cane, vegetables, and some pasture grasses. Maximum annual concentrations of criteria pollutants are predicted to occur approximately 11-100 km from the source (see Table 6-6).

As described in the air quality impact analysis (Section 6.0), the maximum predicted PM, SO_2, NO_x and CO concentrations in the vicinity of the site as a result of the proposed project are predicted to be well below the associated AAQS. The AAQS are designed to protect both the public health (primary standards) and welfare (secondary standards), including effects upon soils and vegetation. The impact of the proposed project is also well below the allowable PSD Class II increments. Therefore no detrimental effects on soils or vegetation should occur in this area.

7.1.1.2 PSD Class I Area

As discussed in Section 6.0, the impact of the proposed project is well below the allowable PSD Class I increments. Therefore there should be no significant ecological effects of the proposed project on the ENP.

The proposed facility's impact on Air Quality Related Values (AQRV) in the ENP are discussed in the following sections. Attachment Q presents a recent AQRV analysis done by the National Park Service. The impact levels discussed in the AQRV analysis are all considerably higher than the impact of the proposed US Sugar project.

ENP is a subtropical preserve comprised of mangrove and saltmarsh, prairie, and pineland. Small islands of tropical hardwood hammock, evergreen temperate swamp, and cypress swamp are interspersed among the larger vegetation communities. Soils consist primarily of histosols and shallow entisols over limestone substrate. Red, black, and white mangroves occupy most of the coastline.

The seasonally inundated prairie is the largest vegetation community in the park. This wetland is dominated by sawgrass, muhlygrass, and bluestem, growing on thin marl. Calcareous marl is the predominant soil in the prairies.

The pinelands occur on a rough limestone with very little soil development. The single canopy tree in the pinelands is the South Florida slash pine. The understory is diverse, and includes tropical hardwoods and herbaceous species endemic to South Florida. The hardwood hammocks occur on small areas of ground higher than the surrounding prairie. Dominant species include gumbo-limbo, poisonwood, buckthorn, strangler fig, and pigeon-plum. Epithytic orchids and bromeliads are frequent.

The temperate swamp hardwoods lie on a peat substrate and are dominated by redbay, wax myrtle, sweetbay, and dahoon; ferns are common. Both bald cypress and pond cypress occur in the park. The understory of cypress-dominated communities is typically open and contains many of the same species found in the hardwood communities. Ferns dominate the ground layer, and the substrate is peat or peaty marls. Bark-dwelling lichens are abundant in hardwood and cypress hammocks.

This combination of plant community types and mixture of fresh and salt water provides habitat for a wide variety of animal life. In addition to serving as a critical stopover point for migrating birds, ENP is home to animals such as the endangered American crocodile, wood stork, and Florida panther.

7.1.2 Impacts on Vegetation

7.1.2.1 Sulfur Dioxide

General

The maximum predicted cumulative annual concentrations of SO_2 in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 34.0 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Sulfur is a plant nutrient which is normally taken up as sulfate ions by the roots. When sulfur dioxide in the atmosphere enters the foliage through pores in the leaves, it reacts with water in the leaf interior to form sulfite ions. Sulfite ions are highly toxic, and they interact with enzymes, compete with normal metabolites, and interfere with a variety of cellular functions (Horsman and Welburn, 1976). However, sulfite is oxidized to sulfate ions within the leaf. These sulfate ions can then be used by the plant as a nutrient. Small amounts of sulfite can be oxidized in the plant before they induce harmful effects.

SO_2 at elevated levels in the ambient air has long been known to cause injury to plants. Acute SO_2 injury usually develops within a few hours or days of exposure. Symptoms include marginal, flecked, and/or intercostal necrotic areas that initially appear water-soaked and dullish green. This type of injury generally occurs to younger leaves. Chronic injury usually is evident by signs of chlorosis, bronzing, premature senescence, reduced growth, and possible tissue necrosis (EPA, 1982).

Many studies have been conducted to determine the effects of high-concentration, short-term SO_2 exposure on vegetation. Sensitive plants include ragweed, legumes, blackberry, southern pine, and red and black oak. These species are potentially injured by 3-hour exposure to SO_2 concentrations ranging from 790-1,570 $\mu g/m^3$. Intermediate plants include locust and sweetgum; these species can be injured by 3-hour exposure to SO_2 concentrations ranging from 1,570-2,100 $\mu g/m^3$. Resistant species, which are not injured at concentrations below 2,100 $\mu g/m^3$ for 3 hours, include white oak and dogwood (EPA, 1982). A study of native Floridian vegetation species (Woltz and Howe, 1991) demonstrated that pine, cypress, oak, and mangrove exposed to 1,300 $\mu g/m^3$ SO_2 for 8 hours were not visibly damaged.

A recent study (Granat and Hallgren, 1992) considered the effects of low-concentration, long-term exposure of SO_2 on a pine forest by exposing the trees to 14-20 $\mu g/m^3$ of SO_2 over a long period. No adverse effects were reported; this study verified previous findings that forests have the capacity to take up wet-deposited sulfur compounds at low concentrations over long periods. Taylor and Bell (1988) evaluated exposure of grasses to SO_2 and reported similar results of no adverse effects at low concentrations over long periods.

No information is available on the sensitivity of sugar cane to SO_2. There has been no discernible damage to cane surrounding the present facilities. Table 7-1 presents concentrations of SO_2 known to adversely affect grasses which have been tested. Concentrations of SO_2 which affect sweet corn and tomatoes are also provided in Table 7-1, since these crops are grown in the region. Orchard grass exhibited reduced growth at concentrations approximating the predicted annual average, but all other species were adversely affected at SO_2 doses much higher than those predicted.

Class I Area

Vegetation in the ENP were sampled to determine any effects from sulfur. The vegetation sampled included Brazilian-pepper bush, Australian-pine, buttonwood, and sawgrass. The tests showed that elemental concentrations in vegetation were not elevated above background levels (Gough, et al, 1986).

Populations of three common epiphytic bromeliads were monitored at five locations within the ENP. Sulfur concentrations in the three species were elevated by a factor of two or three over those in control areas, indicating that sulfur is being accumulated from the atmosphere. It is not known at what levels sulfur may damage bromeliads (Benzing, 1983).

Four species of bromeliads and two species of orchids were exposed to six hours of SO_2 at 0, 857, 1,714 and 3,428 $\mu g/m^3$. All were resistant or able to recover from the acute exposures. Carbon fixation mechanism activity was temporarily suppressed in a few instances, particularly in one type of bromeliad (Benzing, et al).

7.1.2.2 Nitrogen Oxides

The maximum predicted cumulative annual concentrations of NO_x in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 37.1 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

No information is available on the sensitivity of sugar cane to NO_x; however, Ashenden (1979) reported no effect on orchard grass after exposure to 127 $\mu g/m^3$ NO_2 for 20 weeks. Taylor and Bell (1988) evaluated exposure of grasses to NO_x and reported similar results of no adverse effects at low concentrations over long periods.

Fumigation of plants of five species: the kidney bean, tomato, radish, sunflower, and spinach with greater than 10,000 $\mu g/m^3$ of NO_2 in daylight caused no injury, while some injuries to leaves in darkness was reported for the kidney bean (Shimazaki et al., 1992). NO_2 was absorbed by the plant leaves in the dark. The level of accumulated NO_2^- was decreased by light much more rapidly in spinach leaves than in those of the kidney bean, with much less injury to spinach leaves than to those of the kidney bean leaves.

The above concentrations are much greater than that expected from the proposed facility, and thus no adverse impacts on vegetation from NO_x are expected.

7.1.2.3 Particulate Matter

The maximum predicted cumulative annual concentrations of PM10 in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 38.9 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Plants are adversely affected by particulate matter only at grossly high concentrations that result in surface depositions of 1 to 4 g/m^2/day (Lerman and Darley, 1975). Surface deposition from the predicted maximum levels of particulates would be a small fraction of the levels known to impact plant growth and will have no significant effect on vegetation in the region of the site. The particulate matter emissions control equipment at the Clewiston mill will effectively capture a large portion of the PM10 in the exhaust gas streams of the boilers.

7.1.2.4 Carbon Monoxide

The maximum predicted cumulative annual concentration of carbon monoxide in the ENP due to the proposed boiler No. 7 was not calculated, as there are no PSD increments or annual AAQS for CO. The point of maximum impact for CO emissions due to the proposed boiler No. 7 is 30 km from the boiler, or approximately 70 km from the ENP. The maximum predicted cumulative increase in the 8-hour average concentration of CO at this remote location due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources was 6,400 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

Carbon monoxide can be absorbed and metabolized photosynthetically by plants (U.S. EPA, 1979). Chronic effects on plant growth, yield, and reproduction may occur at exposures in excess of 1,150,000 $\mu g/m^3$, while visible effects may occur only at much greater exposures (U.S. EPA, 1979). These levels are much greater than those for wildlife and several orders of magnitude greater than the levels expected from the proposed facility.

7.1.2.5 Ozone

The maximum predicted cumulative annual concentration of NO_x (an ozone precursor) in the ENP due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources is 37.1 $\mu g/m^3$. This is significantly less than the concentration at which impacts on vegetation have been determined.

The maximum predicted cumulative annual concentration of VOCs (also an ozone precursor) in the Palm Beach ozone nonattainment area due to the proposed boiler No. 7 and all other PSD-increment-consuming and background sources was 19.6 $\mu g/m^3$.

Research on slash pine seedlings showed reduced growth due to chronic ozone concentrations, with concentrations ranging from 42 to 200 $\mu g/m^3$ (Hogsett, et al, 1985). Note that there is not a direct relationship between VOC ambient concentration and ozone ambient concentration.

7.1.3 Impacts on Soils

The soils of the ENP are generally classified as histosols or entisols. Histosols (peat soils) are organic and have extremely high buffering capacities based on their cation exchange capacity (CEC), base saturation, and bulk density. Therefore, they would be relatively insensitive to atmospheric inputs. The entisols are shallow sandy soils overlying limestone, such as the soils found in the pinelands. The direct connection of these soils with subsurface limestone tends to neutralize any acidic inputs. Moreover, the groundwater table is highly buffered due to the interaction with subsurface limestone formations which results in high alkalinity [as calcium carbonate ($CaCO_3$)].

The potential and hypothesized effects of atmospheric deposition of SO_2 and NO_x include:

- Increased soil acidification
- Alteration in cation exchange
- Loss of base cations
- Mobilization of trace metals

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil CEC, is important in determining how a soil responds to atmospheric inputs.

Organic soils can adsorb SO_2, sulfates, and NO_x with little change in pH. Deposition of these gases can increase the acidity of sandy soils; however, the low concentrations resulting from the proposed source will have a negligible effect on soil pH. Soils in this area that are utilized for agriculture are commonly amended with lime, thus any tendency towards lower pH would be neutralized. Area crops may benefit from the additional sulfur and nitrogen in the soil.

The relatively low sensitivity of the soils to acid inputs coupled with the extremely low ground-level concentrations of contaminants projected for the facility emissions precludes any significant impact on soils.

7.1.4 Impacts on Wildlife

A wide range of physiological and ecological effects to fauna has been reported for gaseous and particulate pollutants (Newman, 1980; Newman and Schreiber, 1988). The most severe of these effects have been observed at concentrations above the secondary ambient air quality standards. Physiological and behavioral effects have been observed in experimental animals at or below these standards. No observable effects to fauna are expected at concentrations below the values reported in Table 7-1.

The major air quality risk to wildlife in the United States is from continuous exposure to pollutants above the national ambient air quality standards. This occurs in non-attainment areas, e.g., Los Angeles Basin. Risks to wildlife also may occur for wildlife living in the vicinity of an emission source that experiences frequent upsets of episodic conditions resulting from malfunctioning equipment, unique meteorological conditions, or startup operations (Newman and Schreiber, 1988). Under these conditions, chronic effects (e.g., particulate contamination) and acute effects (e.g., injury to health) have been observed (Newman, 1980).

The following sections discuss the lowest threshold values for observed effects on wildlife from exposure to SO_2, NO_x, CO and PM-10. These threshold values are several orders of magnitude greater than the maximum predicted concentrations for the Class I area. Therefore, it is expected that there will be no effects on wildlife AQRVs resulting from the modeled SO_2, NO_x, CO and PM-10 emissions or the ambient concentration in the potential impact area. These results are considered typical and representative of the risk from other air pollutants predicted to be emitted from the facility, and no effects on wildlife AQRVs are expected from any such other pollutants.

7.1.4.1 Sulfur Dioxide

The most sensitive effects of chronic exposure of mammals to SO_2 have generally been effects on pulmonary morphology and function. Changes in pulmonary morphology are a thickening of the mucous layer of the trachea and a hypertrophy of goblet cells and mucous glands, which resembles the pathology of chronic bronchitis in humans. These effects have been observed for rats exposed to 10 ppm (2,620 $\mu g/m^3$) SO_2 for 18 to 67 days (Dalhamn, 1956). A related effect, slowing of tracheal mucous transport, has been observed for dogs exposed daily to 1 ppm (2,620 $\mu g/m^3$) of SO_2 daily for a year (Hirsch et al., 1975), and rats receiving a daily minimum exposure of 0.1 ppm (262 $\mu g/m^3$) SO_2 for a total of 70 to 170 hours (Ferin and Leach, 1973). The basic change in pulmonary function is a measurable increase in flow resistance as a result of a mild degree of bronchial constriction. However, no increase in flow resistance was observed in guinea pigs that were exposed continuously to 0.13 to 5.72 ppm (341 to 14,986 $\mu g/m^3$) of SO_2 for a year or monkeys that were exposed continuously to 0.14 to 1.28 ppm (367 to 3,354 $\mu g/m^3$). Other examples of reported effects of sulfur dioxide on wildlife at concentrations below AAQS are shown in Table 7-2. These levels are one order of magnitude or more above the predicted maximum cumulative annual ambient concentrations of SO_2 that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.2 Nitrogen Oxides

Nitrogen dioxide is a deep lung irritant, and the most sensitive effects of exposure to NO_2 are changes in pulmonary morphology. Damage to cells in the lungs of rats was observed for exposure to 1 ppm (1,880 $\mu g/m^3$) of NO_2 for one hour and 0.5 ppm (940 $\mu g/m^3$) of NO_2 for four hours, but the damage was repaired by the animals within 24 hours. More prolonged alterations in lung collagen occurred in rabbits that were exposed to 0.25 ppm (470 $\mu g/m^3$) of NO_2 daily for 4 hours for 6 days (Mueller and Hitchcock, 1969). Primary lesions in the alveoli occurred in squirrel monkeys that were exposed to a minimum of 10 ppm (18,800 $\mu g/m^3$) of NO_2 for 2 hours (Henry et al., 1969). At this concentration, there were many septal breaks and the alveoli were markedly expanded. Rats grew normally and survived for their natural life-spans in atmosphere containing a minimum of 0.8 ppm (1500 $\mu g/m^3$) NO_2, although they exhibited moderate tachypnea (i.e. increased breathing rate) but without apparent distress (Freeman et al., 1972). These levels are more than an order of magnitude greater than the predicted maximum cumulative annual ambient concentrations of NO_x that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.3 Particulate Matter (PM-10)

Little data was found on PM-10 animal studies, but national ambient air quality standards for PM-10 are a 24-hour standard of 150 $\mu g/m^3$ and an annual standard of 50 $\mu g/m^3$. Studies have found acute effects of particulate pollution on lung function in human children after air pollution episodes where maximal 24-hour mean particulate concentrations were 312 $\mu g/m^3$ (Ohio: Dockery et al., 1989) and 200 $\mu g/m^3$ (Netherlands: Dassen et al., 1986). These levels are more than an order of magnitude greater than the predicted maximum cumulative annual concentrations of PM10 in the ENP from the the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.4 Carbon Monoxide

Carbon monoxide is classed as a chemical asphyxiant, because it binds with hemoglobin and reduces the oxygen-transporting capacity of the blood. The effects of chronic exposure to CO may result from myocardial or nervous damage (U.S. EPA, 1979). Dogs that were exposed to 115 mg/m^3 CO continuously or intermittently, 7 days a week for 6 to 11 weeks, exhibited abnormal electrocardiograms (EKGs) and cardiac muscle degeneration (Lewey and Drabkin, 1944; Ehrich et al., 1944; Lindenberg et al., 1962; Preziosi et. al., 1970). Dogs that were exposed to 58 mg/m^3 CO, 7 days a week for 3 months in one study exhibited no effect (Musselman et al., 1959), while in another study lasting 11 weeks, they exhibited abnormal EKGs (Lindenberg et al., 1962). Cynomolgus monkeys that were exposed to 23 or 77.5 mg/m^3 for 22 hours a day, 7 days a week for 2 years) did not exhibit any cardiac effects. Lewey and Drabkin demonstrated alterations in gait in dogs exposed for 11 weeks to 115 mg/m^3 CO, but Musselman et al. found no effect on activity levels of rats exposed to 58 mg/m^3 for 3 months. These levels are orders of magnitude greater than the predicted maximum cumulative annual concentrations of CO that might occur in the ENP as a result of the proposed boiler No. 7 and all other PSD-increment-consuming and background sources, and therefore no adverse impacts on wildlife are expected.

7.1.4.5 Other Pollutants

Florida panther and raccoon tissue samples were collected throughout southern Florida and analyzed for mercury content. The results indicated that some panthers had higher tissue mercury levels due to bioaccumulation, and suggested the panthers were picking up the mercury through the food chain (e.g., raccoons and alligators) (Roelke, 1991).

7.2 IMPACTS ON VISIBILITY

The visibility analysis required by PSD regulations under Additional Impact Analysis is distinct from that required for Class I areas. This visibility impairment analysis is concerned with impacts that occur within the significant impact area of the proposed project.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the Workbook for Plume Visual Impact Screening and Analysis (EPA, 1992). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. Model input and output results are presented in Tables 7-3 through 7-6. The total PM, NO_x, and sulfuric acid mist emissions from the proposed facility, as presented in Section 3.4, were used as input to the model. The site-specific values for ambient ozone concentration and standard visual range for each the four seasons was based on that measured at the ENP and provided in the AQRV analysis.

As indicated, the maximum visibility impacts caused by the facility do not exceed the screening criteria. As a result, there is no significant impact upon visibility predicted in the significant impact area or for the ENP Class I area.

7.3 IMPACTS DUE TO ASSOCIATED POPULATION GROWTH

There will be a small number of temporary construction workers during construction. There will be no new permanent employees at the Clewiston Mill associated with the operation of boiler No. 7. With no associated industrial, commercial, or residential growth, there will thus be no growth-related air pollution impacts in the area due to the project.

Table 7-1

Lowest Doses of SO_2 Reported to Affect Growth of Sweet Corn, Tomato, and Some Grasses

Species	Lowest SO_2 Dose Known to Affect Species, ($\mu g/m^3$)	Reference
Rye Grass	367 for 131 days reduced growth	Ayazloo and Bell, 1981
Orchard Grass	37-62 for 72 days reduced growth	Crittenden and Read, 1979
Oats	1,048 for 3 hours four times during life cycle reduced growth	Heck and Dunning, 1978
Sweet Corn	812 for 7 days causes chlorosis, but no yield effects	Mandl et al., 1975
Tomato	1,258 for 5 hours on each of 57 days reduced growth	Kohut et al., 1982

Table 7-2
Examples of Reported Effects of Sulfur Dioxide on Wildlife at Concentrations Below National Secondary Ambient Air Quality Standards

Reported Effect	Concentration ($\mu g/m^3$)	Exposure
Respiratory stress in guinea pigs	427 to 854	1 hour
Respiratory stress in rats	267	7 hours/day; 5 day/week for 10 weeks
Decreased abundance in deer mice	13 to 157	Continually for 5 months

TABLE 7-3
Visual Effects Screening Analysis for
Source: USSC Clewiston (Winter)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G /S
NOx (as NO2)	24.19	G /S
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4	.50	G /S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00045 ppm
Background Visual Range:	43.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability: 6	
Wind Speed: 1.00 m/s	

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.344	.05	.003
SKY	140.	84.	102.0	84.	2.00	.069	.05	-.003
TERRAIN	10.	84.	102.0	84.	2.00	.091	.05	.001
TERRAIN	140.	84.	102.0	84.	2.00	.023	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	95.2	104.	2.00	.358	.05	.004
SKY	140.	65.	95.2	104.	2.00	.068	.05	-.003
TERRAIN	10.	55.	91.3	114.	2.00	.118	.05	.001
TERRAIN	140.	55.	91.3	114.	2.00	.030	.05	.001

TABLE 7-4
Visual Effects Screening Analysis for
Source: USSC Clewiston (Spring)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G /S
NOx (as NO2)	24.19	G /S
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4	.50	G /S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00061 ppm
Background Visual Range:	47.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability: 6	
Wind Speed: 1.00 m/s	

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.413	.05	.004
SKY	140.	84.	102.0	84.	2.00	.091	.05	-.004
TERRAIN	10.	84.	102.0	84.	2.00	.125	.05	.001
TERRAIN	140.	84.	102.0	84.	2.00	.030	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	95.2	104.	2.00	.441	.05	.004
SKY	140.	65.	95.2	104.	2.00	.096	.05	-.004
TERRAIN	10.	55.	91.3	114.	2.00	.161	.05	.002
TERRAIN	140.	55.	91.3	114.	2.00	.040	.05	.001

TABLE 7-5
Visual Effects Screening Analysis for
Source: USSC Clewiston (Summer)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G	/S
NOx (as NO2)	24.19	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.50	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00040 ppm
Background Visual Range:	59.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.559	.05	.006
SKY	140.	84.	102.0	84.	2.00	.133	.05	-.006
TERRAIN	10.	84.	102.0	84.	2.00	.251	.05	.003
TERRAIN	140.	84.	102.0	84.	2.00	.055	.05	.002

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	40.	84.1	129.	2.00	.620	.05	.007
SKY	140.	40.	84.1	129.	2.00	.122	.05	-.006
TERRAIN	10.	50.	89.1	119.	2.00	.320	.05	.003
TERRAIN	140.	50.	89.1	119.	2.00	.074	.05	.003

TABLE 7-6
Visual Effects Screening Analysis for
Source: USSC Clewiston (Fall)
Class I Area: Everglades National Park

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	13.95	G	/S
NOx (as NO2)	24.19	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.50	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.00047 ppm
Background Visual Range:	63.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.628	.05	.007
SKY	140.	84.	102.0	84.	2.00	.162	.05	-.006
TERRAIN	10.	84.	102.0	84.	2.00	.301	.05	.003
TERRAIN	140.	84.	102.0	84.	2.00	.064	.05	.002

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	35.	81.0	134.	2.00	.704	.05	.008
SKY	140.	35.	81.0	134.	2.00	.141	.05	-.007
TERRAIN	10.	50.	89.1	119.	2.00	.384	.05	.004
TERRAIN	140.	50.	89.1	119.	2.00	.087	.05	.003

Table 1. Allowable Emissions

Pollutant	Bagasse			No. 2 Fuel Oil		
	lb/MMBtu	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr
Particulate (PM)	0.04	30	129	0.04	10	12.88
Particulate (PM_{10})	0.035	26	113	0.04	10	12.88
Sulfur Dioxide[1]	0.17	125	550	0.05	12.5	16.10
Nitrogen Oxides[2]	0.25	185	809	0.2	50.0	64.40
Carbon Monoxide	0.70	516	2,262	0.066	16.5	21.25
Volatile Organic Compounds	0.212	157	685	0.004	1.0	1.29
Sulfuric Acid Mist	0.017	13	55	0.005	1.25	1.60
Lead				56E-06		
Mercury				6.4E-06		
Beryllium				8.4E-06		
Fluorides				12.6E-06		

[1] Compliance based on use of very-low sulfur fuel oil (0.05% sulfur) and on 24-hour rolling average per 40 CFR 60. Subpart Db

[2] Compliance based on use of low nitrogen fuel oil and on 24-hour rolling average per 40 CFR 60, Subpart Db

Table 3. Maximum Air Quality Impacts for Comparison to the De Minimus Ambient Levels.

Pollutant	Avg. Time	Predicted Impact (ug/m^3)	De Minimus Level (ug/m^3)
NO_2	Annual	0.4	14
Beryllium *	24-hour	0.0004	0.001

* non-criteria pollutant

Table 7. Air Toxics Analysis

	8- hour		24- hour		Annual	
Pollutant	Impact (ug/m^3)	AAC (ug/m^3)	Impact (ug/m^3)	AAC (ug/m^3)	Impact (ug/m^3)	AAC (ug/m^3)
Antimony	0.0022	5	0.001	1.2	0.000033	0.3
Arsenic	0.0018	2	0.00082	0.48	0.000027	0.000230
Barium	0.0062	5	0.0029	1.2	0.000096	50
Beryllium	0.00039	0.02	0.00018	0.0048	0.000006	0.00042
Bromine	0.00065	6.6	0.0003	1.58	-	-
Cadmium	0.00015	0.5	0.0004	0.12	0.000023	0.00056
Chromium metals	0.002	5	0.00091	1.2	0.00003	1000
Chromium+6	0.0002	0.5	0.00009	0.12	0.000006	0.000083
Cobalt	0.011	0.5	0.0051	0.12	-	-
Copper	0.026	10	0.012	2.4	-	-
Fluoride	0.011	25	0.0052	6	-	-
Formaldehyde	0.038	12	0.018	2.88	0.000058	0.077
Hydrogen Chloride	0.059	75	0.028	18	0.00091	7.0
Manganese	0.0024	50	0.0011	12	-	-
Mercury	0.0003	0.5	0.00014	0.12	0.000005	0.3
Molybdenum	0.0045	50	0.0021	12	-	-
Nickel	0.12	0.5	0.055	0.12	0.0018	0.0042
Phosphorus	0.0054	1	0.0025	0.24	-	-
Selenium	0.0035	2	0.0016	0.48	-	-
Sulfuric Acid Mist	-	-	3.1	2.4	-	-
Tin	0.031	1	0.014	0.24	-	-
Zinc	0.0062	10	0.0029	2.4	-	-

Note: AAC = Acceptable Ambient Concentration

7.1 IMPACTS ON SOILS AND VEGETATION

7.1.1 General

7.1.1.1 Vicinity of Clewiston Mill

The U.S. Sugar Clewiston mill is less than 5 km southwest of Lake Okeechobee and approximately 101 km north of the Everglades National Park (ENP). The major crops grown in the vicinity of the site are sugar cane, vegetables, and some pasture grasses. Maximum annual concentrations of criteria pollutants are predicted to occur approximately 11-100 km from the source (see Table 6-6).

As described in the air quality impact analysis (Section 6.0), the maximum predicted PM, SO_2, NO_x and CO concentrations in the vicinity of the site as a result of the proposed project are predicted to be well below the associated AAQS. The AAQS are designed to protect both the public health (primary standards) and welfare (secondary standards), including effects upon soils and vegetation. The impact of the proposed project is also well below the allowable PSD Class II increments. Therefore no detrimental effects on soils or vegetation should occur in this area.

7.1.1.2 PSD Class I Area

As discussed in Section 6.0, the impact of the proposed project is well below the allowable PSD Class I increments. Therefore there should be no significant ecological effects of the proposed project on the ENP.

The proposed facility's impact on Air Quality Related Values (AQRV) in the ENP are discussed in the following sections. The AQRV include freshwater and coastal wetlands, dominant land communities, unique and rare plant communities, soils and associated periphyton, and the wildlife dependent upon these communities for habitat. Rare, endemic, threatened, and endangered species of the national park, and bioindicators of air pollution (e.g., lichens) are also evaluated.

7.1.2 Impacts on Vegetation

7.1.2.1 Sulfur Dioxide

The predicted maximum increase in annual concentrations of SO_2 due to the proposed boiler No. 7 is less than 26 $\mu g/m^3$. Sulfur is a plant nutrient which is normally taken up as sulfate ions by the roots. When sulfur dioxide in the atmosphere enters the foliage through pores in the leaves, it reacts with water in the leaf interior to form sulfite ions. Sulfite ions are highly toxic, and they interact with enzymes, compete with normal metabolites, and interfere with a variety of cellular functions (Horsman and Welburn, 1976). However, sulfite is oxidized to sulfate ions within the leaf. These sulfate ions can then be used by the plant as a nutrient. Small amounts of sulfite can be oxidized in the plant before they induce harmful effects.

SO_2 at elevated levels in the ambient air has long been known to cause injury to plants. Acute SO_2 injury usually develops within a few hours or days of exposure. Symptoms include marginal, flecked, and/or intercostal necrotic areas that initially appear water-soaked and dullish green. This type of injury generally occurs to younger leaves. Chronic injury usually is evident by signs of chlorosis, bronzing, premature senescence, reduced growth, and possible tissue necrosis (EPA, 1982).

Many studies have been conducted to determine the effects of high-concentration, short-term SO_2 exposure on vegetation. Sensitive plants include ragweed, legumes, blackberry, southern pine, and red and black oak. These species are potentially injured by 3-hour exposure to SO_2 concentrations ranging from 790-1,570 $\mu g/m^3$. Intermediate plants include locust and sweetgum; these species can be injured by 3-hour exposure to SO_2 concentrations ranging from 1,570-2,100 $\mu g/m^3$. Resistant species, which are not injured at concentrations below 2,100 ug/m^3 for 3 hours, include white oak and dogwood (EPA, 1982). A study of native Floridian vegetation species (Woltz and Howe, 1991) demonstrated that pine, cypress, oak, and mangrove exposed to 1,300 ug/m^3 SO_2 for 8 hours were not visibly damaged.

A recent study (Granat and Hallgren, 1992) considered the effects of low-concentration, long-term exposure of SO_2 on a pine forest by exposing the trees to 14-20 ug/m^3 of SO_2 over a long period. No adverse effects were reported; this study verified previous findings that forests have the capacity to take up wet-deposited sulfur compounds at low concentrations over long periods. Taylor and Bell (1988) evaluated exposure of grasses to SO_2 and reported similar results of no adverse effects at low concentrations over long periods.

No information is available on the sensitivity of sugar cane to SO_2. There has been no discernible damage to cane surrounding the present facilities. Table 7-1 presents concentrations of SO_2 known to adversely affect grasses which have been tested. Concentrations of SO_2 which affect sweet corn and tomatoes are also provided in Table 7-1, since these crops are grown in the region. Orchard grass exhibited reduced growth at concentrations approximating the predicted annual average, but all other species were adversely affected at SO_2 doses much higher than those predicted.

7.1.2.2 Nitrogen Oxides

The predicted maximum increase in annual concentrations of NO_x due to the proposed boiler No. 7 is less than 20 $\mu g/m^3$. No information is available on the sensitivity of sugar cane to NO_x; however, Ashenden (1979) reported no effect on orchard grass after exposure to 127 $\mu g/m^3$ NO_2 for 20 weeks.

Table 7-1

Lowest Doses of SO_2 Reported to Affect Growth of Sweet Corn, Tomato, and Some Grasses

Species	Lowest SO_2 Dose Known to Affect Species, ($\mu g/m^3$)	Reference
Rye Grass	367 for 131 days reduced growth	Ayazloo and Bell, 1981
Orchard Grass	37-62 for 72 days reduced growth	Crittenden and Read, 1979
Oats	1,048 for 3 hours four times during life cycle reduced growth	Heck and Dunning, 1978
Sweet Corn	812 for 7 days causes chlorosis, but no yield effects	Mandl et al., 1975
Tomato	1,258 for 5 hours on each of 57 days reduced growth	Kohut et al., 1982

Taylor and Bell (1988) evaluated exposure of grasses to NO_x and reported similar results of no adverse effects at low concentrations over long periods.

Fumigation of plants of five species: the kidney bean, tomato, radish, sunflower, and spinach with greater than 10,000 ug/m^3 of NO_2 in daylight caused no injury, while some injuries to leaves in darkness was reported for the kidney bean (Shimazaki et al., 1992). NO_2 was absorbed by the plant leaves in the dark. The level of accumulated NO_2^- was decreased by light much more rapidly in spinach leaves than in those of the kidney bean, with much less injury to spinach leaves than to those of the kidney bean leaves.

The above concentrations are much greater than that expected from the proposed facility, and thus no adverse impacts on vegetation from NO_x are expected.

7.1.2.3 Particulate Matter

Predicted maximum increase in the annual average concentration of PM due to the proposed boiler No. 7 is 15 $\mu g/m^3$. Plants are adversely affected by particulate matter only at grossly high concentrations that result in surface depositions of 1 to 4 g/m^2/day (Lerman and Darley, 1975). Surface deposition from the predicted maximum levels of particulates would be a small fraction of the levels known to impact plant growth and will have no significant effect on vegetation in the region of the site. The wet scrubbers controlling particulate matter emissions at the Clewiston mill will effectively capture a large portion of the PM in the exhaust gas streams of the boilers.

7.1.2.4 Carbon Monoxide

Carbon monoxide can be absorbed and metabolized photosynthetically by plants (U.S. EPA, 1979). Chronic effects on plant growth, yield, and reproduction may occur at exposures in excess of 1150 mg/m^3, while visible effects may occur only at much greater exposures (U.S. EPA, 1979). These levels are much greater than those for wildlife and several orders of magnitude greater than the levels expected from the proposed facility.

7.1.3 Impacts on Soils

The soils of the ENP are generally classified as histosols or entisols. Histosols (peat soils) are organic and have extremely high buffering capacities based on their cation exchange capacity (CEC), base saturation, and bulk density. Therefore, they would be relatively insensitive to atmospheric inputs. The entisols are shallow sandy soils overlying limestone, such as the soils found in the pinelands. The direct connection of these soils with subsurface limestone tends to neutralize any acidic inputs. Moreover, the groundwater table is highly buffered due to the interaction with subsurface limestone formations which results in high alkalinity [as calcium carbonate ($CaCO_3$)].

The potential and hypothesized effects of atmospheric deposition of SO_2 and NO_x include:

- Increased soil acidification
- Alteration in cation exchange
- Loss of base cations
- Mobilization of trace metals

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil CEC, is important in determining how a soil responds to atmospheric inputs.

Organic soils can adsorb SO_2, sulfates, and NO_x with little change in pH. Deposition of these gases can increase the acidity of sandy soils; however, the low concentrations resulting from the proposed source will have a negligible effect on soil pH. Soils in this area that are utilized for agriculture are commonly amended with lime, thus any tendency towards lower pH would be neutralized. Area crops may benefit from the additional sulfur and nitrogen in the soil.

The relatively low sensitivity of the soils to acid inputs coupled with the extremely low ground-level concentrations of contaminants projected for the facility emissions precludes any significant impact on soils.

7.1.4 Impacts on Wildlife

A wide range of physiological and ecological effects to fauna has been reported for gaseous and particulate pollutants (Newman, 1980; Newman and Schreiber, 1988). The most severe of these effects have been observed at concentrations above the secondary ambient air quality standards. Physiological and behavioral effects have been observed in experimental animals at or below these standards. No observable effects to fauna are expected at concentrations below the values reported in Table 7-1.

The major air quality risk to wildlife in the United States is from continuous exposure to pollutants above the national ambient air quality standards. This occurs in non-attainment areas, e.g., Los Angeles Basin. Risks to wildlife also may occur for wildlife living in the vicinity of an emission source that experiences frequent upsets of episodic conditions resulting from malfunctioning equipment, unique meteorological conditions, or startup operations (Newman and Schreiber, 1988). Under these conditions, chronic effects (e.g., particulate contamination) and acute effects (e.g., injury to health) have been observed (Newman, 1980).

The following sections discuss the lowest threshold values for observed effects on wildlife from exposure to SO_2, NO_x, CO and PM-10. These threshold values are several orders of magnitude greater than the maximum predicted concentrations for the Class I area. Therefore, it is expected that there will be no effects on wildlife AQRVs resulting from the modeled SO_2, NO_x, CO and PM-10 emissions or the ambient concentration in the potential impact area. These results are considered typical and representative of the risk from other air pollutants predicted to be emitted from the facility, and no effects on wildlife AQRVs are expected from any such other pollutants.

7.1.4.1 Sulfur Dioxide

The most sensitive effects of chronic exposure of mammals to SO_2 has generally been effects on pulmonary morphology and function. Changes in pulmonary morphology are a thickening of the mucous layer of the trachea and a hypertrophy of goblet cells and mucous glands, which resembles the pathology of chronic bronchitis in humans. These effects have been observed for rats exposed to 10 ppm (2,620 $\mu g/m^3$) SO_2 for 18 to 67 days (Dalhamn, 1956). A related effect, slowing of tracheal mucous transport, has been observed for dogs exposed daily to 1 ppm (2,620 $\mu g/m^3$) of SO_2 daily for a year (Hirsch et al., 1975), and rats receiving a daily minimum exposure of 0.1 ppm (262 $\mu g/m^3$) SO_2 for a total of 70 to 170 hours (Ferin and Leach, 1973). The basic change in pulmonary function is a measurable increase in flow resistance as a result of a mild degree of bronchial constriction. However, no increase in flow resistance was observed in guinea pigs that were exposed continuously to 0.13 to 5.72 ppm (341 to 14,986 $\mu g/m^3$) of SO_2 for a year or monkeys that were exposed continuously to 0.14 to 1.28 ppm (367 to 3,354 $\mu g/m^3$). Other examples of reported effects of sulfur dioxide on wildlife at concentrations below AAQS are shown in Table 7-2. These levels are one order of magnitude or more above the predicted maximum increase in annual ambient concentrations of SO_2 as a result of the proposed boiler No. 7.

7.1.4.2 Nitrogen Oxides

Nitrogen dioxide is a deep lung irritant, and the most sensitive effects of exposure to NO_2 are changes in pulmonary morphology. Damage to cells in the lungs of rats was observed for exposure to 1 ppm (1,880 $\mu g/m^3$) of NO_2 for one hour and 0.5 ppm (940 $\mu g/m^3$) of NO_2 for four hours, but the damage was repaired by the animals within 24 hours. More prolonged alterations in lung collagen occurred in rabbits that were exposed to 0.25 ppm (470 $\mu g/m^3$) of NO_2 daily for 4 hours for 6 days (Mueller and Hitchcock, 1969). Primary lesions in the alveoli occurred in squirrel monkeys that were exposed to a minimum of 10 ppm (18,800 $\mu g/m^3$) of NO_2 for 2 hours (Henry et al., 1969). At this concentration, there were many septal breaks and the alveoli were markedly expanded. Rats grew normally and survived for their natural life-spans in atmosphere containing a minimum of 0.8 ppm (1500 $\mu g/m^3$) NO_2, although they exhibited moderate tachypnea (i.e. increased breathing rate) but without apparent distress (Freeman et al., 1972). These levels are more than an order of magnitude

Table 7-2

Examples of Reported Effects of Sulfur Dioxide on Wildlife at Concentrations Below National Secondary Ambient Air Quality Standards

Reported Effect	Concentration ($\mu g/m^3$)	Exposure
Respiratory stress in guinea pigs	427 to 854	1 hour
Respiratory stress in rats	267	7 hours/day; 5 day/week for 10 weeks
Decreased abundance in deer mice	13 to 157	Continually for 5 months

greater than that expected from the proposed facility, and therefore no adverse impacts on wildlife from NO_x are expected.

7.1.4.3 Particulate Matter (PM-10)

Little data was found on PM-10 animal studies, but national ambient air quality standards for PM-10 are a 24-hour standard of 150 $\mu g/m^3$ and an annual standard of 50 $\mu g/m^3$. Studies have found acute effects of particulate pollution on lung function in human children after air pollution episodes where maximal 24-hour mean particulate concentrations were 312 $\mu g/m^3$ (Ohio: Dockery et al., 1989) and 200 $\mu g/m^3$ (Netherlands: Dassen et al., 1986). These levels are more than an order of magnitude greater than expected from the proposed facility, and therefore no adverse impacts on wildlife are expected.

7.1.4.4 Carbon Monoxide

Carbon monoxide is classed as a chemical asphyxiant, because it binds with hemoglobin and reduces the oxygen-transporting capacity of the blood. The effects of chronic exposure to CO may result from myocardial or nervous damage (U.S. EPA, 1979). Dogs that were exposed to 115 mg/m^3 CO continuously or intermittently, 7 days a week for 6 to 11 weeks, exhibited abnormal electrocardiograms (EKGs) and cardiac muscle degeneration (Lewey and Drabkin, 1944; Ehrich et al., 1944; Lindenberg et al., 1962; Preziosi et. al., 1970). Dogs that were exposed to 58 mg/m^3 CO, 7 days a week for 3 months in one study exhibited no effect (Musselman et al., 1959), while in another study lasting 11 weeks, they exhibited abnormal EKGs (Lindenberg et al., 1962). Cynomolgus monkeys that were exposed to 23 or 77.5 mg/m^3 for 22 hours a day, 7 days a week for 2 years) did not exhibit any cardiac effects. Lewey and Drabkin demonstrated alterations in gait in dogs exposed for 11 weeks to 115 mg/m^3 CO, but Musselman et al. found no effect on activity levels of rats exposed to 58 mg/m^3 for 3 months. These levels are orders of magnitude greater than the predicted maximum increase in annual concentrations of CO as a result of the proposed boiler No. 7, and therefore no adverse impacts on wildlife are expected.

7.2 IMPACTS ON VISIBILITY

The visibility analysis required by PSD regulations under Additional Impact Analysis is distinct from that required for Class I areas. This visibility impairment analysis is concerned with impacts that occur within the significant impact area of the proposed project.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the Workbook for Plume Visual Impact Screening and Analysis (EPA, 1988c). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used

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Table 7-3

Visual Effects Screening Analysis for
Source: USSC-Clewiston, Boiler 7
Class I Area: Everglades National Park

*** Level-1 Screening ***

Input Emissions for

Particulates	13.95	G /S
NOx (as NO2)	24.19	G /S
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4	.50	G /S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	102.00 km
Min. Source-Class I Distance:	102.00 km
Max. Source-Class I Distance:	175.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	102.0	84.	2.00	.306	.05	.003
SKY	140.	84.	102.0	84.	2.00	.061	.05	-.003
TERRAIN	10.	84.	102.0	84.	2.00	.070	.05	.001
TERRAIN	140.	84.	102.0	84.	2.00	.018	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	95.2	104.	2.00	.325	.05	.003
SKY	140.	65.	95.2	104.	2.00	.063	.05	-.003
TERRAIN	10.	55.	91.3	114.	2.00	.092	.05	.001
TERRAIN	140.	55.	91.3	114.	2.00	.024	.05	.001

for this analysis. Model input and output results are presented in Table 7-3. The total PM, NO_x, and sulfuric acid mist emissions from the proposed facility, as presented in Section 3.4, were used as input to the model. As indicated, the maximum visibility impacts caused by the facility do not exceed the screening criteria. As a result, there is no significant impact upon visibility predicted in the significant impact area or for the ENP Class I area.

7.3 IMPACTS DUE TO ASSOCIATED POPULATION GROWTH

There will be a small number of temporary construction workers during construction. There will be no new permanent employees at the Clewiston Mill associated with the operation of boiler No. 7. With no associated industrial, commercial, or residential growth, there will thus be no growth-related air pollution impacts in the area due to the project.

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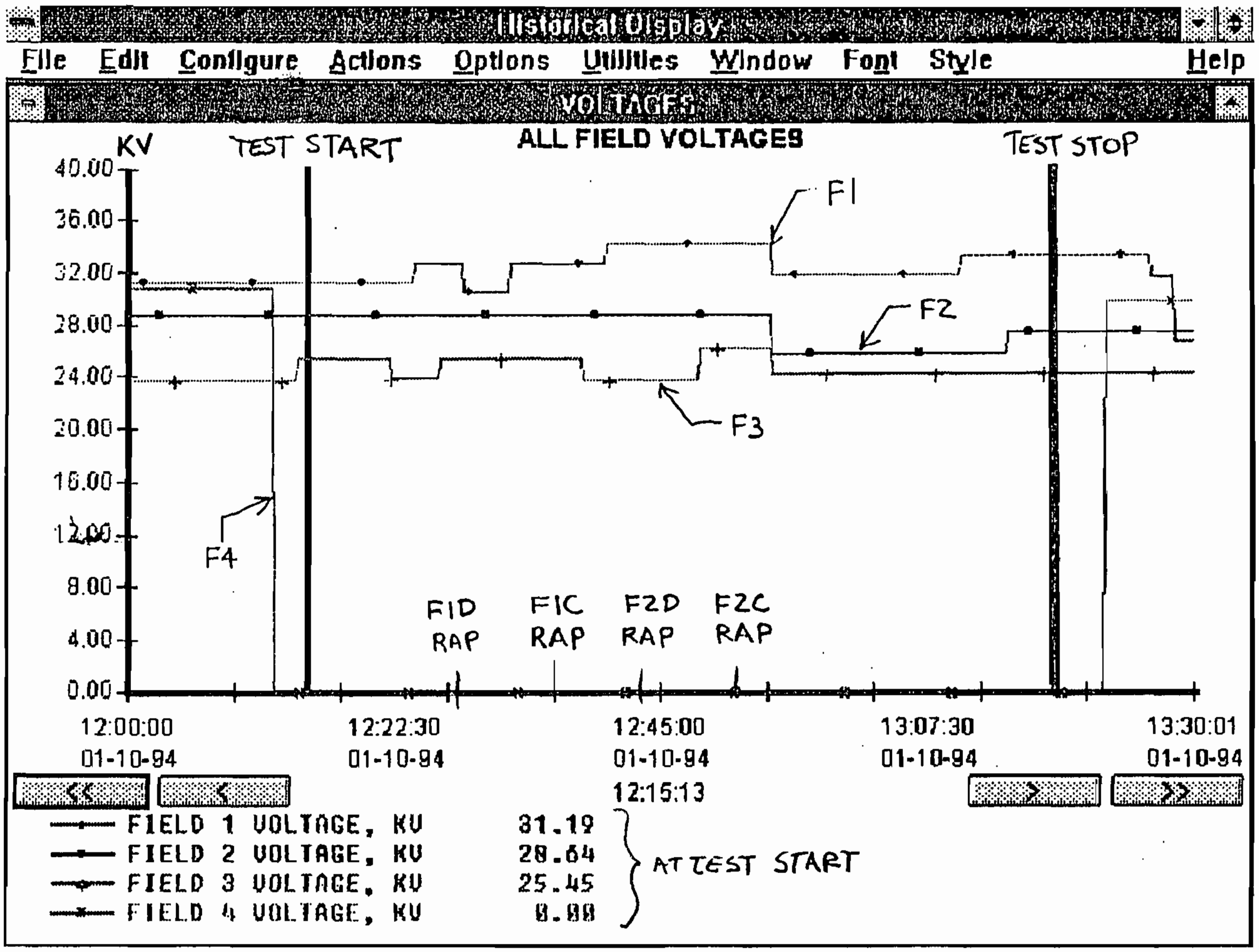
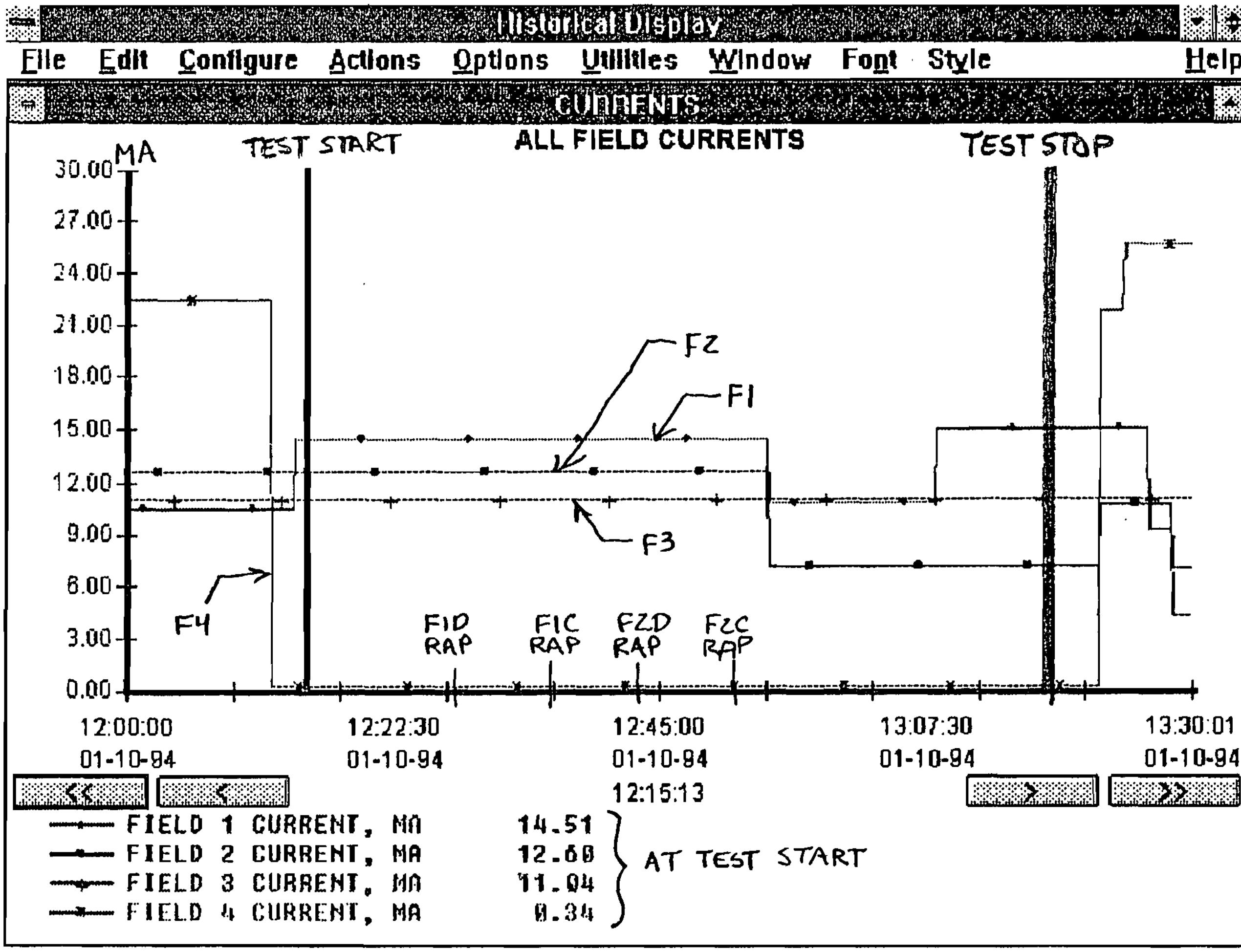
APPENDIX 4

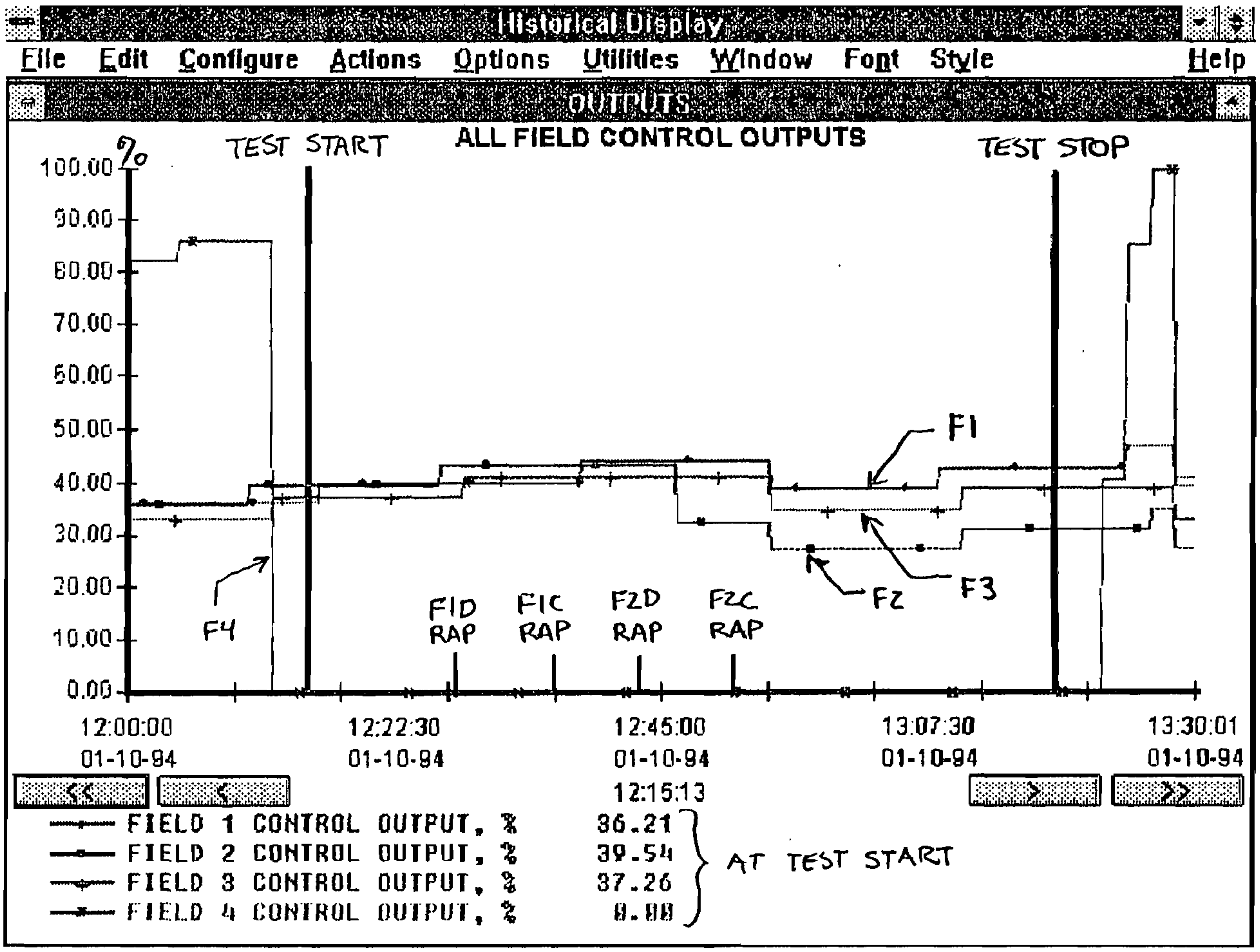
EP Operating Data


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F1
F2
F3
F4
F1D RAP
F1C RAP
F2D RAP
F2C RAP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
12:00:00 01-10-94
12:22:30 01-10-94
12:45:00 01-10-94
13:07:30 01-10-94
13:30:01 01-10-94
12:15:13
FIELD 1 VOLTAGE, KV 31.19
FIELD 2 VOLTAGE, KV 28.64
FIELD 3 VOLTAGE, KV 25.45
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

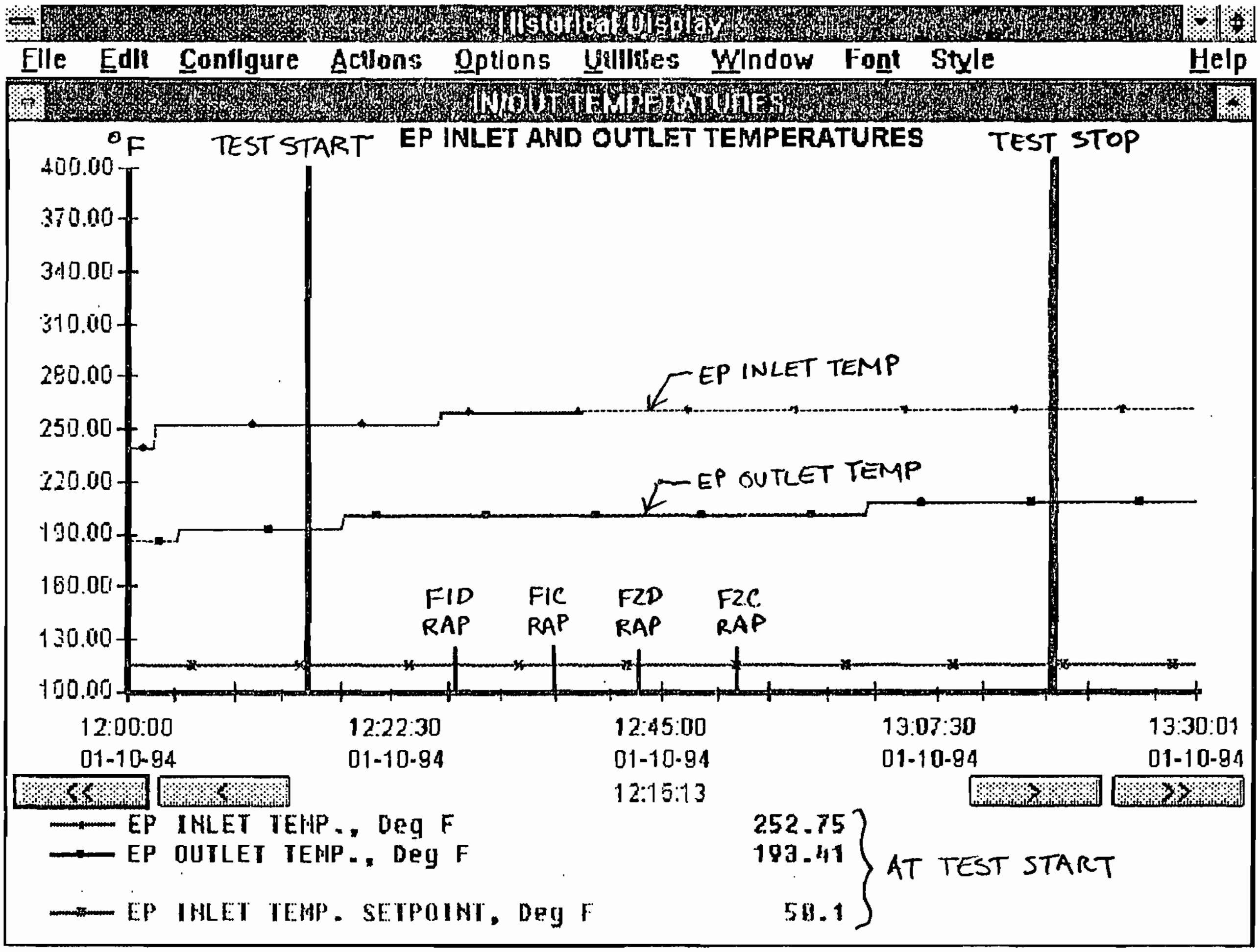
DRY EP TEST 1.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F2
F1
F3
F4
F1D RAP
F1C RAP
F2D RAP
F2C RAP
12:00:00 01-10-94
12:22:30 01-10-94
12:45:00 01-10-94
13:07:30 01-10-94
13:30:01 01-10-94
12:15:13
FIELD 1 CURRENT, MA 14.51
FIELD 2 CURRENT, MA 12.60
FIELD 3 CURRENT, MA 11.04
FIELD 4 CURRENT, MA 0.34
AT TEST START

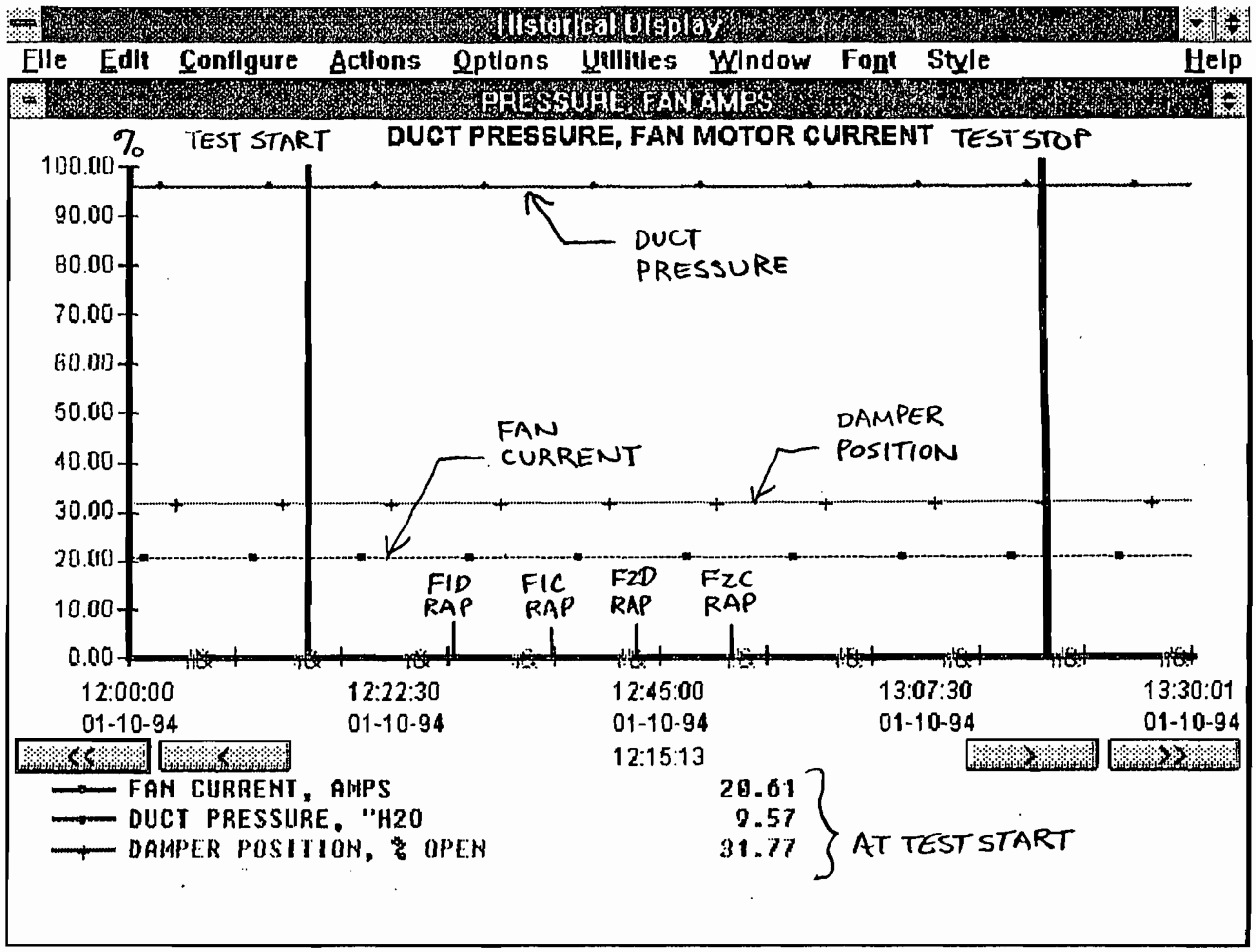
DRY EP TEST 1.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F4
F1D RAP
F1C RAP
F2D RAP
F2C RAP
F1
F2
F3
12:00:00 01-10-94
12:22:30 01-10-94
12:45:00 01-10-94
13:07:30 01-10-94
13:30:01 01-10-94
12:15:13
FIELD 1 CONTROL OUTPUT, % 36.21
FIELD 2 CONTROL OUTPUT, % 39.54
FIELD 3 CONTROL OUTPUT, % 37.26
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

DRY EP TEST 1.

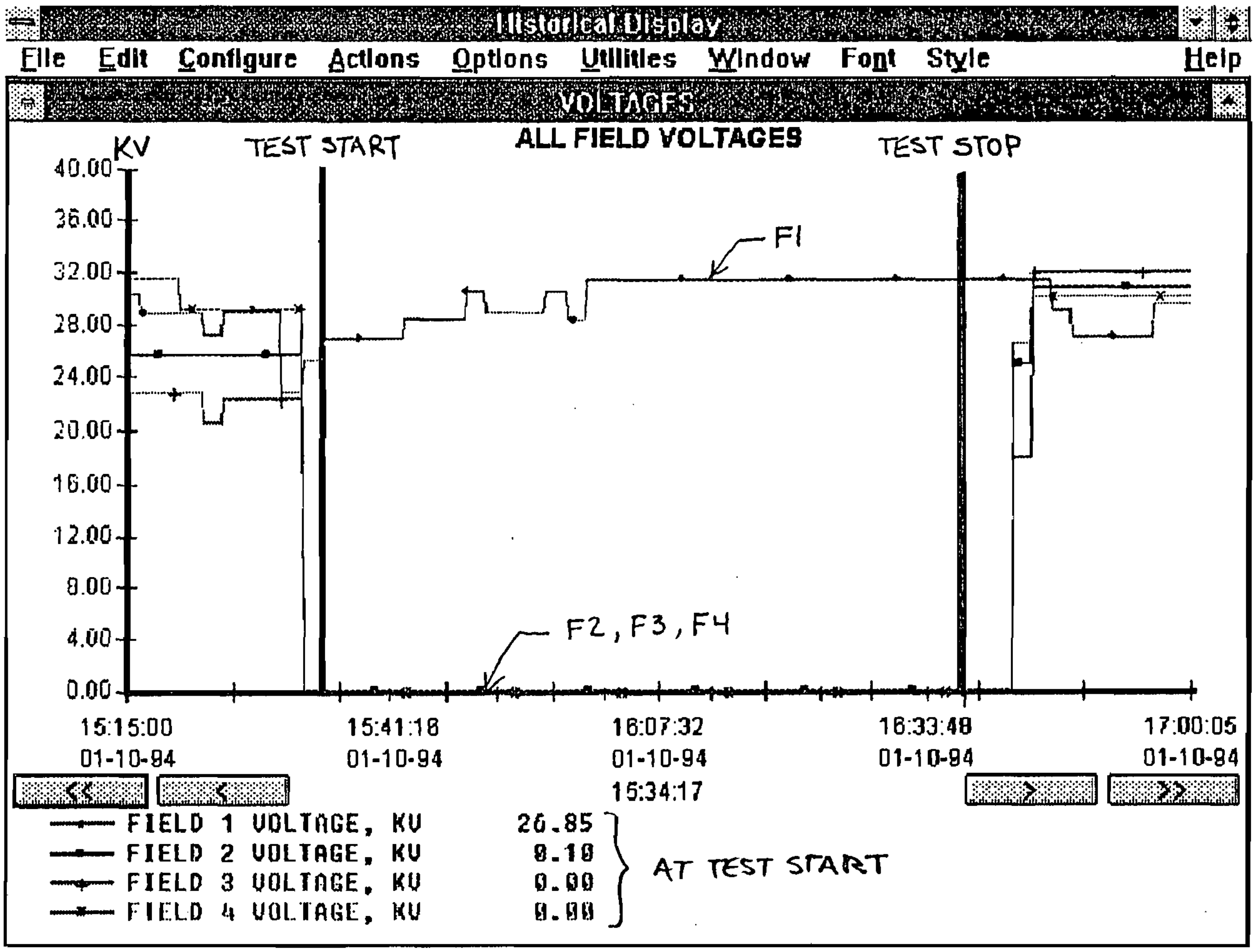

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
F1D RAP
F1C RAP
F2D RAP
F2C RAP
12:00:00 01-10-94
12:22:30 01-10-94
12:45:00 01-10-94
13:07:30 01-10-94
13:30:01 01-10-94
12:15:13
EP INLET TEMP., Deg F 252.75
EP OUTLET TEMP., Deg F 193.41
EP INLET TEMP. SETPOINT, Deg F 58.1
AT TEST START

DRY EP TEST 1.



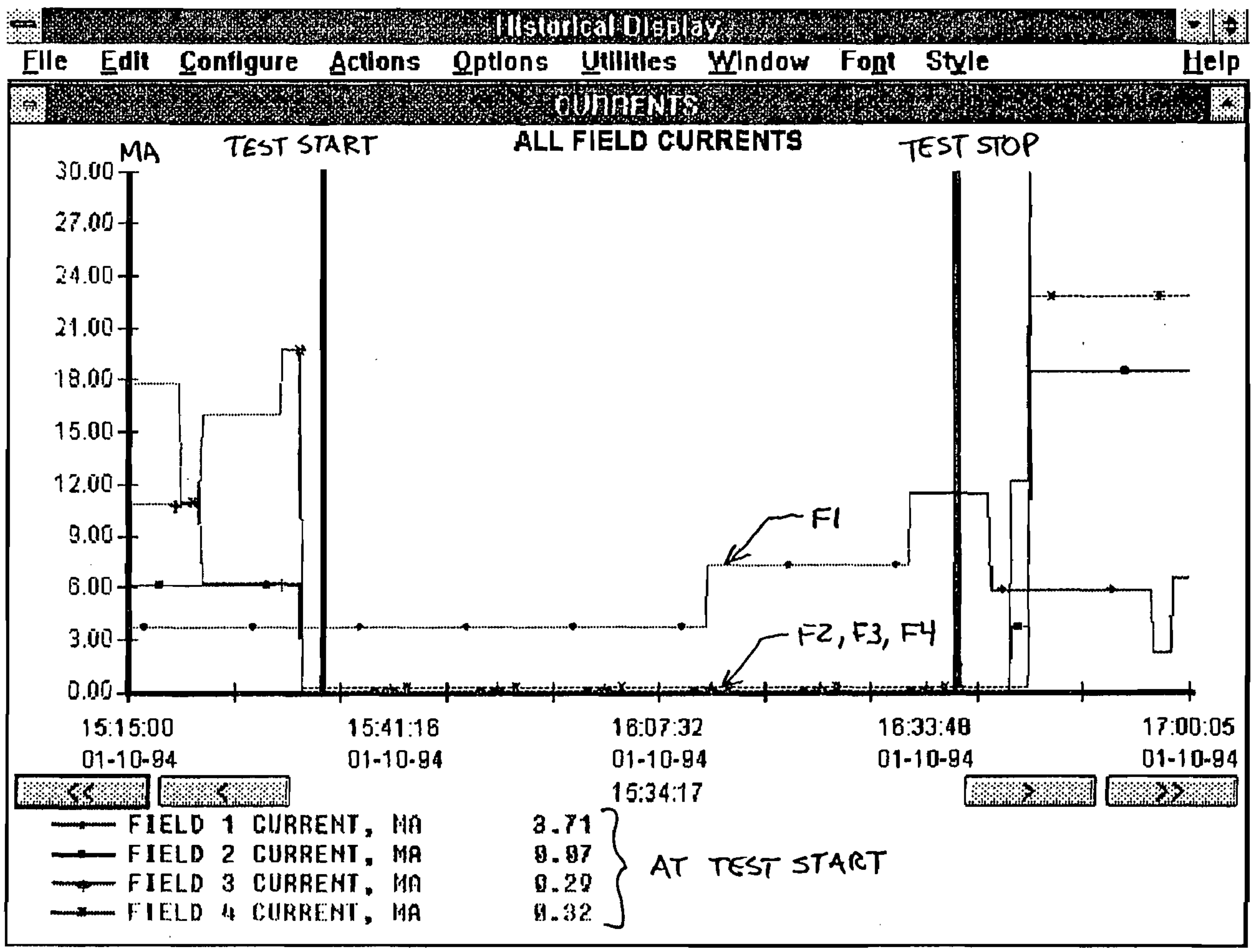
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DUCT PRESSURE
FAN CURRENT
DAMPER POSITION
F1D RAP
F1C RAP
F2D RAP
F2C RAP
12:00:00 01-10-94
12:22:30 01-10-94
12:45:00 01-10-94
13:07:30 01-10-94
13:30:01 01-10-94
12:15:13
FAN CURRENT, AMPS 20.61
DUCT PRESSURE, "H20 9.57
DAMPER POSITION, % OPEN 31.77
AT TEST START

DRY EP TEST 1.

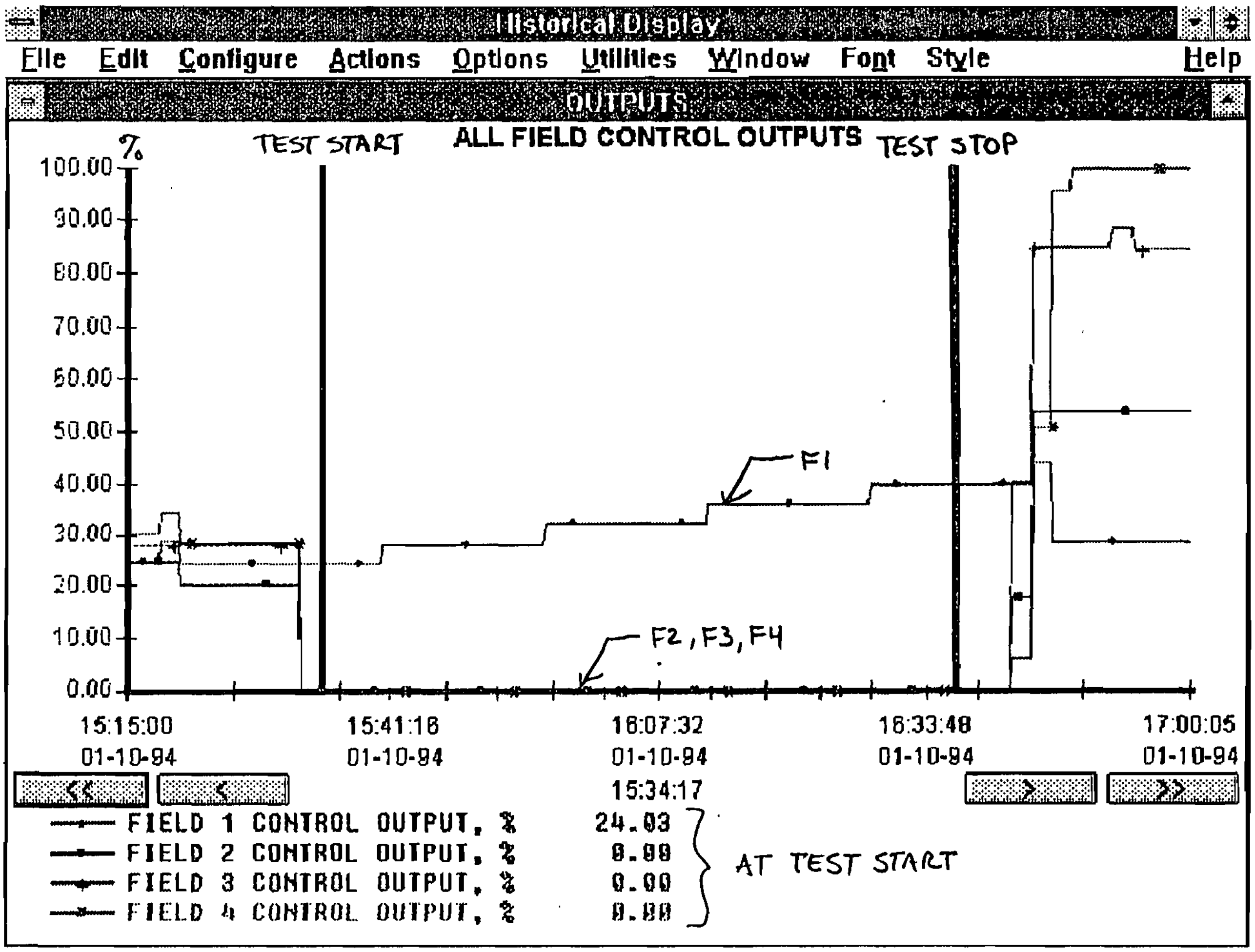


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
KV
TEST START
ALL FIELD VOLTAGES
TEST STOP
F1
F2, F3, F4
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
15:15:00 01-10-94
15:41:18 01-10-94
16:07:32 01-10-94
16:33:48 01-10-94
17:00:05 01-10-94
15:34:17
FIELD 1 VOLTAGE, KV 26.85
FIELD 2 VOLTAGE, KV 0.10
FIELD 3 VOLTAGE, KV 0.00
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

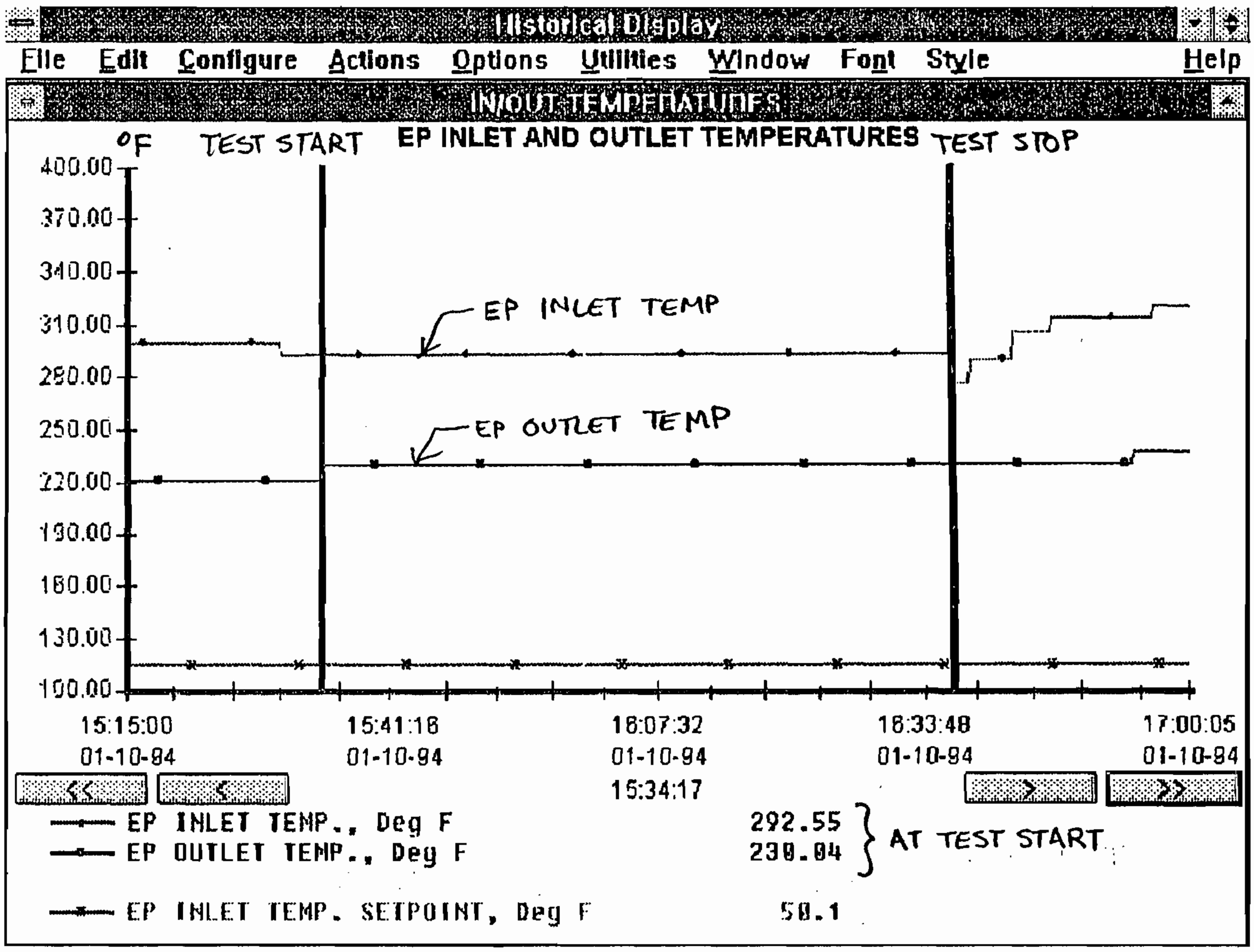
DRY EP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F1
F2, F3, F4
15:15:00 01-10-94
15:41:16 01-10-94
16:07:32 01-10-94
16:33:48 01-10-94
17:00:05 01-10-94
15:34:17
FIELD 1 CURRENT, MA 3.71
FIELD 2 CURRENT, MA 0.07
FIELD 3 CURRENT, MA 0.29
FIELD 4 CURRENT, MA 0.32
AT TEST START

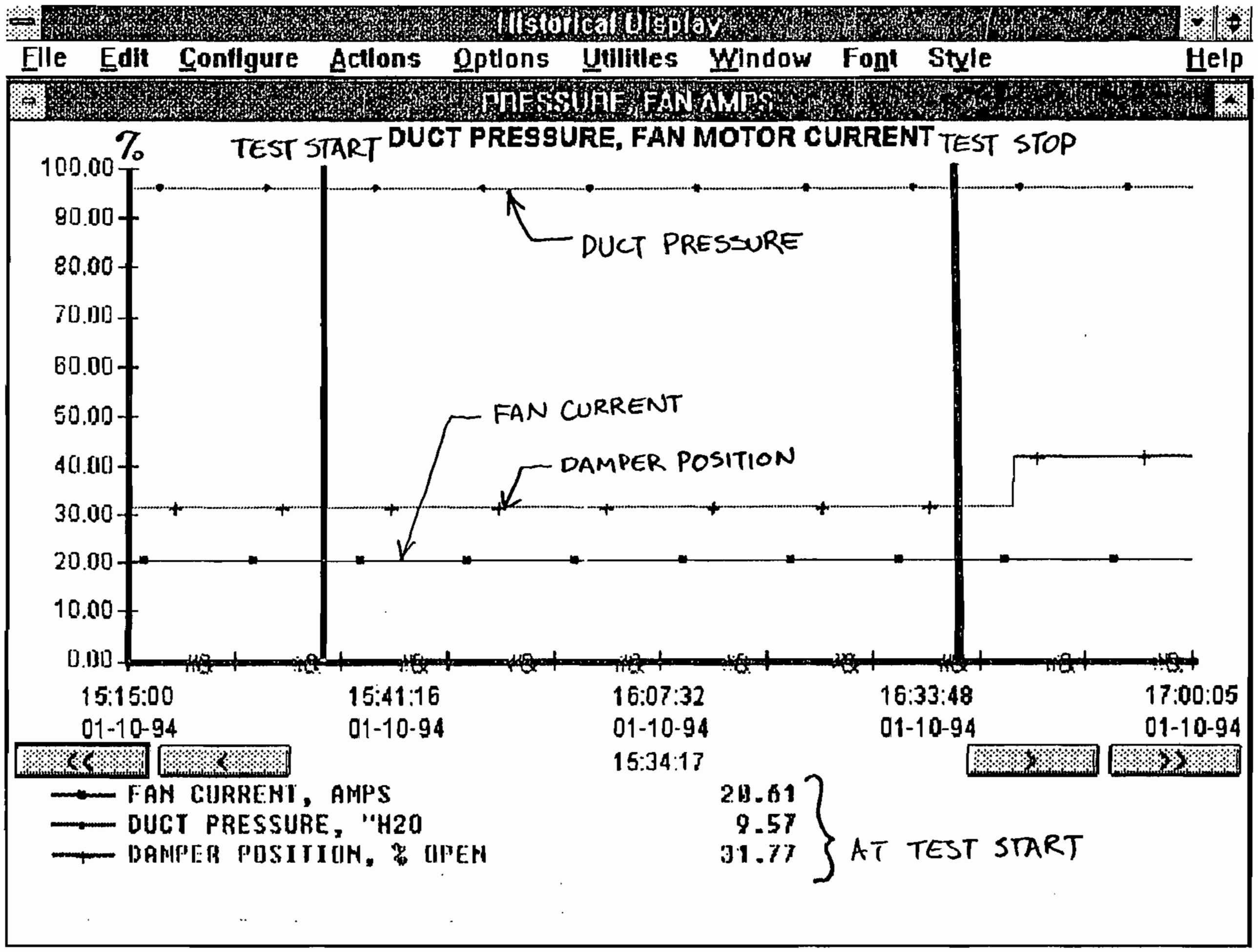
DRY EP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F1
F2, F3, F4
15:15:00 01-10-94
15:41:16 01-10-94
16:07:32 01-10-94
16:33:48 01-10-94
17:00:05 01-10-94
15:34:17
FIELD 1 CONTROL OUTPUT, % 24.03
FIELD 2 CONTROL OUTPUT, % 0.00
FIELD 3 CONTROL OUTPUT, % 0.00
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

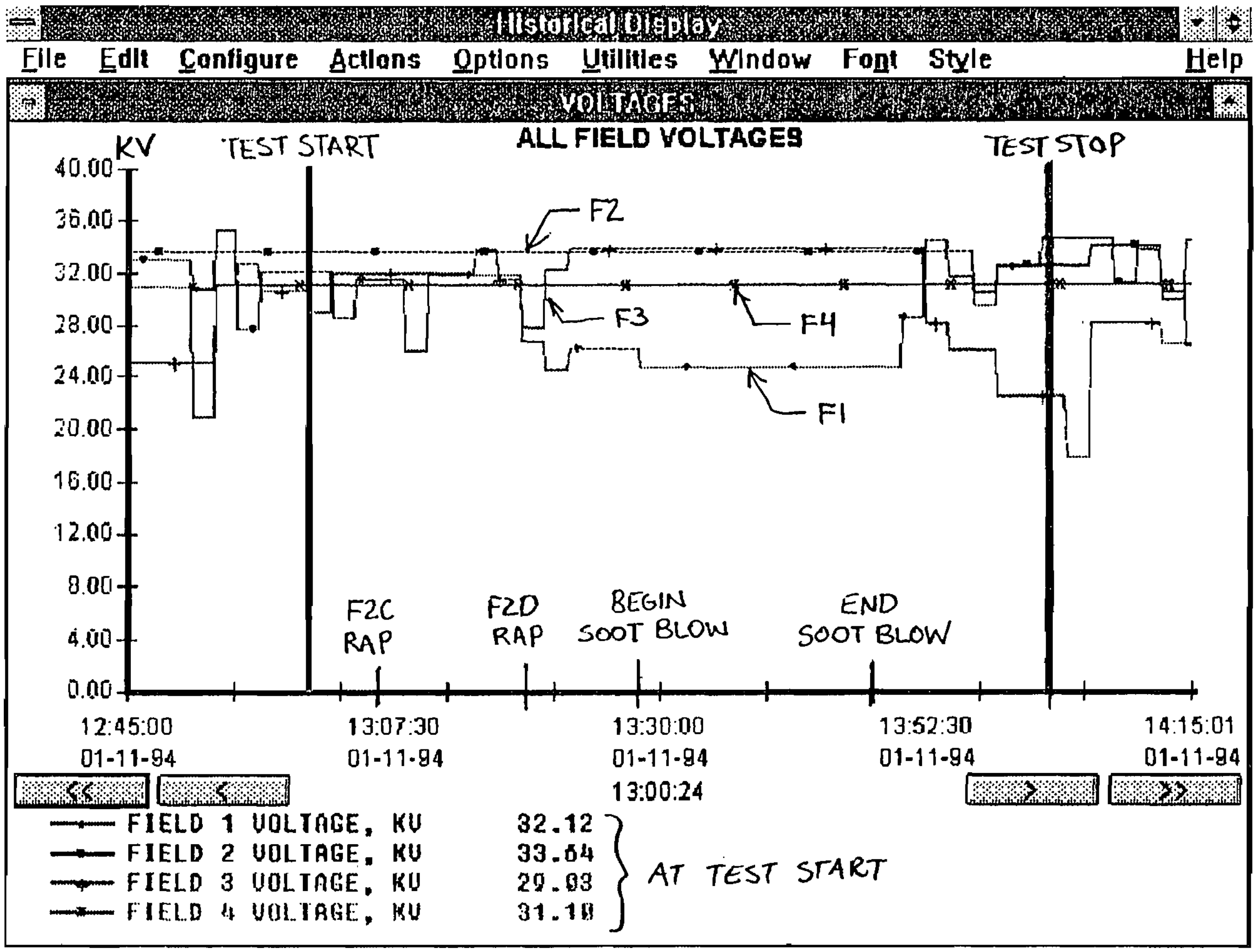
DRY EP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
°F
TEST START
EP INLET AND OUTLET TEMPERATURES
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
15:15:00 01-10-94
15:41:16 01-10-94
16:07:32 01-10-94
16:33:48 01-10-94
17:00:05 01-10-94
15:34:17
EP INLET TEMP., Deg F 292.55
EP OUTLET TEMP., Deg F 230.04
AT TEST START
EP INLET TEMP. SETPOINT, Deg F 50.1

DRY EP TEST 3.

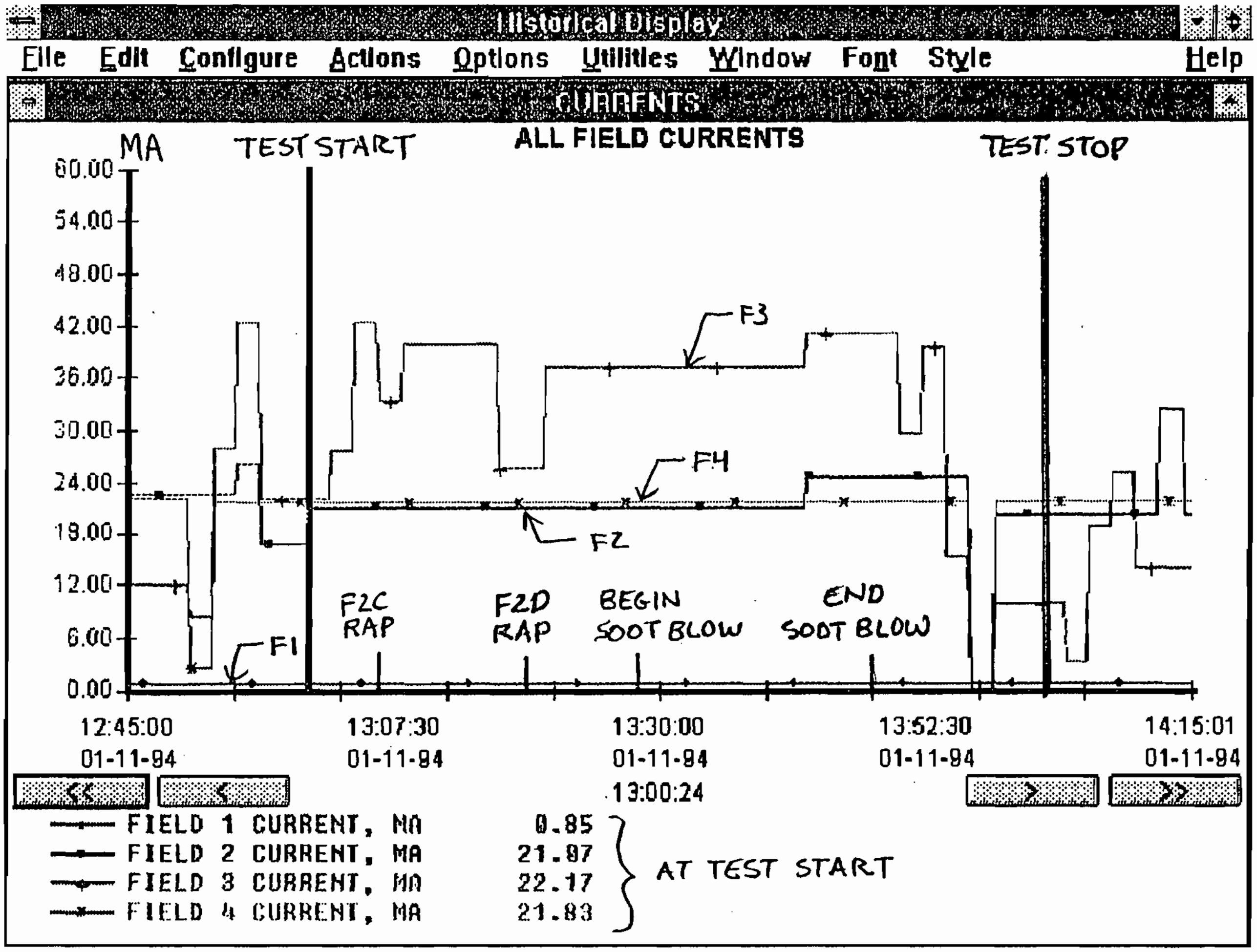

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DUCT PRESSURE
FAN CURRENT
DAMPER POSITION
15:15:00 01-10-94
15:41:16 01-10-94
16:07:32 01-10-94
16:33:48 01-10-94
17:00:05 01-10-94
15:34:17
FAN CURRENT, AMPS 20.61
DUCT PRESSURE, "H20 9.57
DAMPER POSITION, % OPEN 31.77
AT TEST START

DRY EP TEST 3.



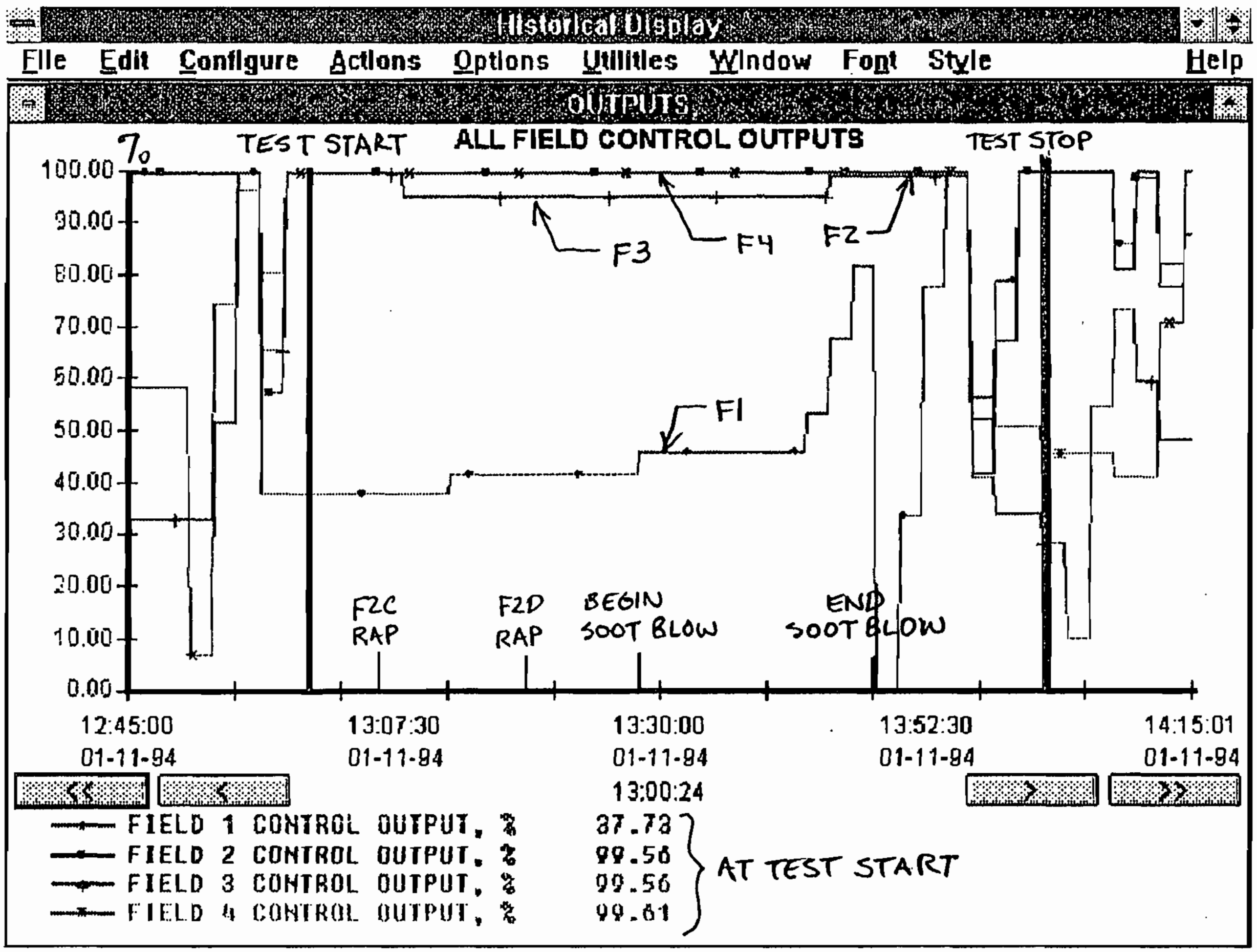
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F2
F3
F4
F1
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2C RAP
F2D RAP
BEGIN SOOT BLOW
END SOOT BLOW
12:45:00 01-11-94
13:07:30 01-11-94
13:30:00 01-11-94
13:52:30 01-11-94
14:15:01 01-11-94
13:00:24
FIELD 1 VOLTAGE, KV 32.12
FIELD 2 VOLTAGE, KV 33.64
FIELD 3 VOLTAGE, KV 29.03
FIELD 4 VOLTAGE, KV 31.10
AT TEST START

DRY EP TEST 7.

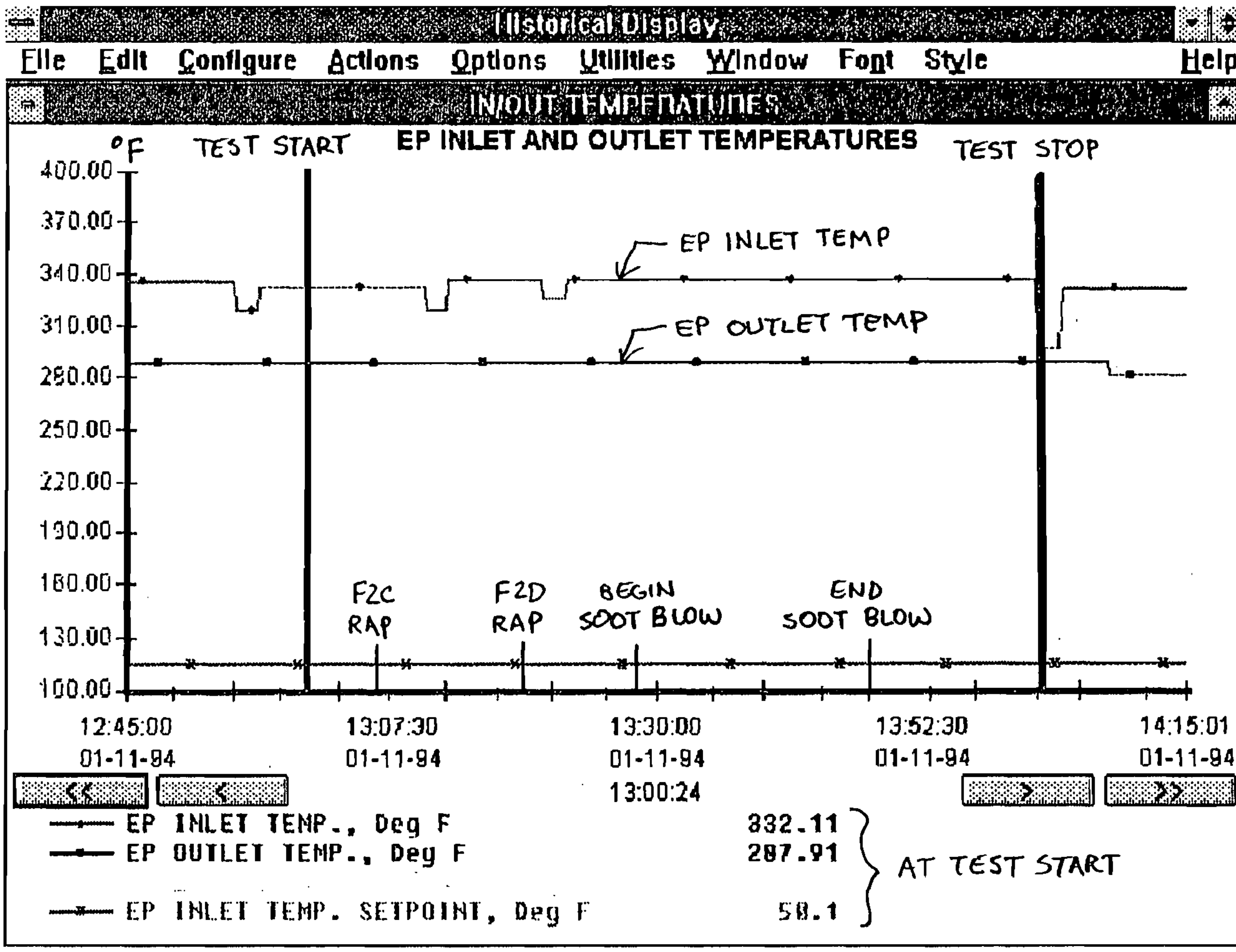


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
F3
F4
F2
F1
F2C RAP
F2D RAP
BEGIN SOOT BLOW
END SOOT BLOW
60.00
54.00
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
12:45:00 01-11-94
13:07:30 01-11-94
13:30:00 01-11-94
13:52:30 01-11-94
14:15:01 01-11-94
13:00:24
FIELD 1 CURRENT, MA 0.85
FIELD 2 CURRENT, MA 21.07
FIELD 3 CURRENT, MA 22.17
FIELD 4 CURRENT, MA 21.83
AT TEST START

DRY EP TEST 7.

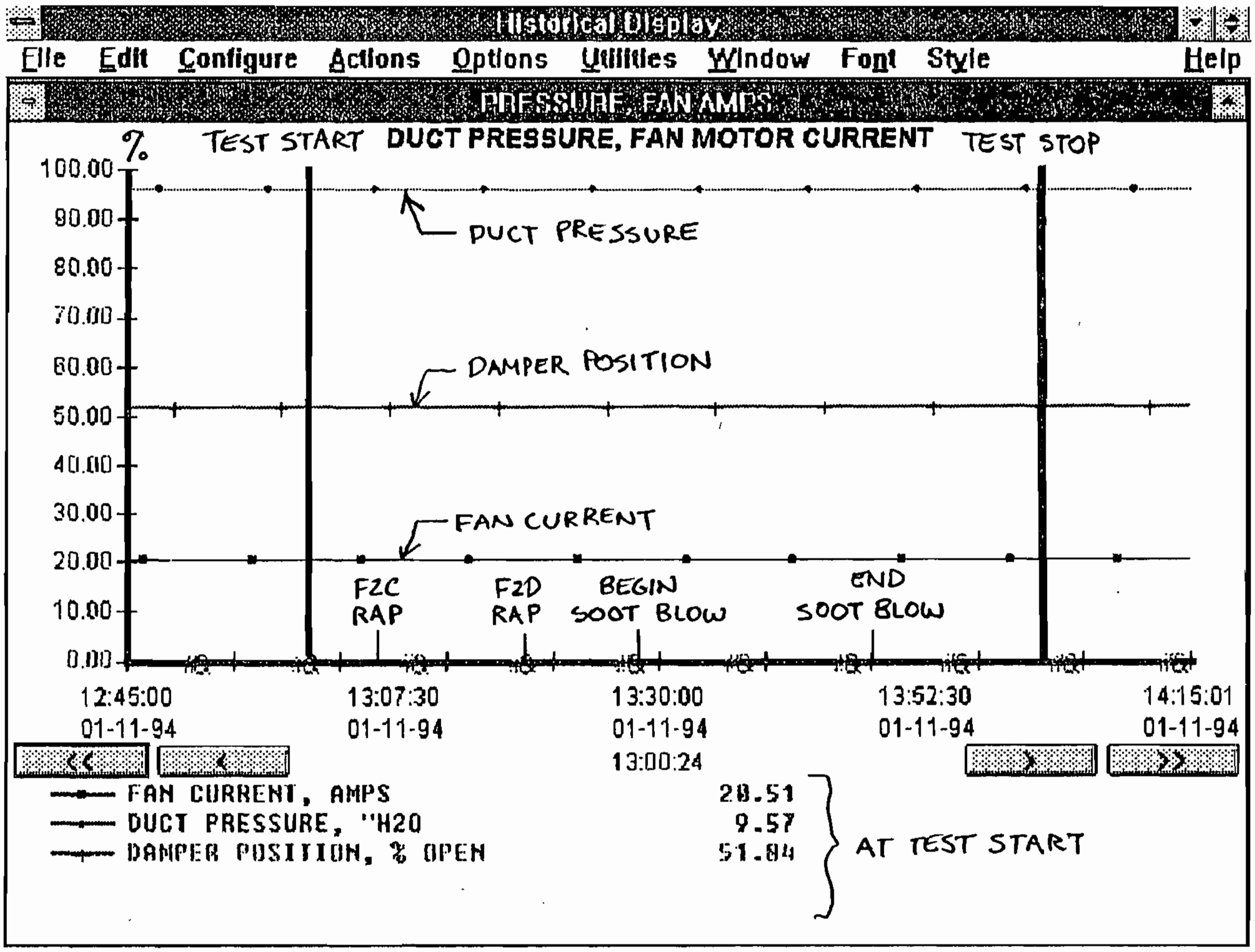

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
F3
F4
F2
F1
F2C RAP
F2D RAP
BEGIN SOOT BLOW
END SOOT BLOW
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
12:45:00 01-11-94
13:07:30 01-11-94
13:30:00 01-11-94
13:52:30 01-11-94
14:15:01 01-11-94
13:00:24
FIELD 1 CONTROL OUTPUT, % 37.73
FIELD 2 CONTROL OUTPUT, % 99.56
FIELD 3 CONTROL OUTPUT, % 99.56
FIELD 4 CONTROL OUTPUT, % 99.61
AT TEST START

DRY EP TEST 7.

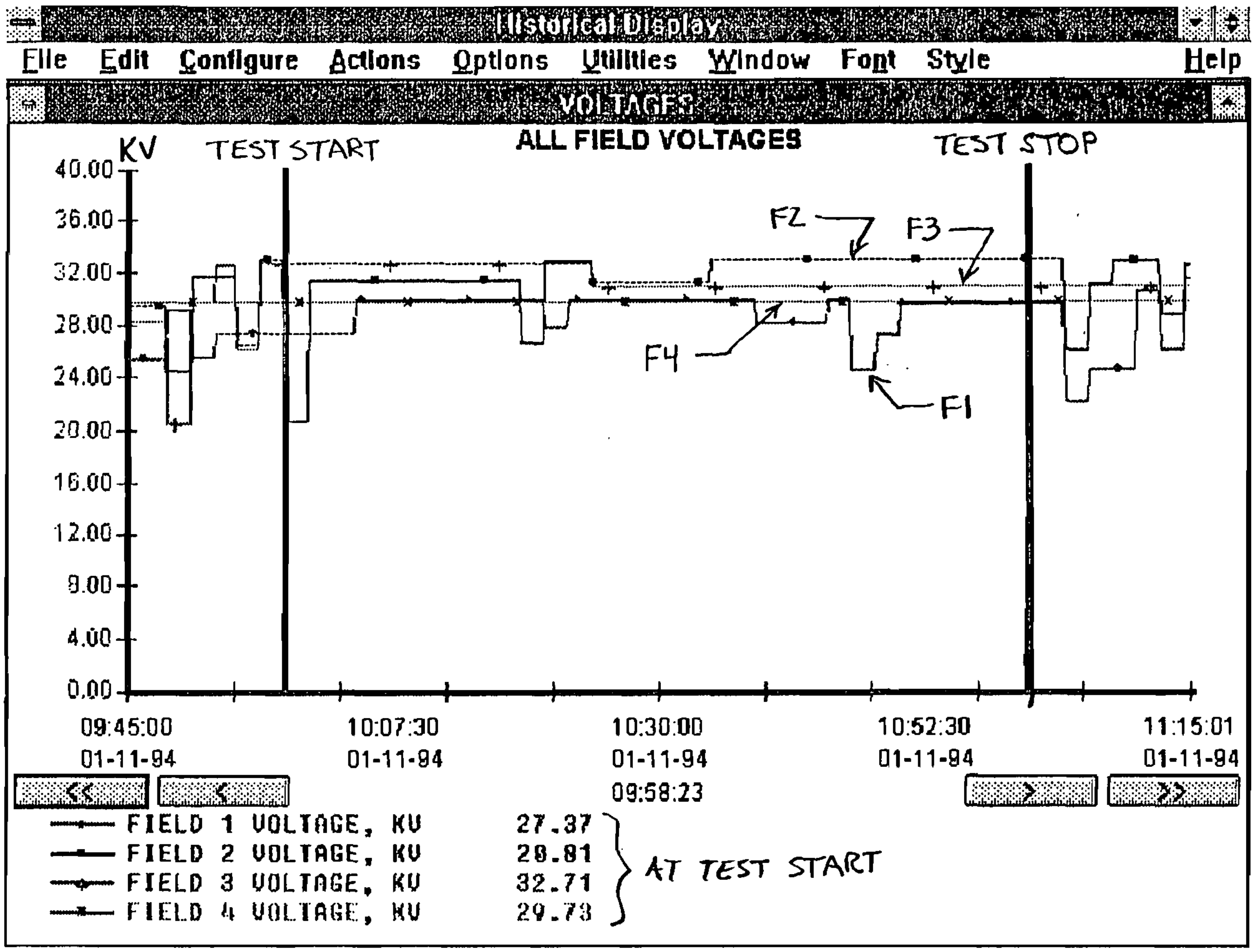


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
F2C RAP
F2D RAP
BEGIN SOOT BLOW
END SOOT BLOW
12:45:00 01-11-94
13:07:30 01-11-94
13:30:00 01-11-94
13:52:30 01-11-94
14:15:01 01-11-94
13:00:24
EP INLET TEMP., Deg F 332.11
EP OUTLET TEMP., Deg F 287.91
EP INLET TEMP. SETPOINT, Deg F 58.1
AT TEST START

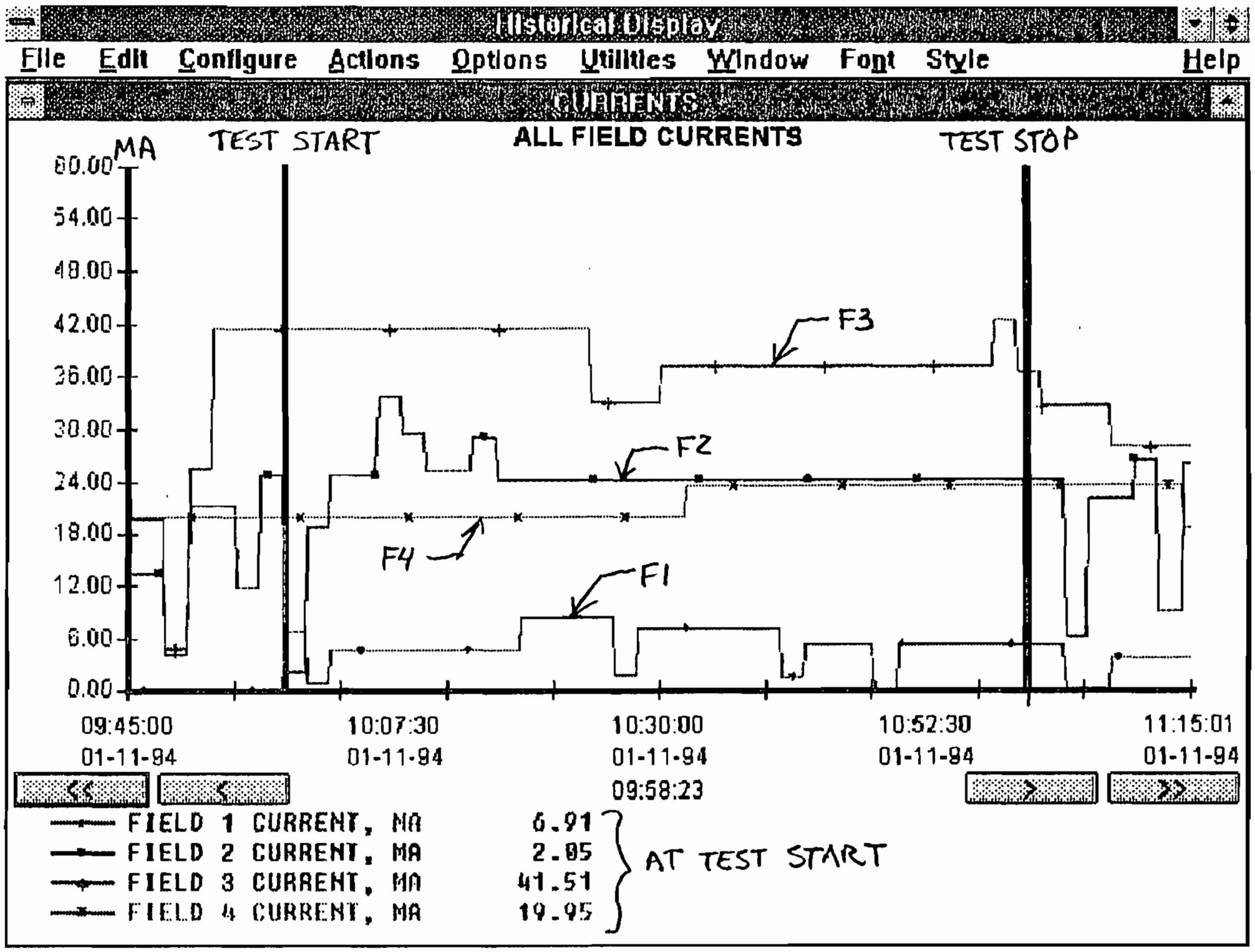
DRY EP TEST 7.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DUCT PRESSURE
DAMPER POSITION
FAN CURRENT
F2C RAP
F2D RAP
BEGIN SOOT BLOW
END SOOT BLOW
12:45:00 01-11-94
13:07:30 01-11-94
13:30:00 01-11-94
13:52:30 01-11-94
14:15:01 01-11-94
13:00:24
FAN CURRENT, AMPS 20.51
DUCT PRESSURE, "H2O 9.57
DAMPER POSITION, % OPEN 51.84
AT TEST START

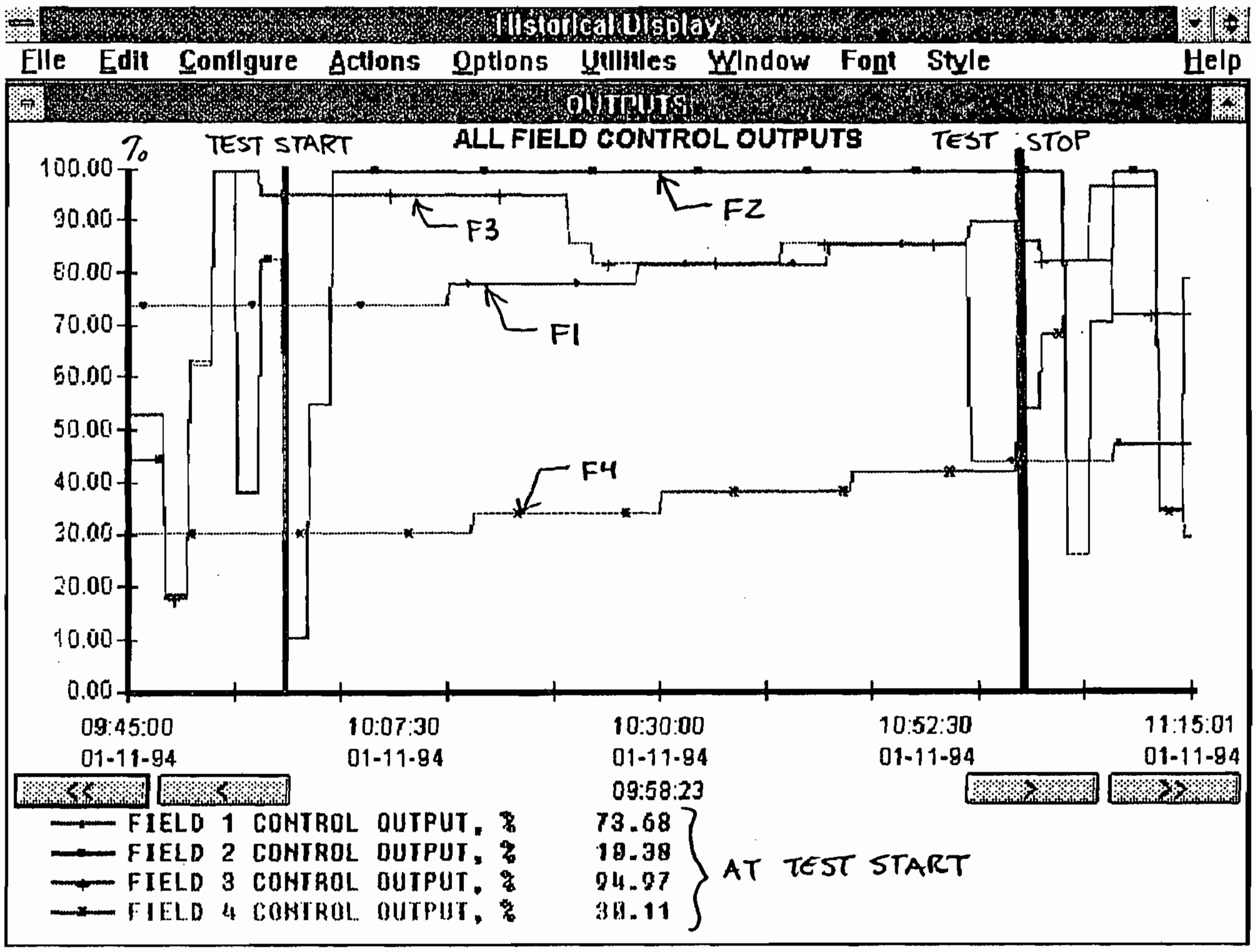
DRY EP TEST 7.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F2
F3
F4
F1
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
09:45:00 01-11-94
10:07:30 01-11-94
10:30:00 01-11-94
10:52:30 01-11-94
11:15:01 01-11-94
09:58:23
FIELD 1 VOLTAGE, KV 27.37
FIELD 2 VOLTAGE, KV 28.81
FIELD 3 VOLTAGE, KV 32.71
FIELD 4 VOLTAGE, KV 29.73
AT TEST START

DRY EP TEST 8.

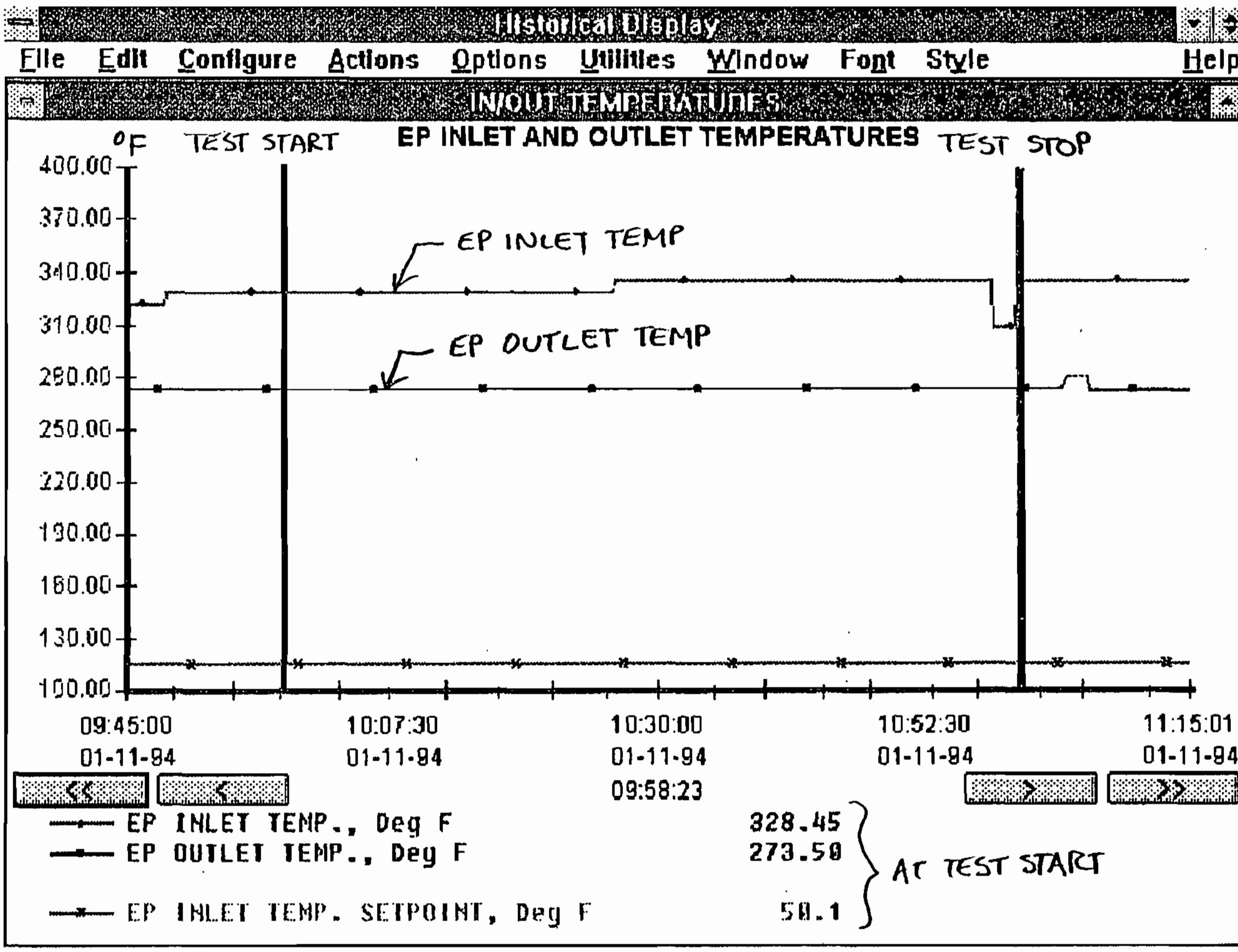

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
F1
F2
F3
F4
60.00
54.00
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
09:45:00 01-11-94
10:07:30 01-11-94
10:30:00 01-11-94 09:58:23
10:52:30 01-11-94
11:15:01 01-11-94
FIELD 1 CURRENT, MA 6.91
FIELD 2 CURRENT, MA 2.85
FIELD 3 CURRENT, MA 41.51
FIELD 4 CURRENT, MA 19.95
AT TEST START

DRY EP TEST 8.

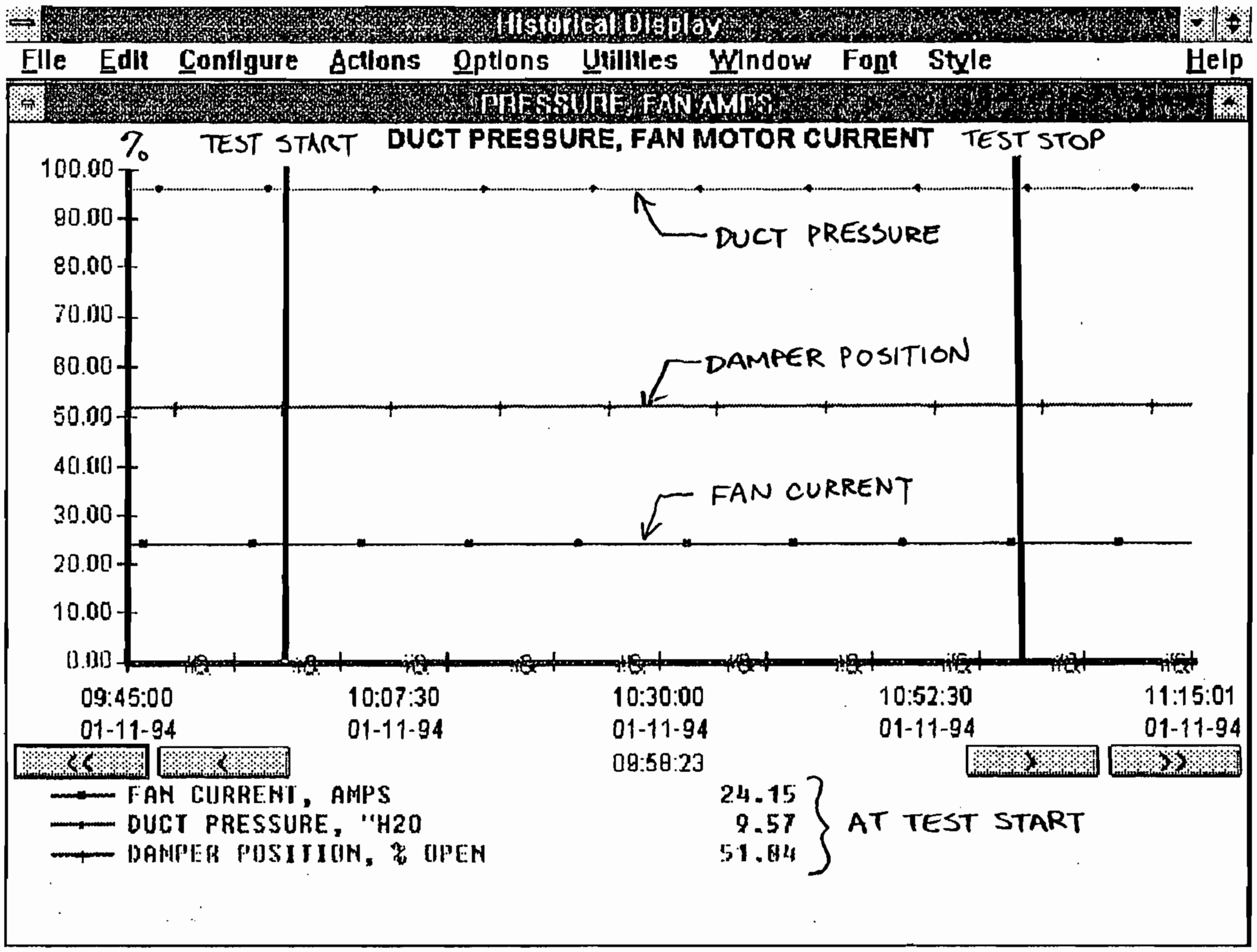


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F2
F3
F1
F4
09:45:00 01-11-94
10:07:30 01-11-94
10:30:00 01-11-94
10:52:30 01-11-94
11:15:01 01-11-94
09:58:23
FIELD 1 CONTROL OUTPUT, % 73.68
FIELD 2 CONTROL OUTPUT, % 10.38
FIELD 3 CONTROL OUTPUT, % 94.97
FIELD 4 CONTROL OUTPUT, % 30.11
AT TEST START

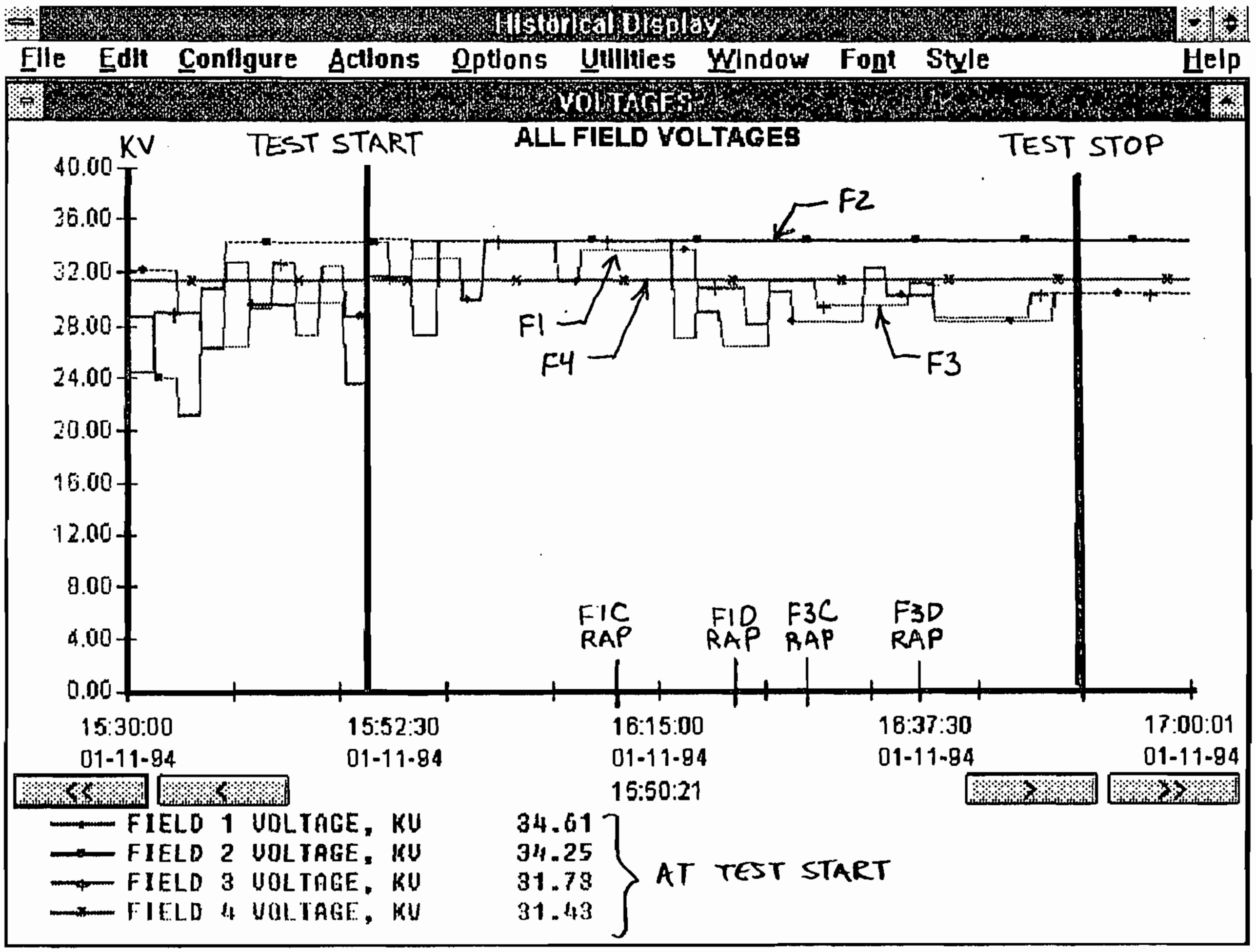
DRY EP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
°F
TEST START
EP INLET AND OUTLET TEMPERATURES
TEST STOP
EP INLET TEMP
EP OUTLET TEMP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
09:45:00 01-11-94
10:07:30 01-11-94
10:30:00 01-11-94
10:52:30 01-11-94
11:15:01 01-11-94
09:58:23
EP INLET TEMP., Deg F 328.45
EP OUTLET TEMP., Deg F 273.50
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

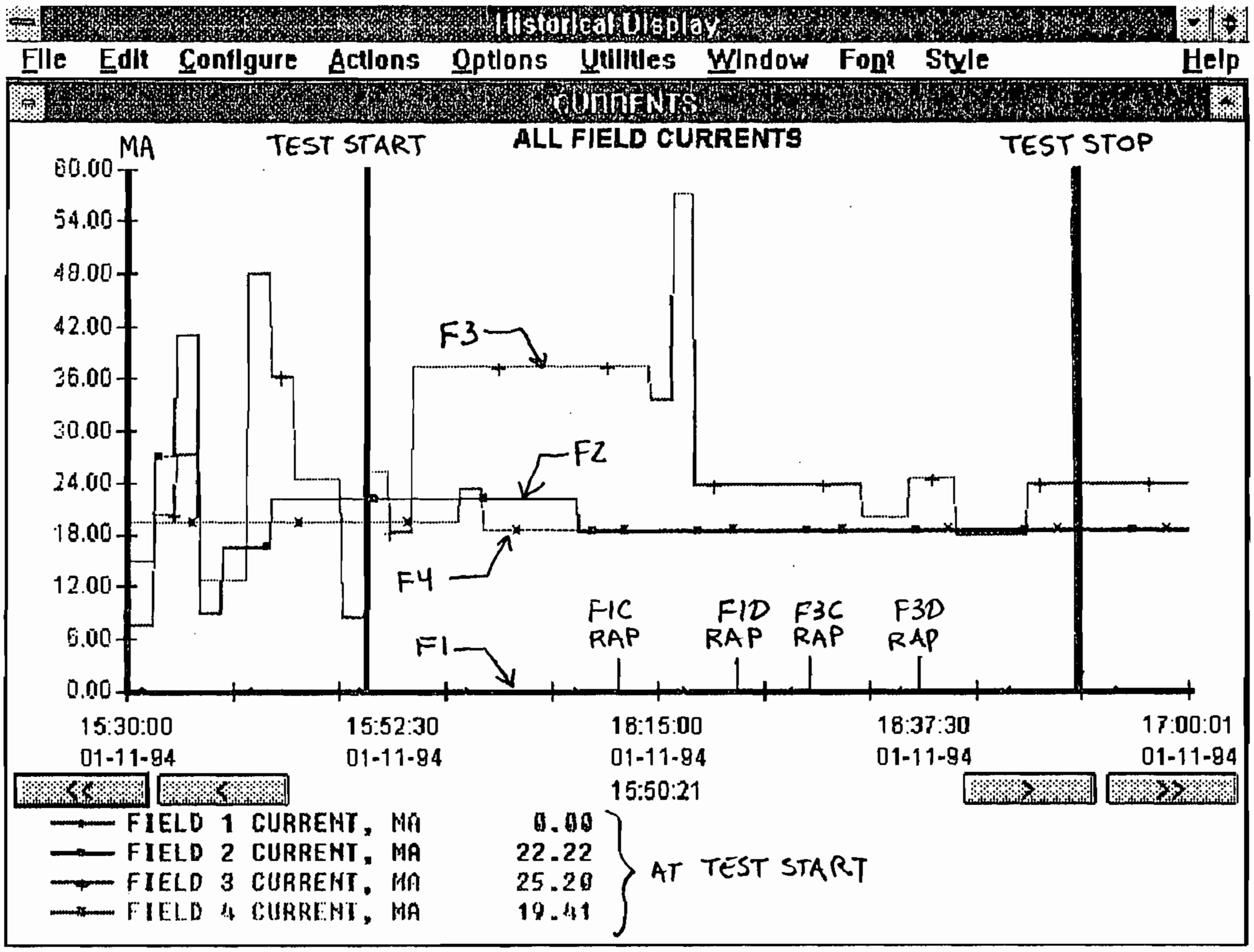
DRY EP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DUCT PRESSURE
DAMPER POSITION
FAN CURRENT
09:45:00 01-11-94
10:07:30 01-11-94
10:30:00 01-11-94
10:52:30 01-11-94
11:15:01 01-11-94
09:58:23
FAN CURRENT, AMPS 24.15
DUCT PRESSURE, "H20 9.57
DAMPER POSITION, % OPEN 51.84
AT TEST START

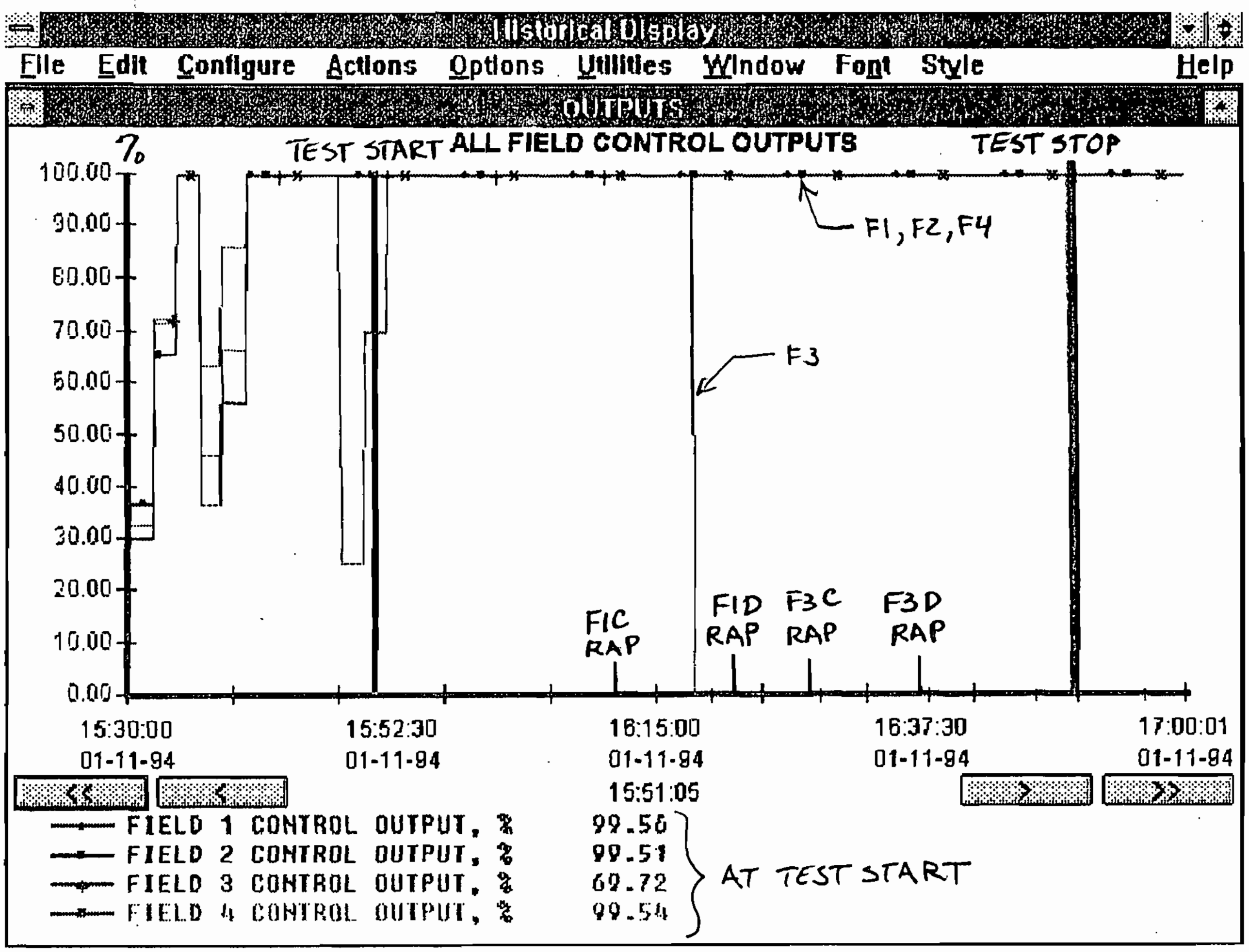
DRY EP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F2
F1
F4
F3
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F1C RAP
F1D RAP
F3C RAP
F3D RAP
15:30:00 01-11-94
15:52:30 01-11-94
16:15:00 01-11-94
16:37:30 01-11-94
17:00:01 01-11-94
15:50:21
FIELD 1 VOLTAGE, KV 34.61
FIELD 2 VOLTAGE, KV 34.25
FIELD 3 VOLTAGE, KV 31.73
FIELD 4 VOLTAGE, KV 31.43
AT TEST START

DRY EP TEST 9.

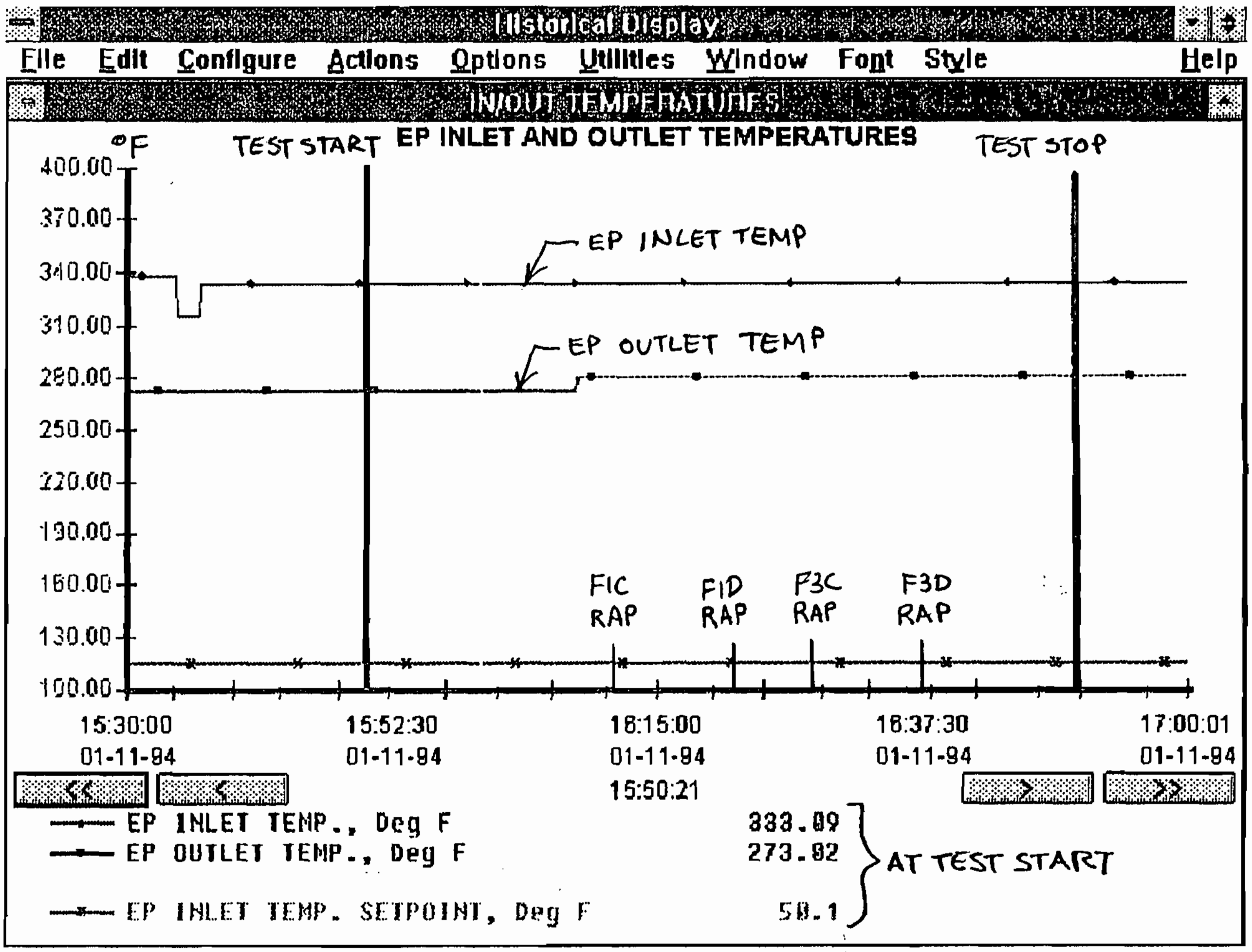

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
MA
TEST START
ALL FIELD CURRENTS
TEST STOP
60.00
54.00
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
F3
F2
F4
F1
F1C RAP
F1D RAP
F3C RAP
F3D RAP
15:30:00 01-11-94
15:52:30 01-11-94
16:15:00 01-11-94
16:37:30 01-11-94
17:00:01 01-11-94
15:50:21
FIELD 1 CURRENT, MA 0.00
FIELD 2 CURRENT, MA 22.22
FIELD 3 CURRENT, MA 25.20
FIELD 4 CURRENT, MA 19.41
AT TEST START

DRY EP TEST 9.

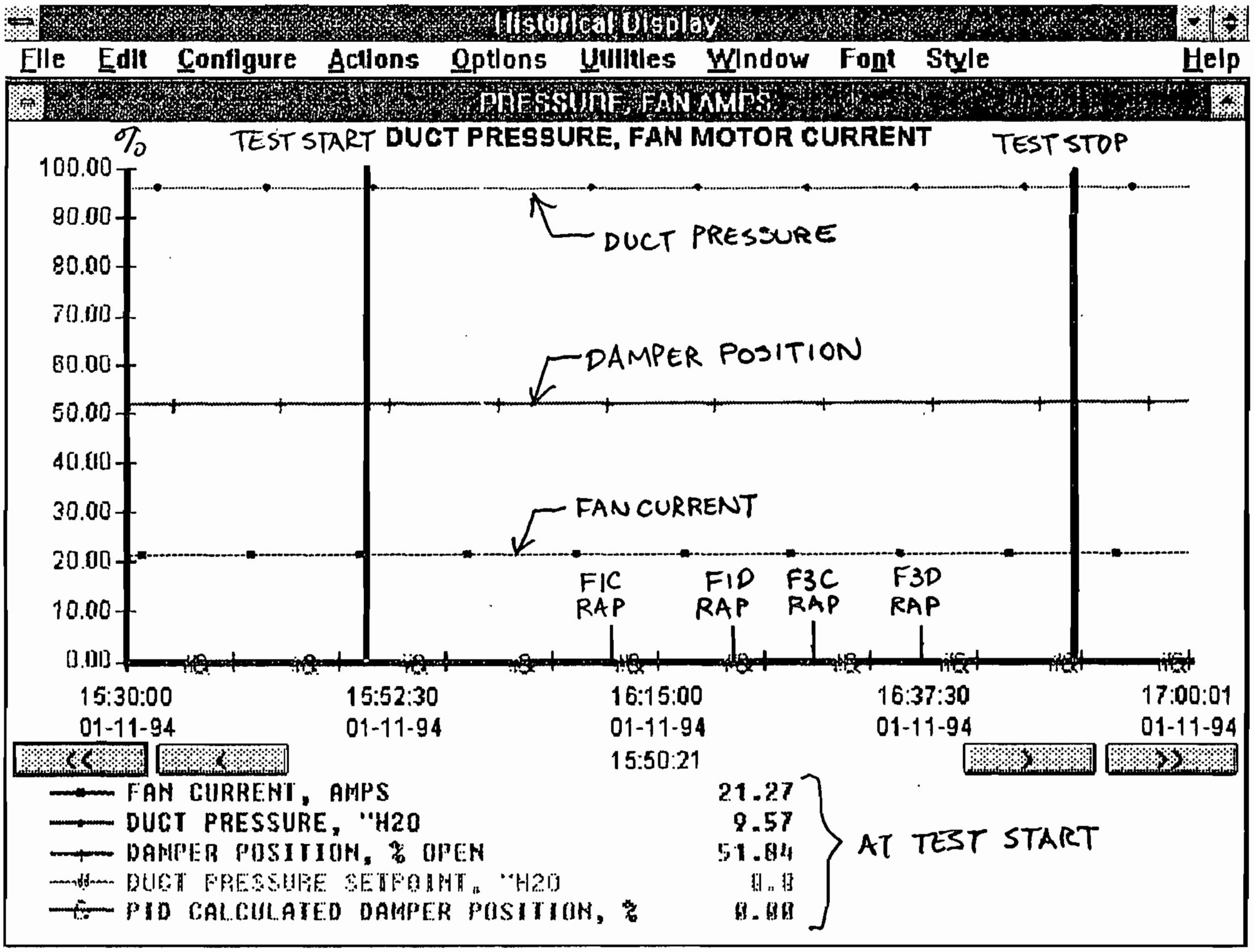


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
%
TEST START
ALL FIELD CONTROL OUTPUTS
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F1, F2, F4
F3
F1C RAP
F1D RAP
F3C RAP
F3D RAP
15:30:00 01-11-94
15:52:30 01-11-94
16:15:00 01-11-94
16:37:30 01-11-94
17:00:01 01-11-94
15:51:05
FIELD 1 CONTROL OUTPUT, % 99.56
FIELD 2 CONTROL OUTPUT, % 99.51
FIELD 3 CONTROL OUTPUT, % 69.72
FIELD 4 CONTROL OUTPUT, % 99.54
AT TEST START

DRY EP TEST 9.

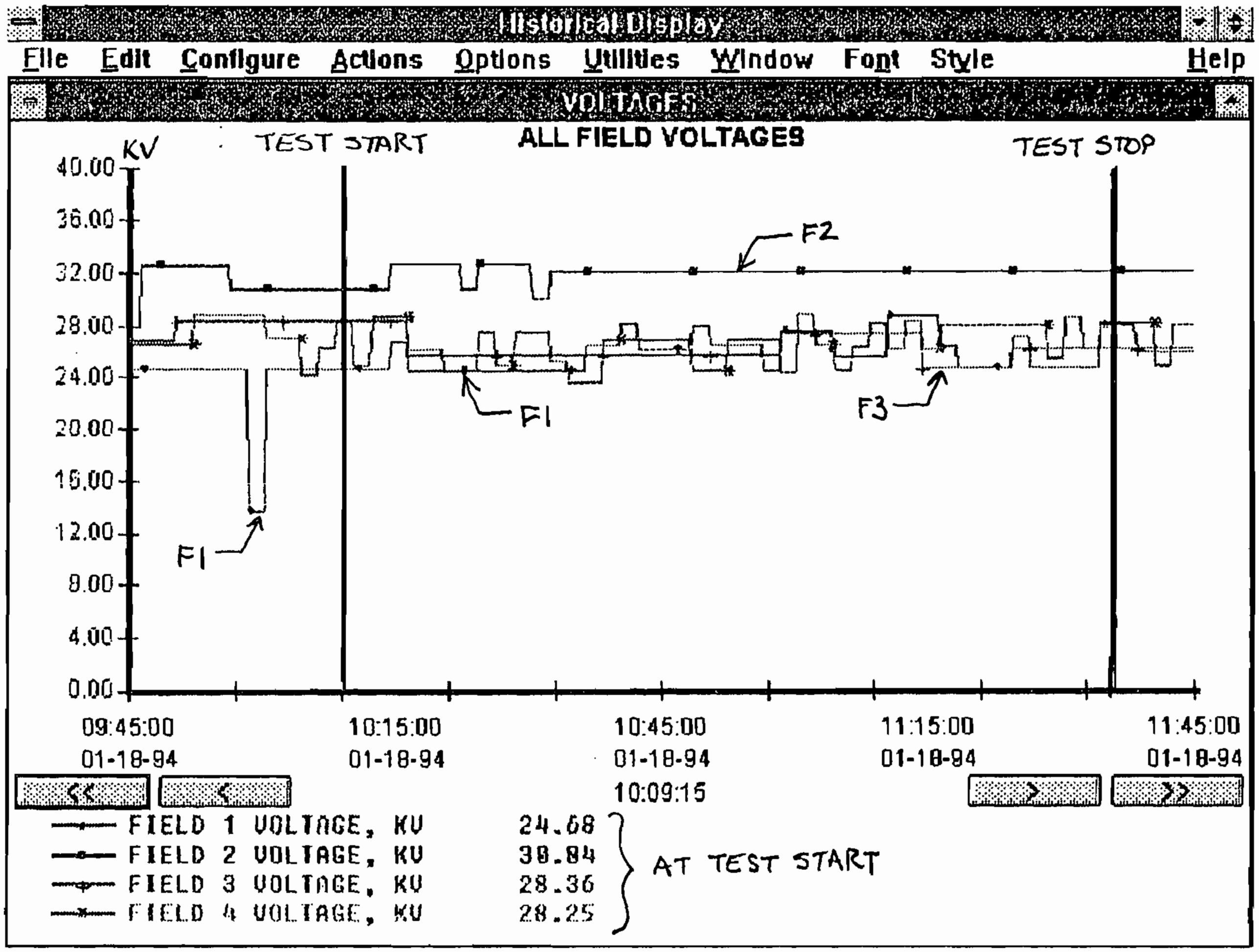

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
°F
TEST START
EP INLET AND OUTLET TEMPERATURES
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
F1C RAP
F1D RAP
F3C RAP
F3D RAP
15:30:00 01-11-94
15:52:30 01-11-94
16:15:00 01-11-94
16:37:30 01-11-94
17:00:01 01-11-94
15:50:21
EP INLET TEMP., Deg F 333.09
EP OUTLET TEMP., Deg F 273.92
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

DRY EP TEST 9.

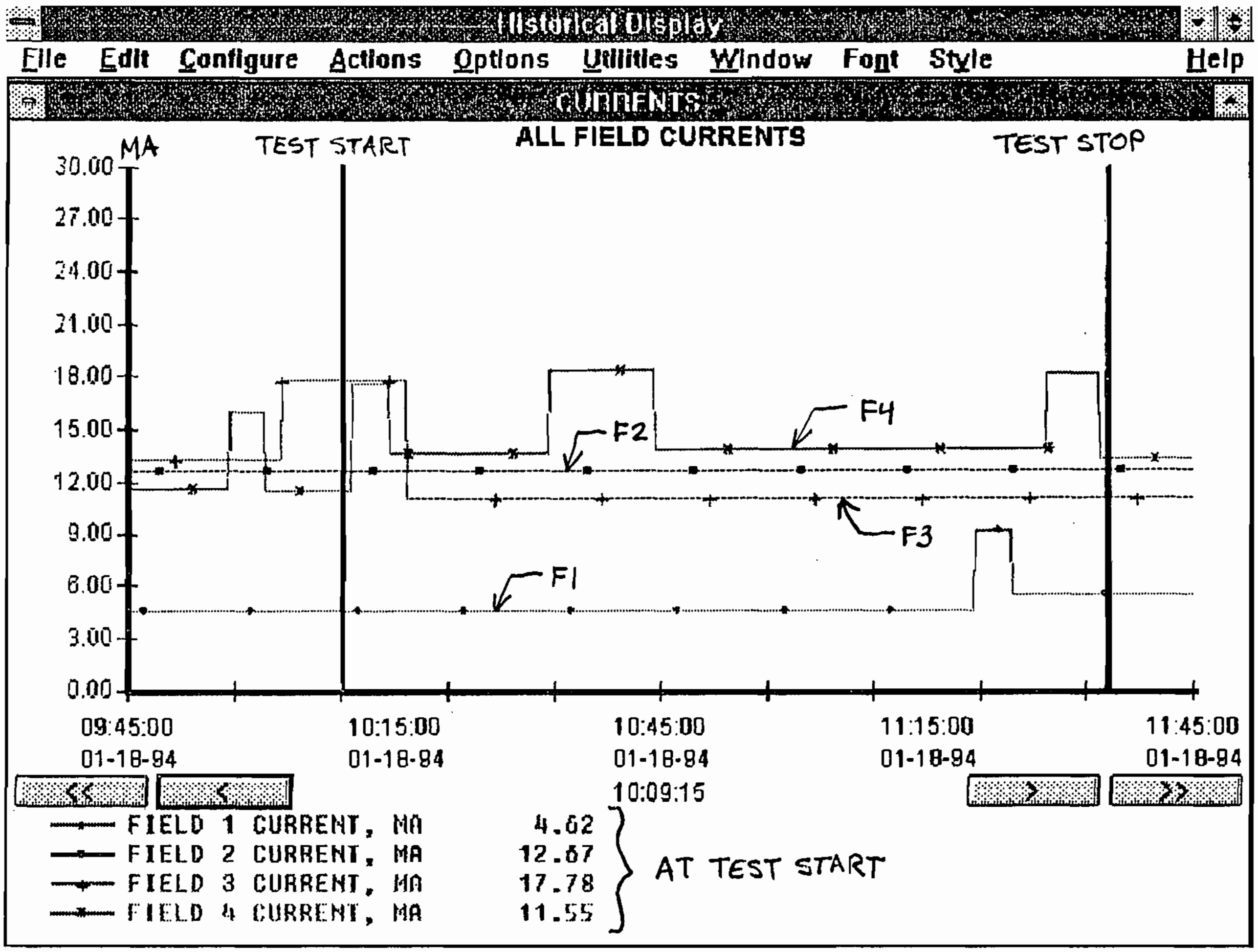


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DUCT PRESSURE
DAMPER POSITION
FAN CURRENT
F1C RAP
F1D RAP
F3C RAP
F3D RAP
15:30:00 01-11-94
15:52:30 01-11-94
16:15:00 01-11-94
16:37:30 01-11-94
17:00:01 01-11-94
15:50:21
FAN CURRENT, AMPS 21.27
DUCT PRESSURE, "H2O 9.57
DAMPER POSITION, % OPEN 51.84
DUCT PRESSURE SETPOINT, "H2O 0.0
PID CALCULATED DAMPER POSITION, % 0.00
AT TEST START

DRY EP TEST 9.

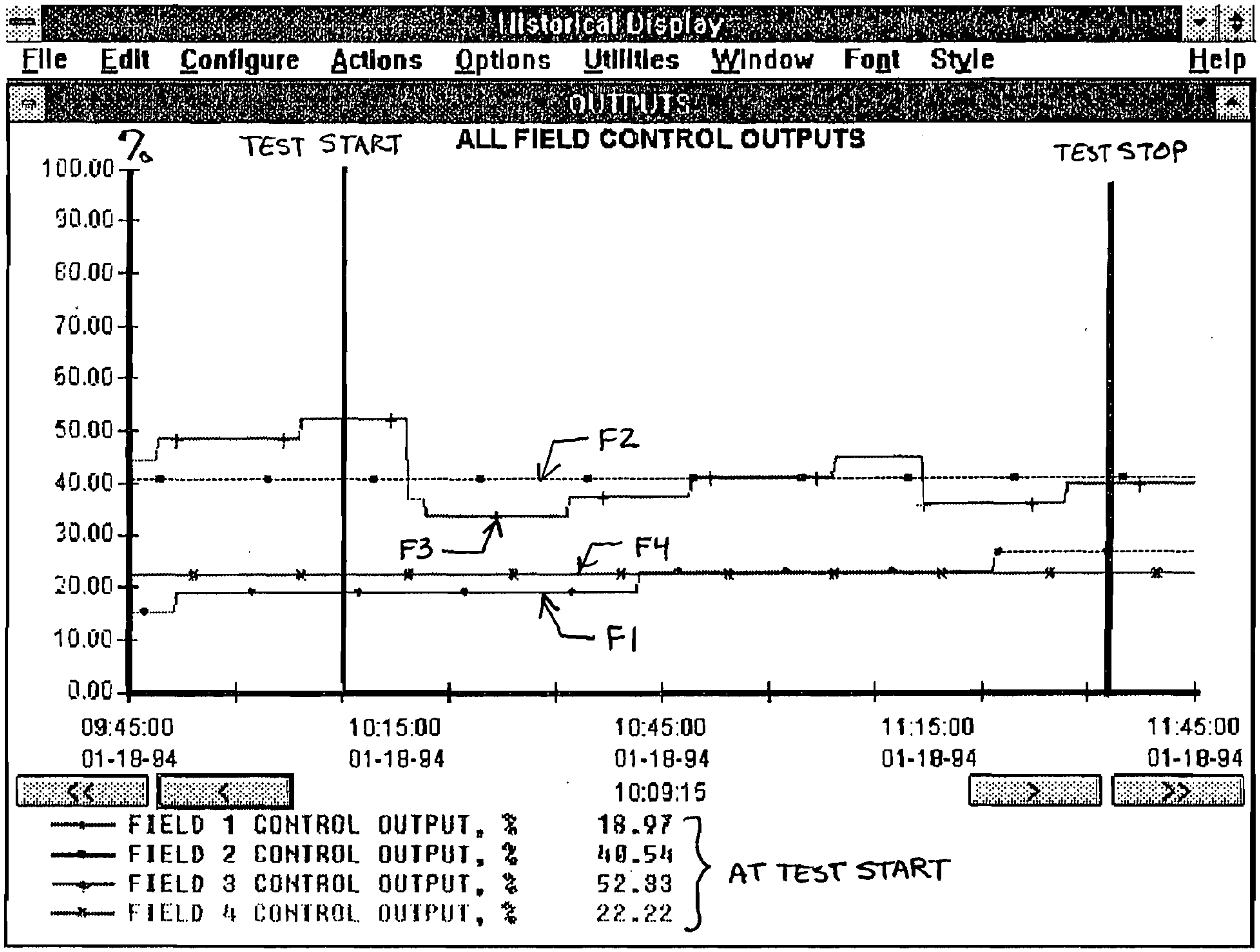

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2
F1
F3
F1
09:45:00 01-18-94
10:15:00 01-18-94
10:45:00 01-18-94
11:15:00 01-18-94
11:45:00 01-18-94
10:09:15
FIELD 1 VOLTAGE, KV 24.68
FIELD 2 VOLTAGE, KV 30.84
FIELD 3 VOLTAGE, KV 28.36
FIELD 4 VOLTAGE, KV 28.25
AT TEST START

WEP TEST 1.



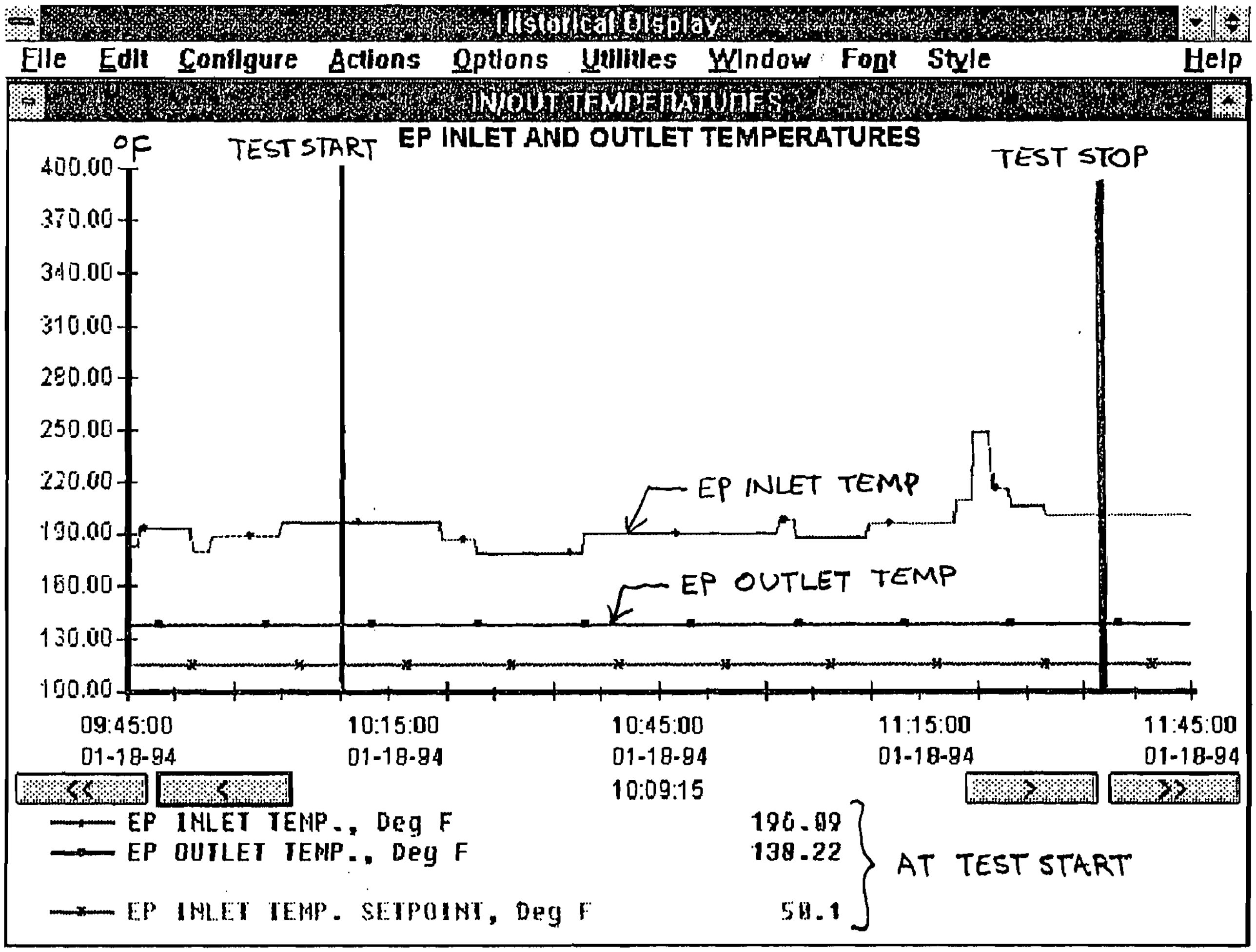
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F4
F2
F3
F1
09:45:00 01-18-94
10:15:00 01-18-94
10:45:00 01-18-94
11:15:00 01-18-94
11:45:00 01-18-94
10:09:15
FIELD 1 CURRENT, MA 4.62
FIELD 2 CURRENT, MA 12.67
FIELD 3 CURRENT, MA 17.78
FIELD 4 CURRENT, MA 11.55
AT TEST START

WEP TEST 1.



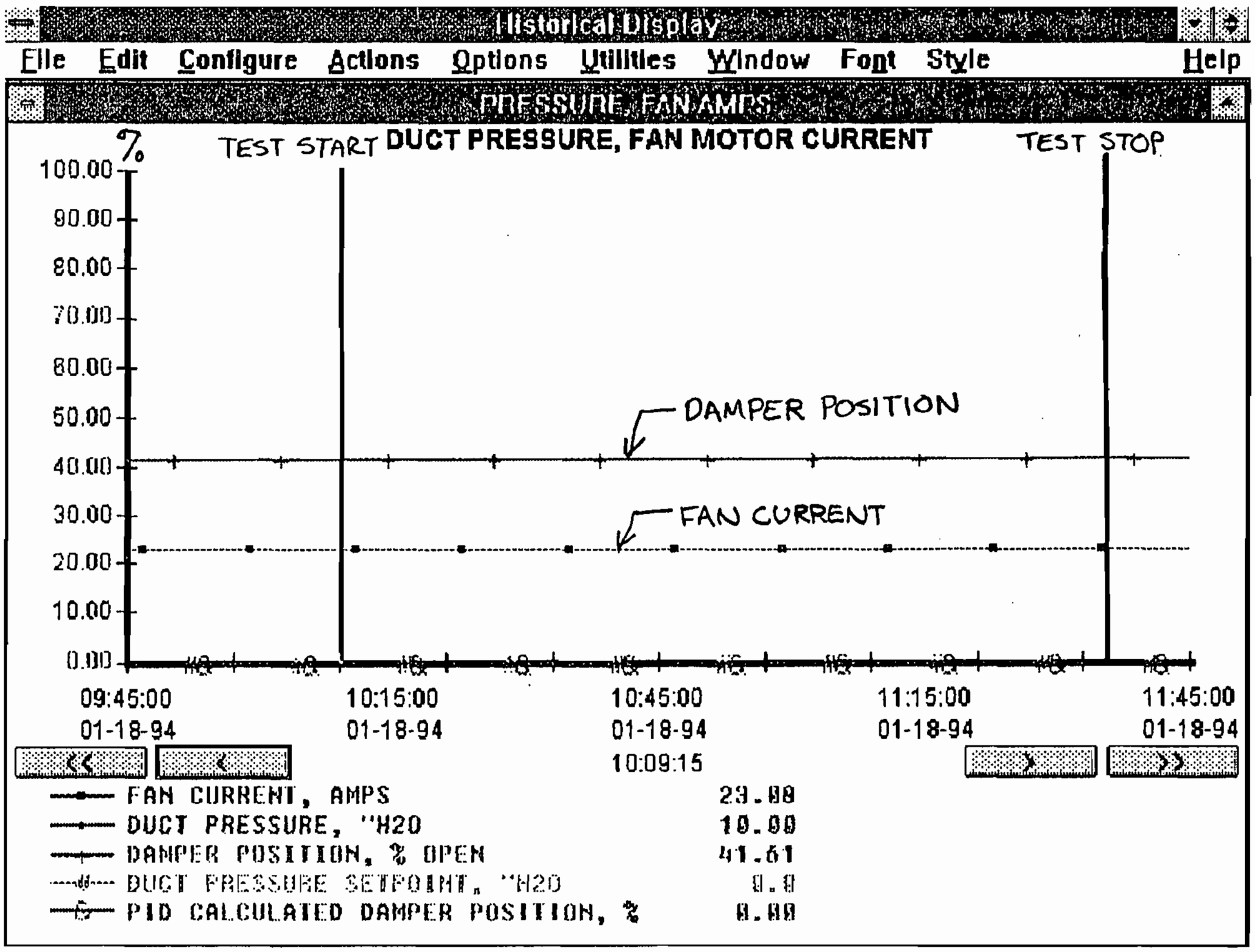
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F2
F3
F4
F1
09:45:00 01-18-94
10:15:00 01-18-94
10:45:00 01-18-94
11:15:00 01-18-94
11:45:00 01-18-94
10:09:15
FIELD 1 CONTROL OUTPUT, % 18.97
FIELD 2 CONTROL OUTPUT, % 40.54
FIELD 3 CONTROL OUTPUT, % 52.33
FIELD 4 CONTROL OUTPUT, % 22.22
AT TEST START

WEP TEST 1.

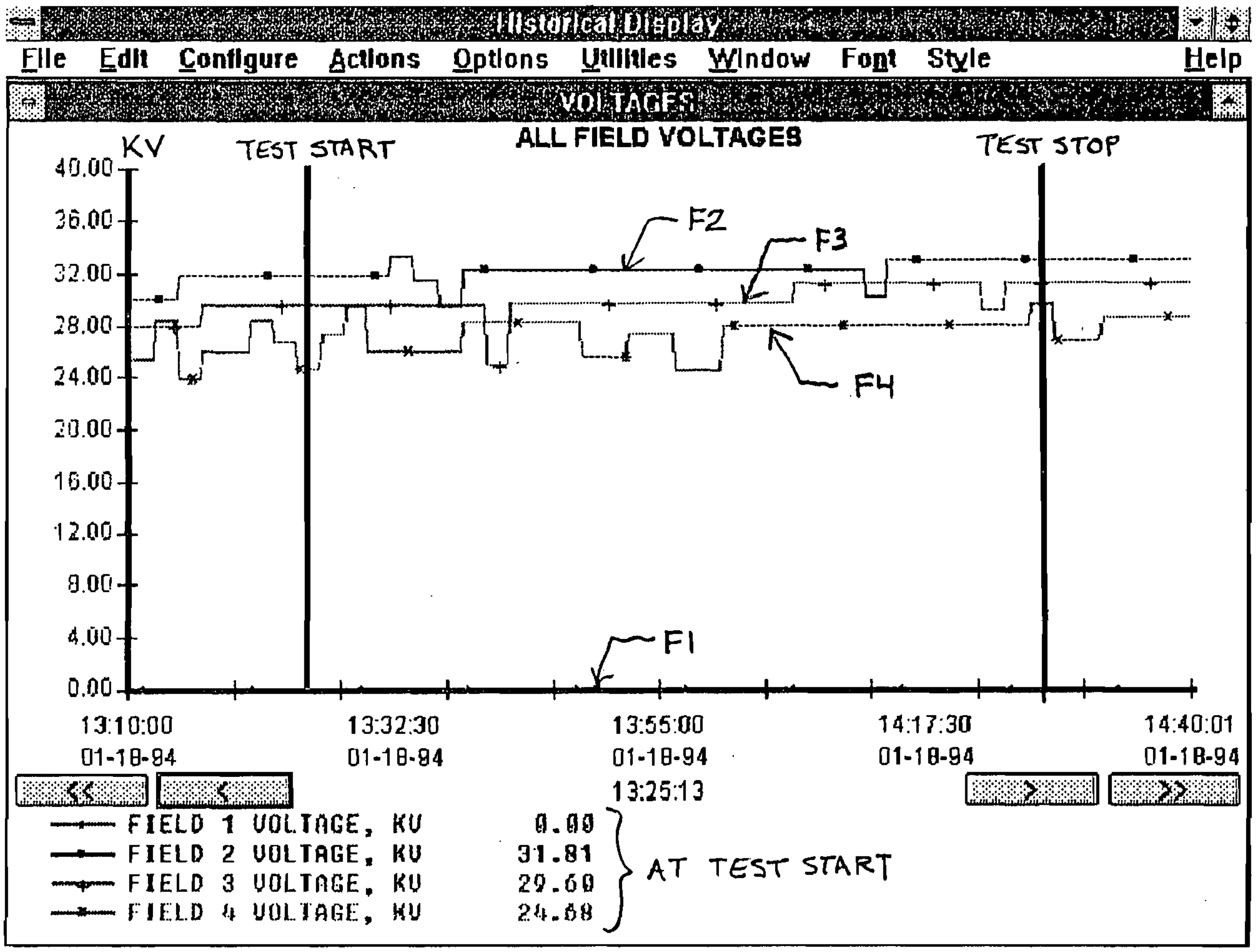


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
09:45:00 01-18-94
10:15:00 01-18-94
10:45:00 01-18-94
11:15:00 01-18-94
11:45:00 01-18-94
10:09:15
EP INLET TEMP., Deg F 196.09
EP OUTLET TEMP., Deg F 138.22
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

WEP TEST 1.

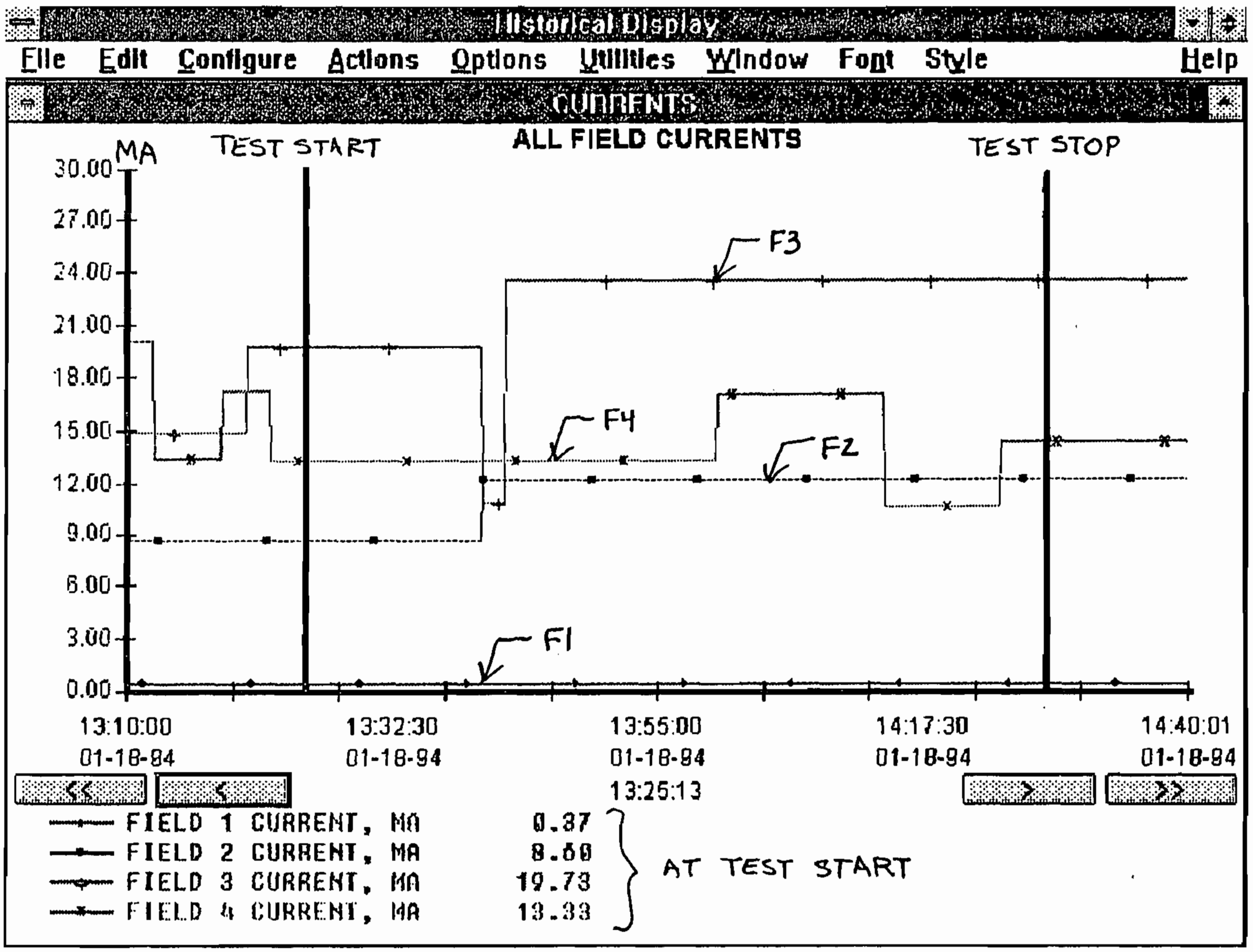

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DAMPER POSITION
FAN CURRENT
09:45:00 01-18-94
10:15:00 01-18-94
10:45:00 01-18-94
11:15:00 01-18-94
11:45:00 01-18-94
10:09:15
FAN CURRENT, AMPS 23.00
DUCT PRESSURE, "H2O 10.00
DAMPER POSITION, % OPEN 41.61
DUCT PRESSURE SETPOINT, "H2O 0.0
PID CALCULATED DAMPER POSITION, % 0.00

WEP TEST 1.



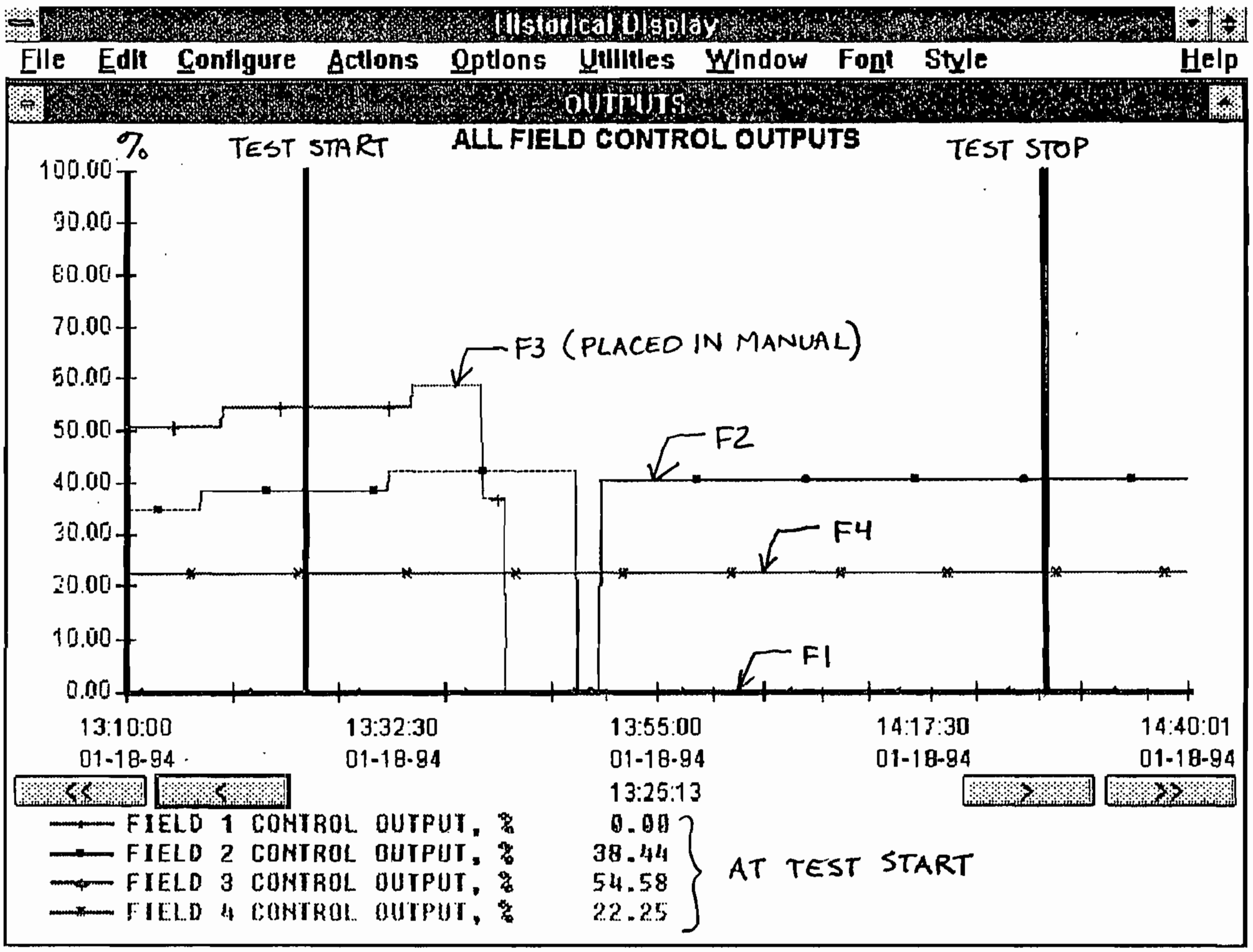
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F2
F3
F4
F1
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
13:10:00 01-18-94
13:32:30 01-18-94
13:55:00 01-18-94
14:17:30 01-18-94
14:40:01 01-18-94
13:25:13
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 31.81
FIELD 3 VOLTAGE, KV 29.60
FIELD 4 VOLTAGE, KV 24.68
AT TEST START

WEP TEST 2.



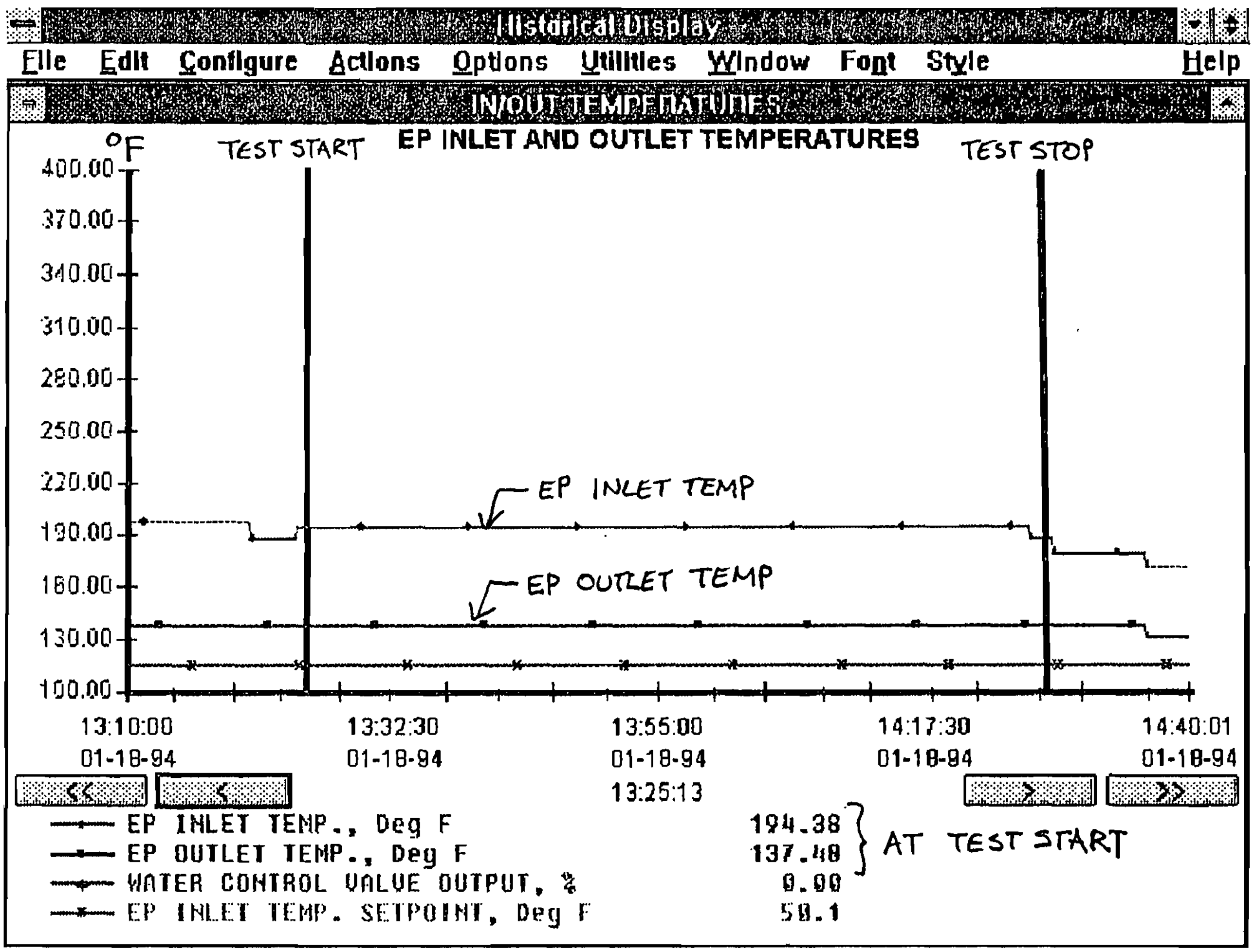
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
F3
F4
F2
F1
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
13:10:00 01-18-94
13:32:30 01-18-94
13:55:00 01-18-94
14:17:30 01-18-94
14:40:01 01-18-94
13:25:13
FIELD 1 CURRENT, MA 0.37
FIELD 2 CURRENT, MA 8.60
FIELD 3 CURRENT, MA 19.73
FIELD 4 CURRENT, MA 13.33
AT TEST START

WEP TEST 2.

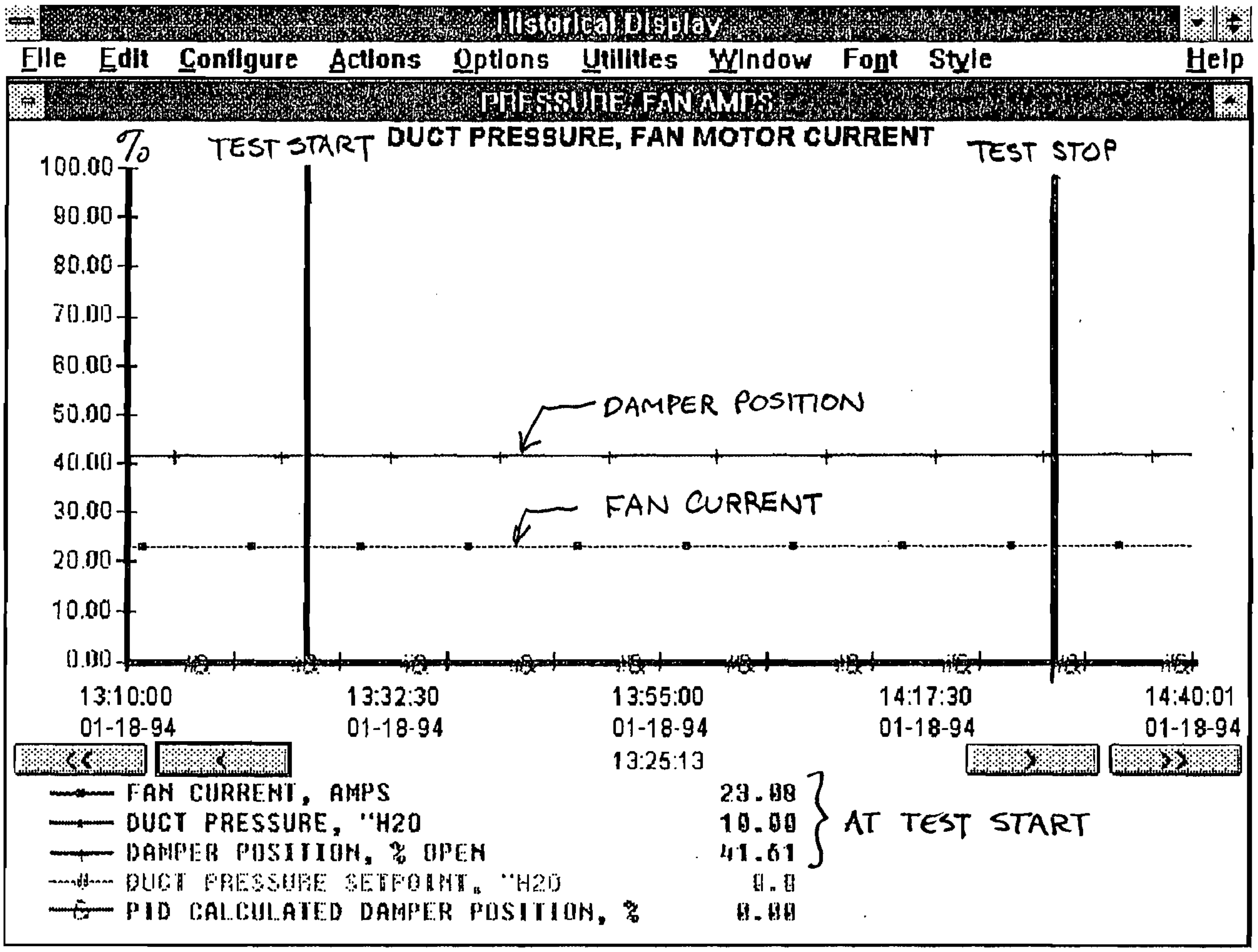


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F3 (PLACED IN MANUAL)
F2
F4
F1
13:10:00 01-18-94
13:32:30 01-18-94
13:55:00 01-18-94
14:17:30 01-18-94
14:40:01 01-18-94
13:25:13
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 38.44
FIELD 3 CONTROL OUTPUT, % 54.58
FIELD 4 CONTROL OUTPUT, % 22.25
AT TEST START

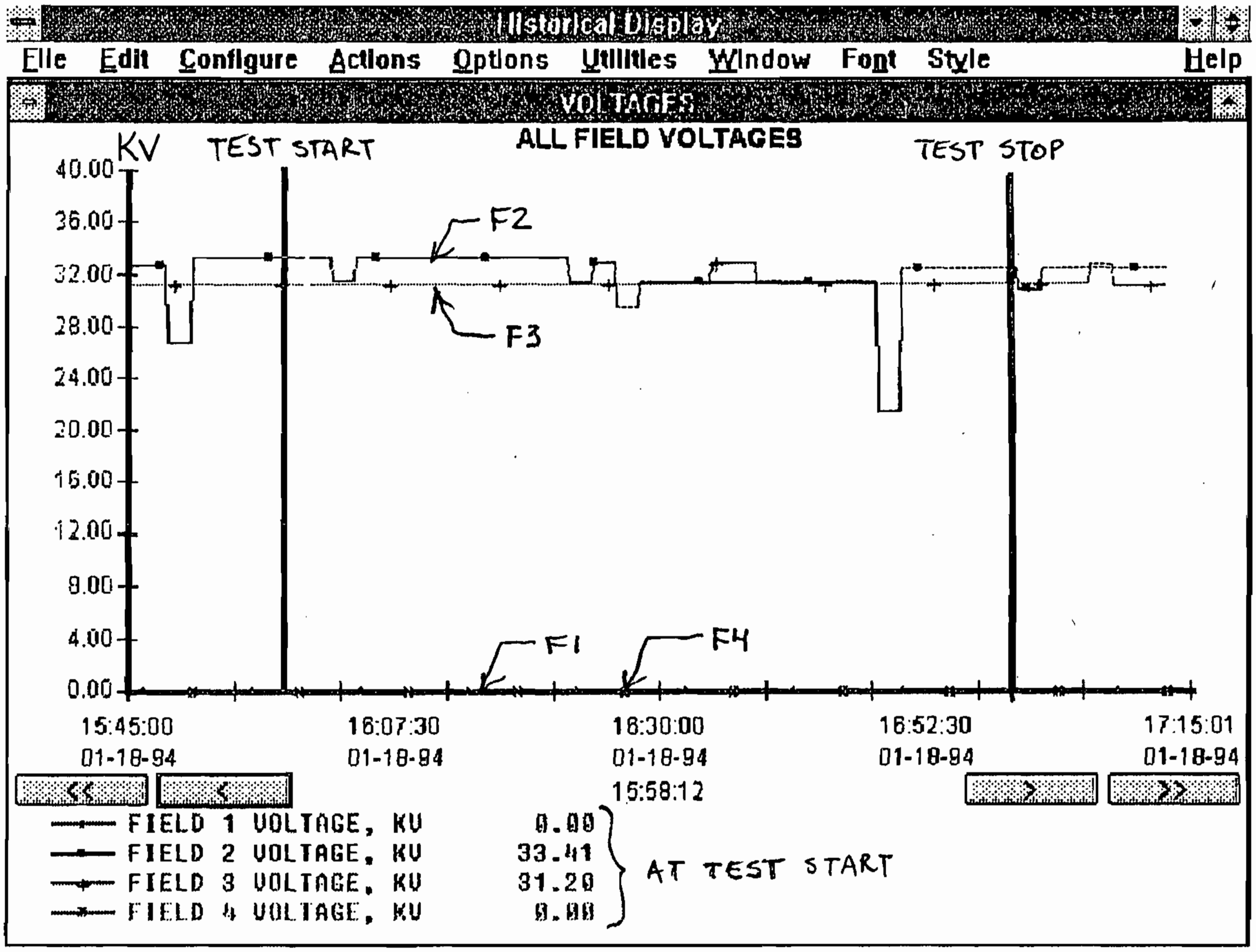
WEP TEST 2.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
13:10:00 01-18-94
13:32:30 01-18-94
13:55:00 01-18-94
14:17:30 01-18-94
14:40:01 01-18-94
13:25:13
EP INLET TEMP., Deg F 194.38
EP OUTLET TEMP., Deg F 137.48
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

WEP TEST 2.

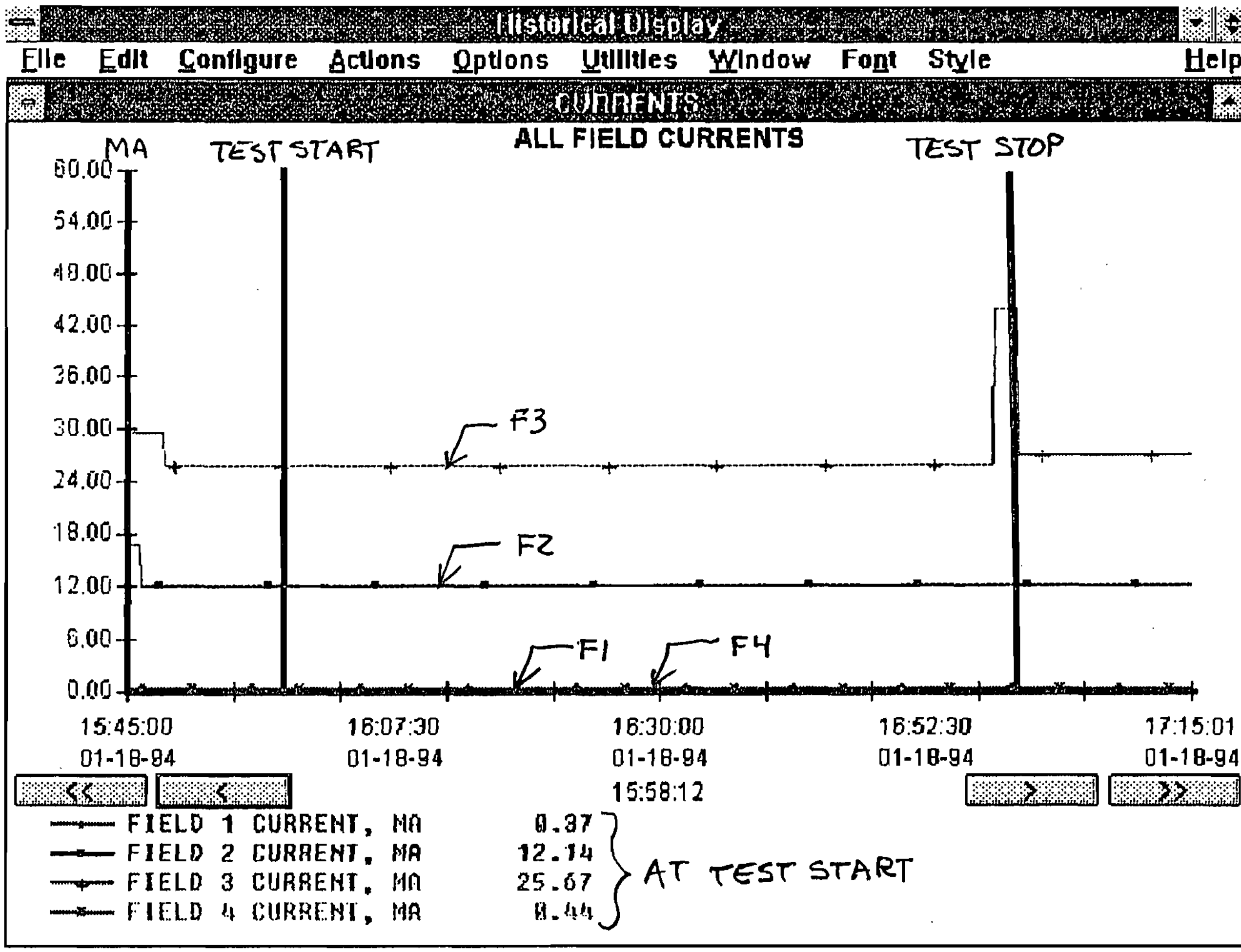

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DAMPER POSITION
FAN CURRENT
13:10:00 01-18-94
13:32:30 01-18-94
13:55:00 01-18-94
14:17:30 01-18-94
14:40:01 01-18-94
13:25:13
FAN CURRENT, AMPS 23.08
DUCT PRESSURE, "H20 10.00
DAMPER POSITION, % OPEN 41.61
AT TEST START
DUCT PRESSURE SETPOINT, "H20 0.0
PID CALCULATED DAMPER POSITION, % 0.00

WEP TEST 2.



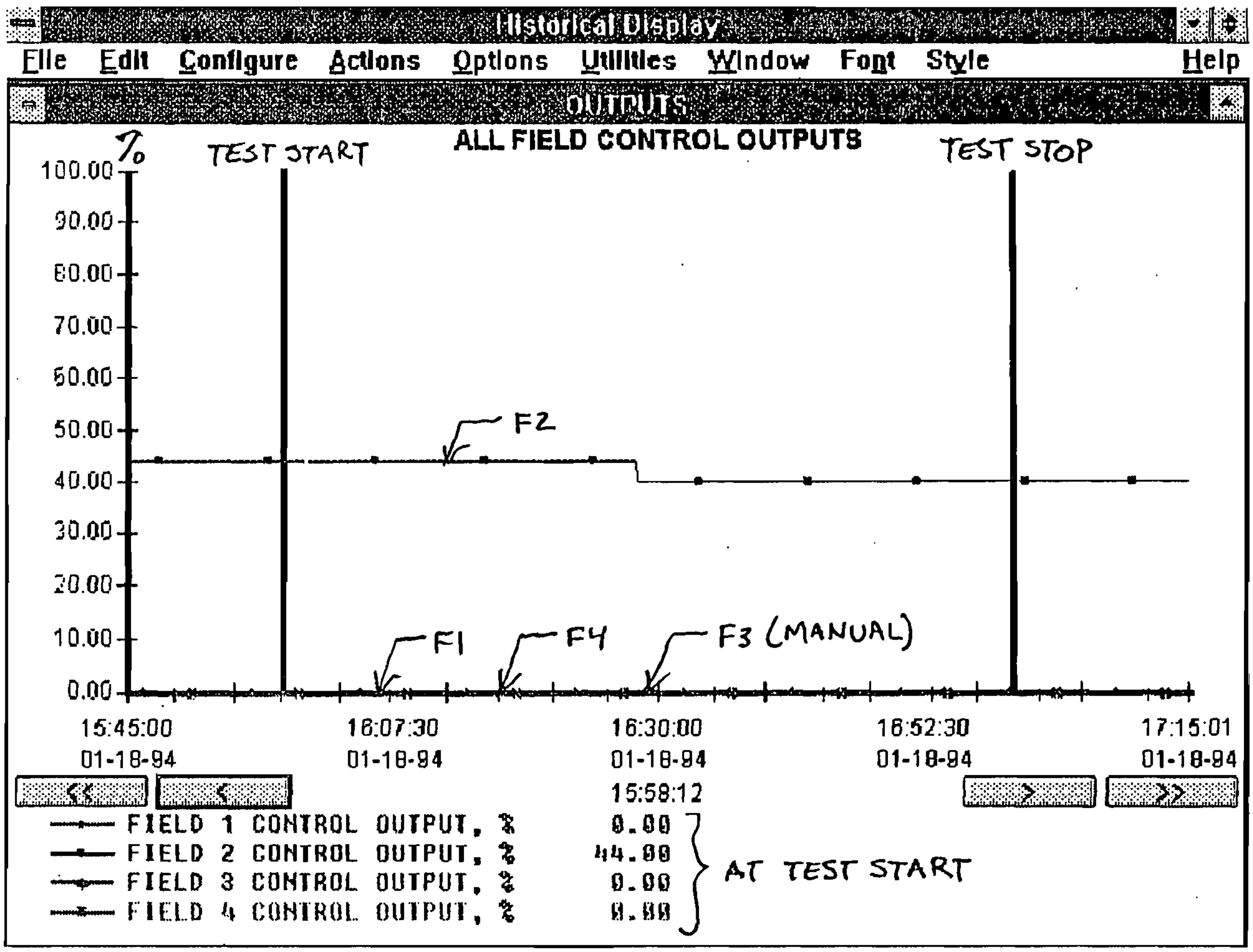
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2
F3
F1
F4
15:45:00 01-18-94
16:07:30 01-18-94
16:30:00 01-18-94
16:52:30 01-18-94
17:15:01 01-18-94
15:58:12
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 33.41
FIELD 3 VOLTAGE, KV 31.20
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

WEP TEST 3.

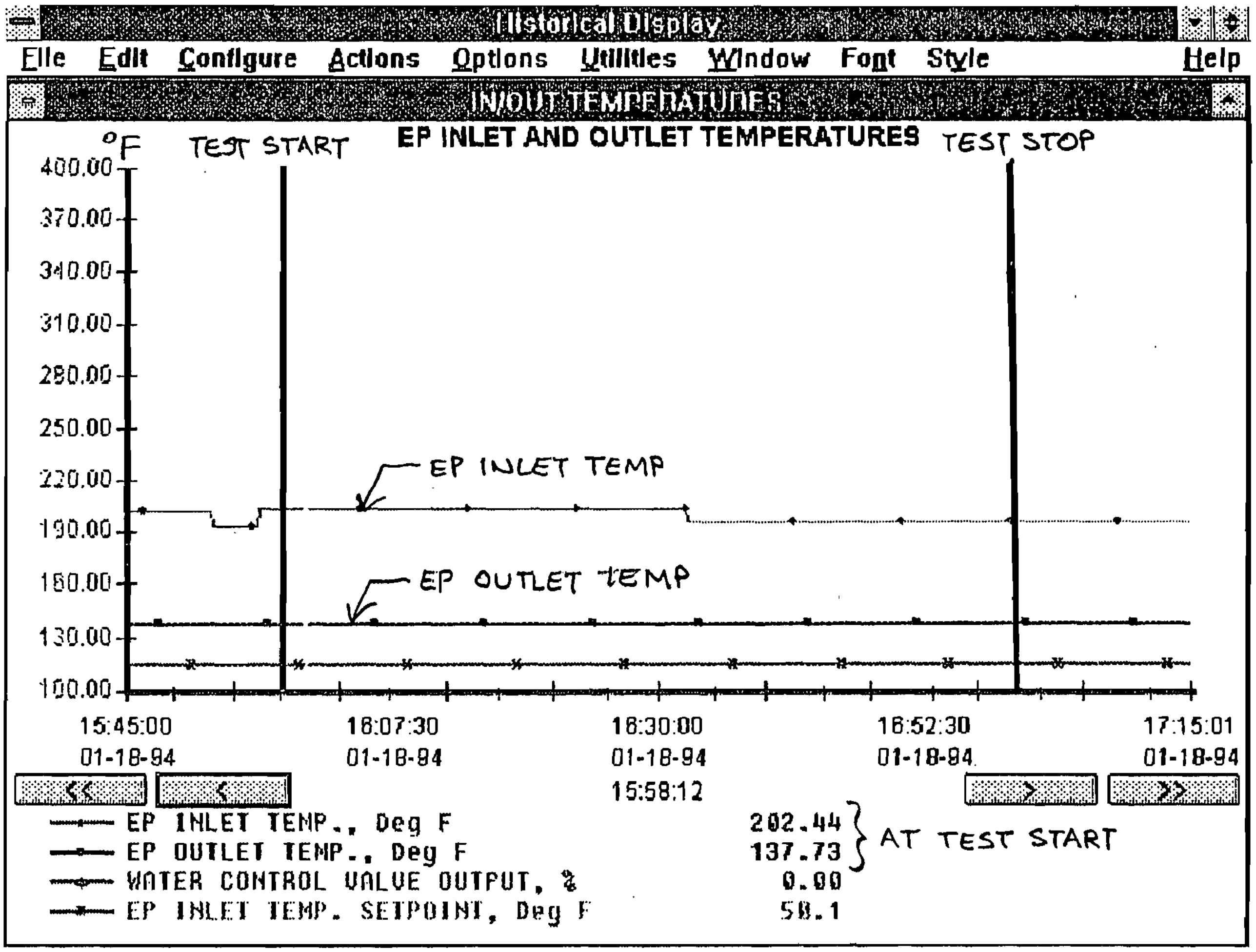


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
60.00
54.00
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
F3
F2
F1
F4
15:45:00 01-18-94
16:07:30 01-18-94
16:30:00 01-18-94
16:52:30 01-18-94
17:15:01 01-18-94
15:58:12
FIELD 1 CURRENT, MA 0.37
FIELD 2 CURRENT, MA 12.14
FIELD 3 CURRENT, MA 25.67
FIELD 4 CURRENT, MA 0.44
AT TEST START

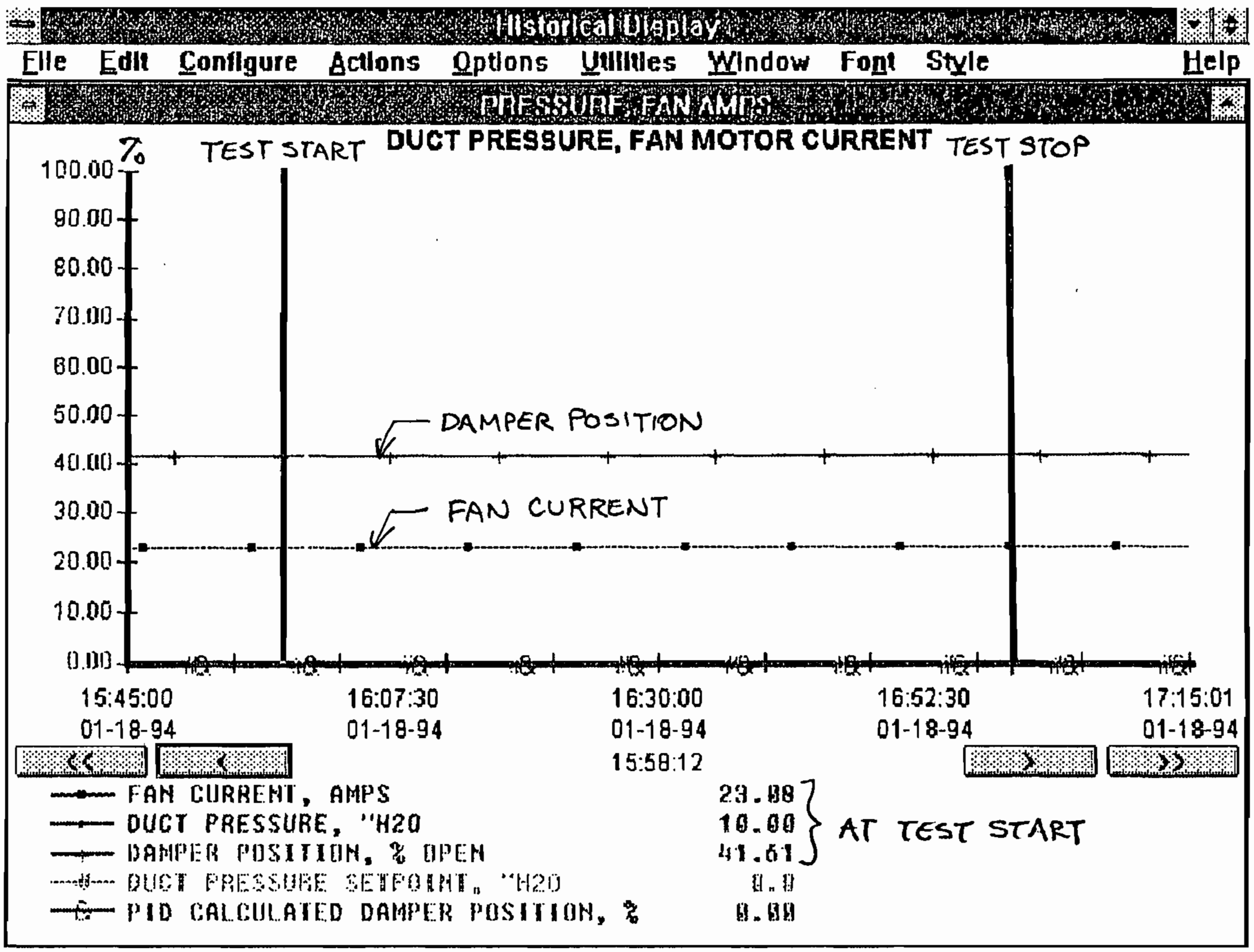
WEP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F2
F1
F4
F3 (MANUAL)
15:45:00 01-18-94
16:07:30 01-18-94
16:30:00 01-18-94
16:52:30 01-18-94
17:15:01 01-18-94
15:58:12
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 44.00
FIELD 3 CONTROL OUTPUT, % 0.00
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

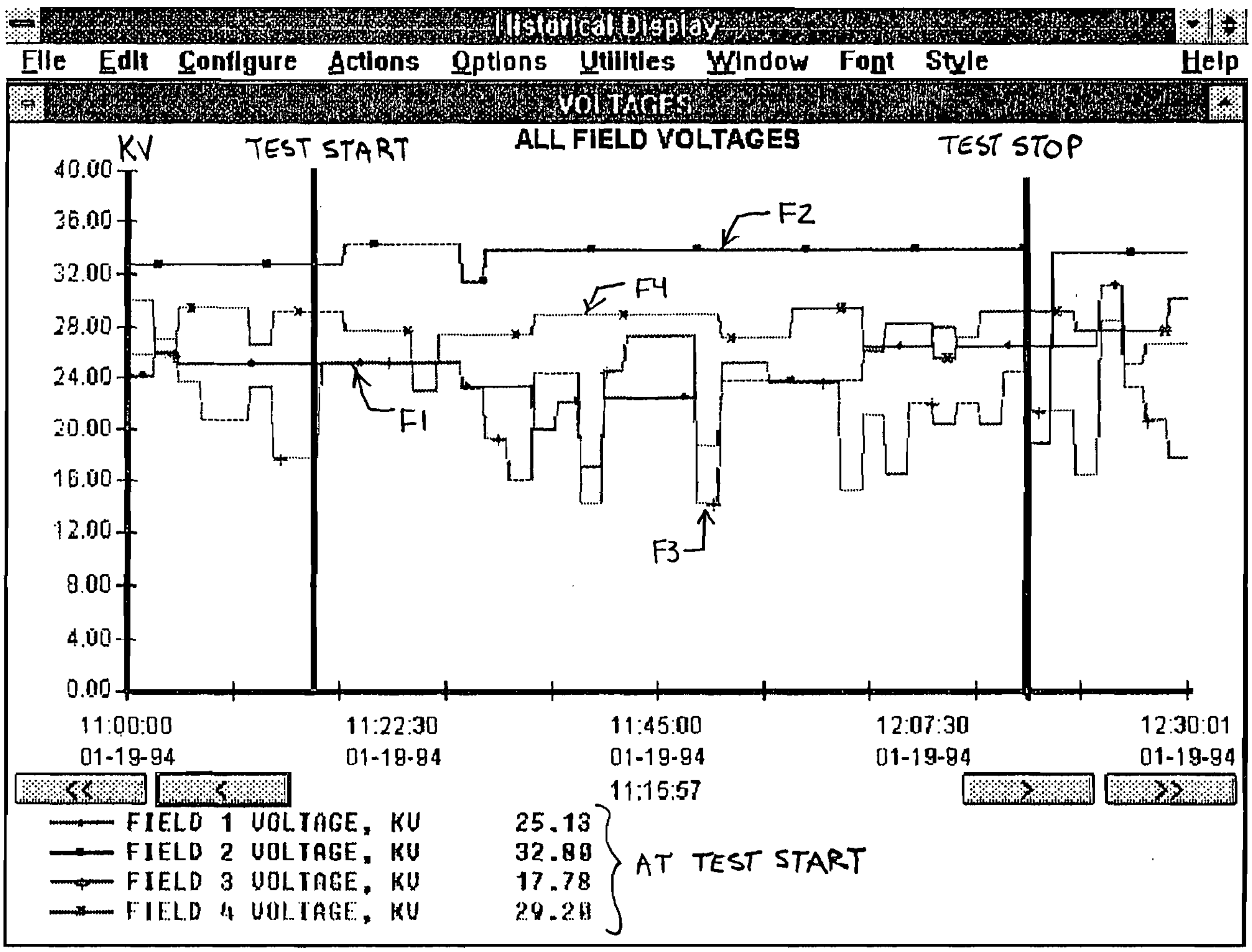
WEP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
EP INLET TEMP
EP OUTLET TEMP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
15:45:00 01-18-94
16:07:30 01-18-94
16:30:00 01-18-94
16:52:30 01-18-94
17:15:01 01-18-94
15:58:12
EP INLET TEMP., Deg F 202.44
EP OUTLET TEMP., Deg F 137.73
AT TEST START
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 58.1

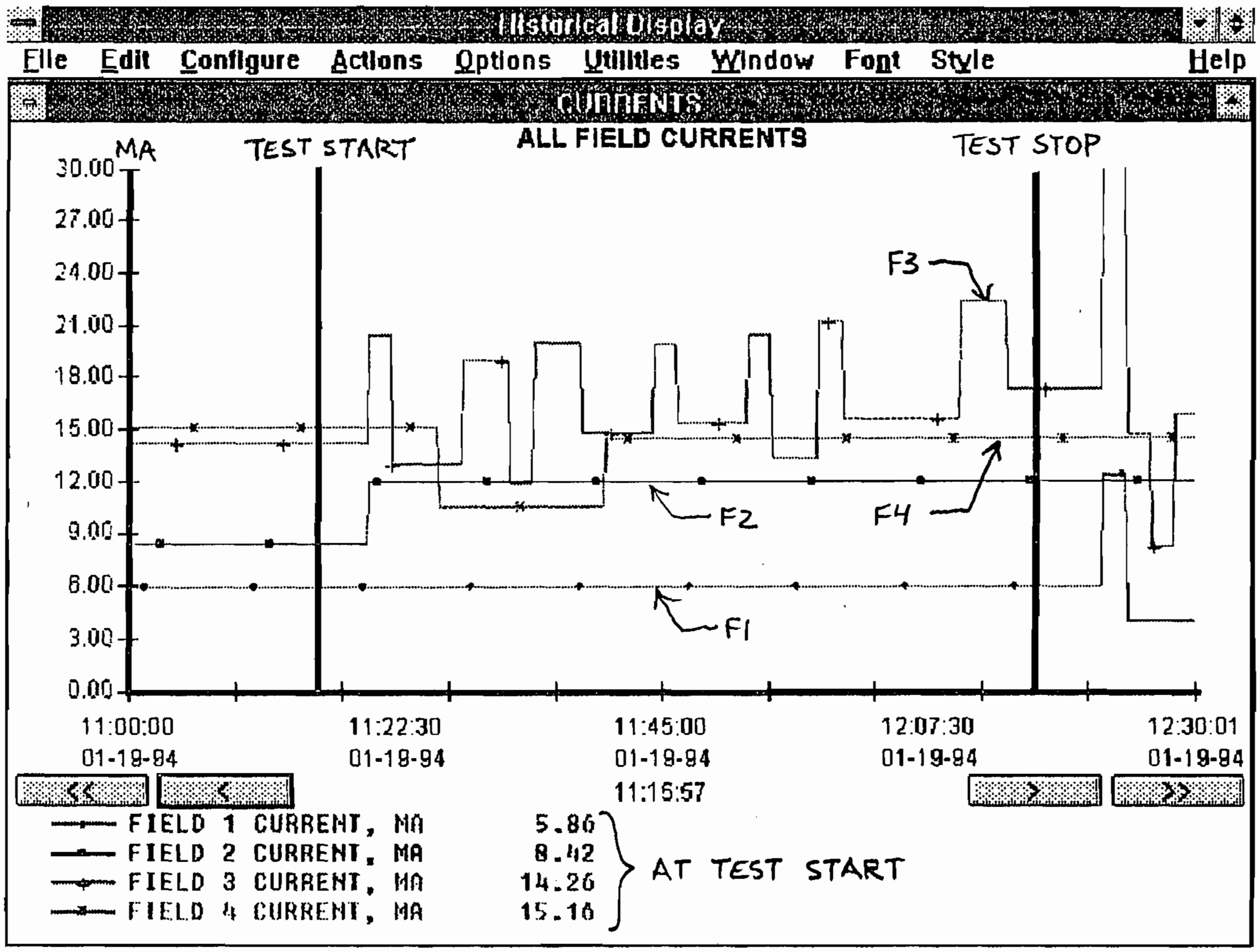
WEP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DAMPER POSITION
FAN CURRENT
15:45:00 01-18-94
16:07:30 01-18-94
16:30:00 01-18-94
16:52:30 01-18-94
17:15:01 01-18-94
15:58:12
FAN CURRENT, AMPS 23.08
DUCT PRESSURE, "H2O 10.00
DAMPER POSITION, % OPEN 41.61
AT TEST START
DUCT PRESSURE SETPOINT, "H2O 0.0
PID CALCULATED DAMPER POSITION, % 0.00

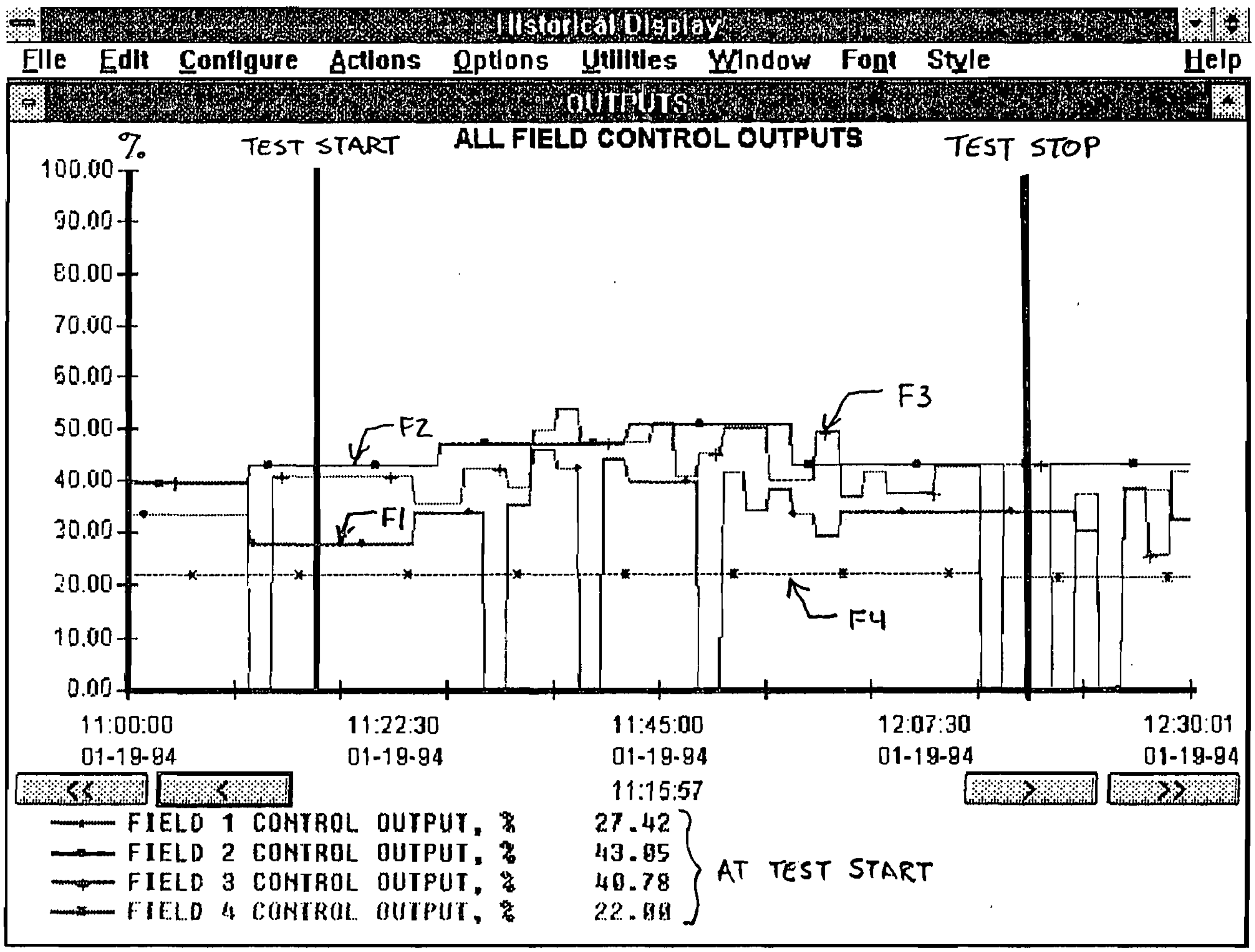
WEP TEST 3.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F1
F2
F3
F4
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
11:00:00 01-19-94
11:22:30 01-19-94
11:45:00 01-19-94
12:07:30 01-19-94
12:30:01 01-19-94
11:15:57
FIELD 1 VOLTAGE, KV 25.13
FIELD 2 VOLTAGE, KV 32.80
FIELD 3 VOLTAGE, KV 17.78
FIELD 4 VOLTAGE, KV 29.20
AT TEST START

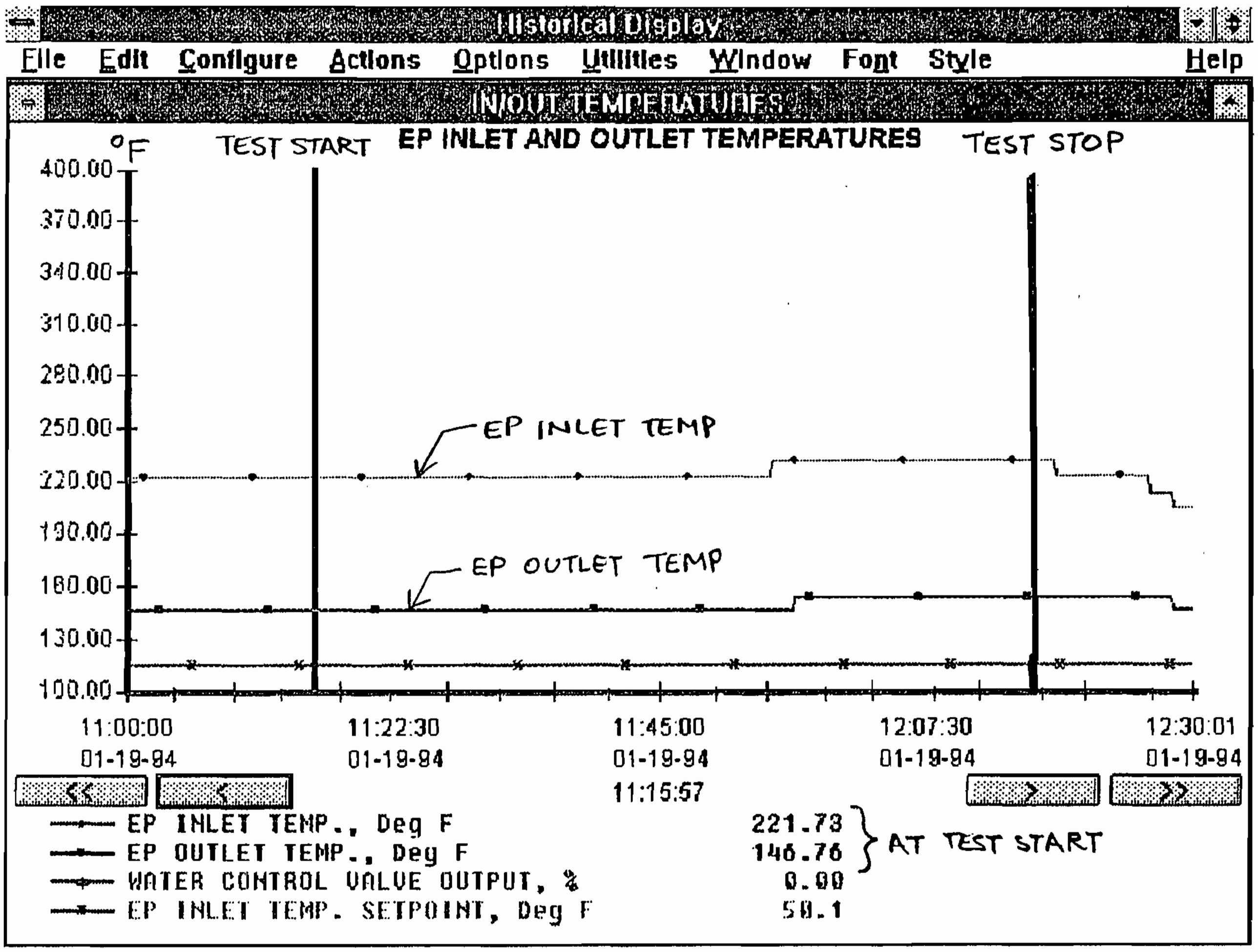
WEP TEST 4.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F3
F2
F4
F1
11:00:00 01-19-94
11:22:30 01-19-94
11:45:00 01-19-94
12:07:30 01-19-94
12:30:01 01-19-94
11:16:57
FIELD 1 CURRENT, MA 5.86
FIELD 2 CURRENT, MA 8.42
FIELD 3 CURRENT, MA 14.26
FIELD 4 CURRENT, MA 15.16
AT TEST START

WEP TEST 4.

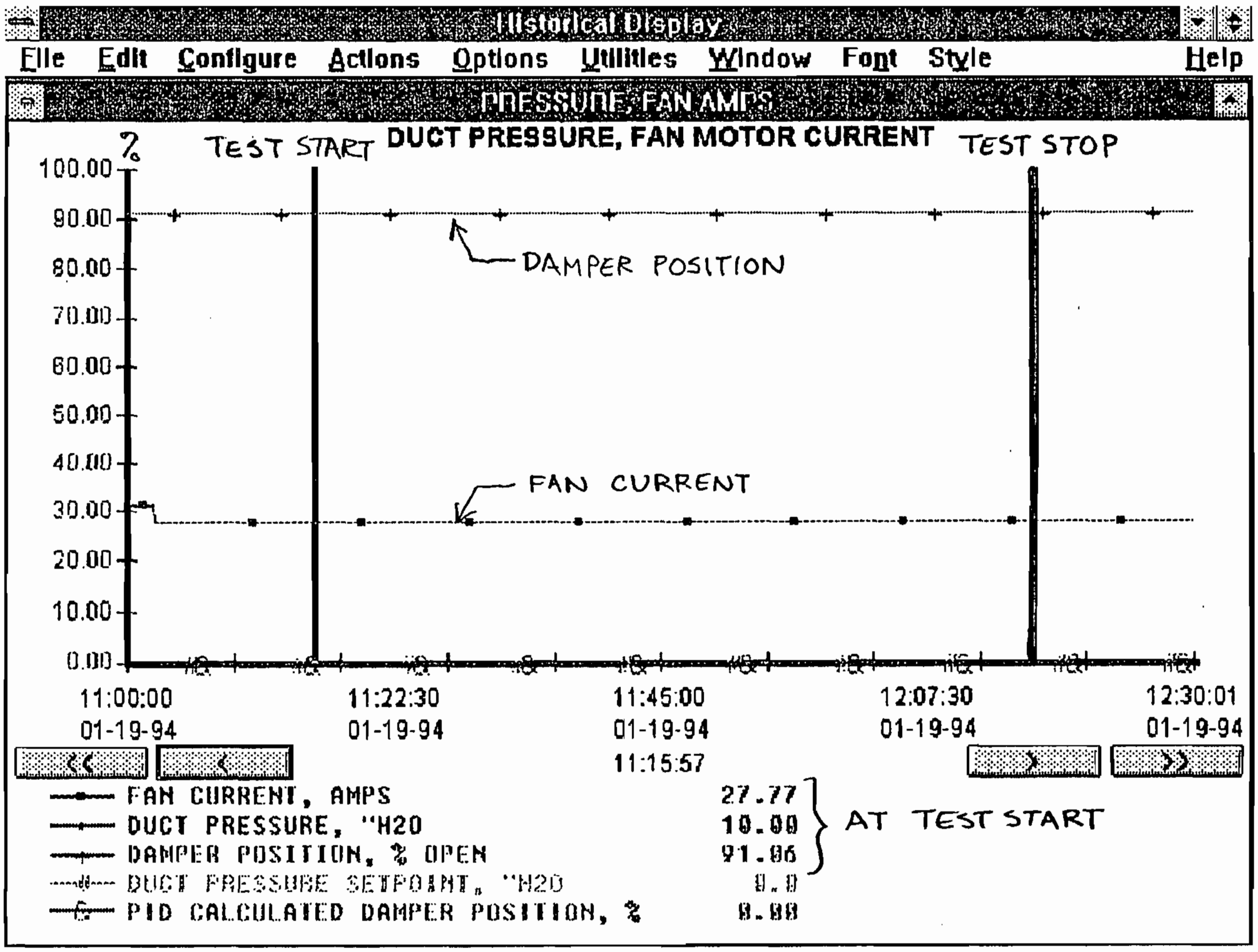

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
F1
F2
F3
F4
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
11:00:00 01-19-94
11:22:30 01-19-94
11:45:00 01-19-94
12:07:30 01-19-94
12:30:01 01-19-94
11:15:57
FIELD 1 CONTROL OUTPUT, % 27.42
FIELD 2 CONTROL OUTPUT, % 43.85
FIELD 3 CONTROL OUTPUT, % 40.78
FIELD 4 CONTROL OUTPUT, % 22.00
AT TEST START

WEP TEST 4.

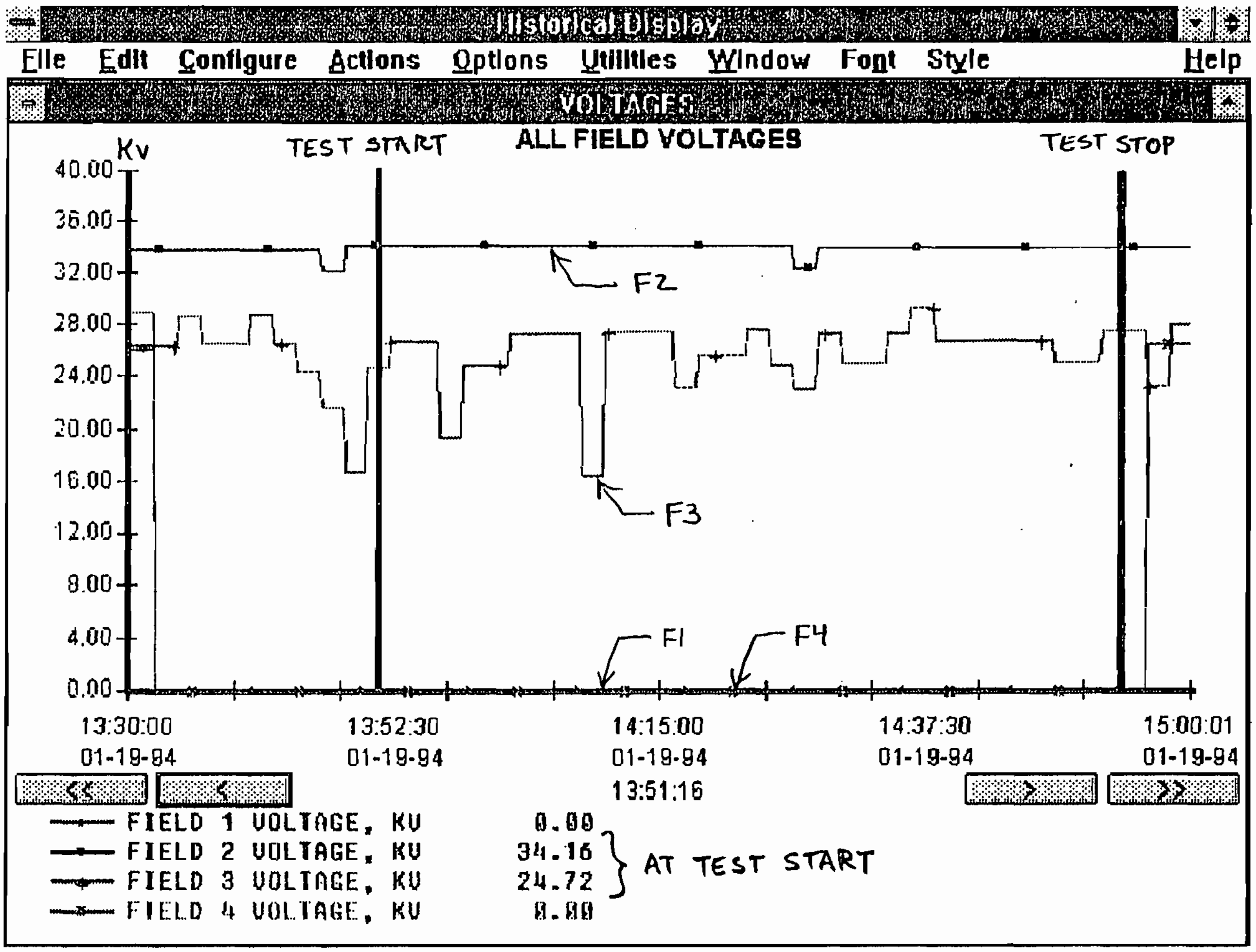


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
°F
TEST START
EP INLET AND OUTLET TEMPERATURES
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
11:00:00 01-19-94
11:22:30 01-19-94
11:45:00 01-19-94
12:07:30 01-19-94
12:30:01 01-19-94
11:15:57
EP INLET TEMP., Deg F 221.73
EP OUTLET TEMP., Deg F 146.76
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

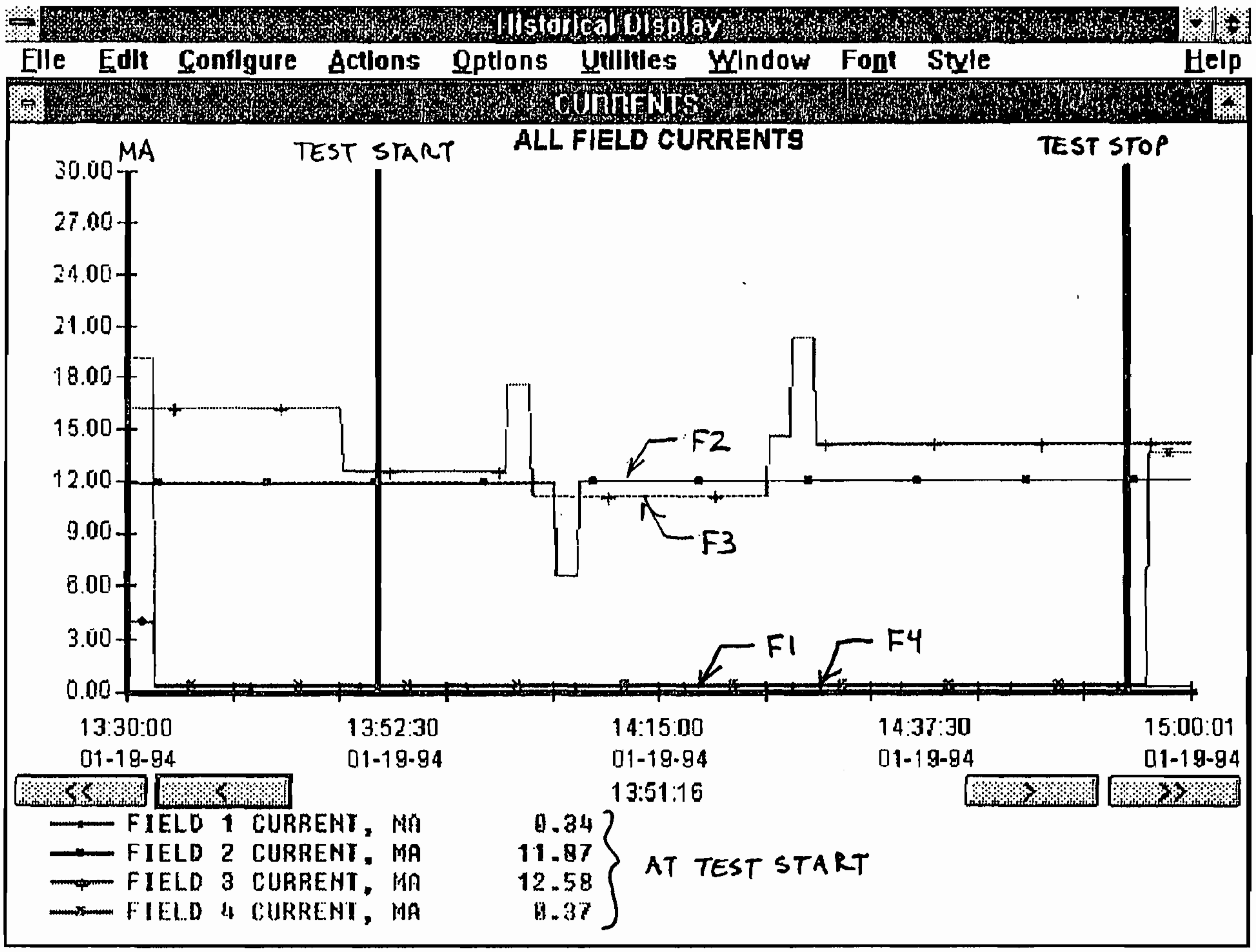
WEP TEST 4.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
DAMPER POSITION
FAN CURRENT
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
11:00:00 01-19-94
11:22:30 01-19-94
11:45:00 01-19-94
12:07:30 01-19-94
12:30:01 01-19-94
11:15:57
FAN CURRENT, AMPS 27.77
DUCT PRESSURE, "H20 10.00
DAMPER POSITION, % OPEN 91.06
DUCT PRESSURE SETPOINT, "H20 0.0
PID CALCULATED DAMPER POSITION, % 0.00
AT TEST START

WEP TEST 4.

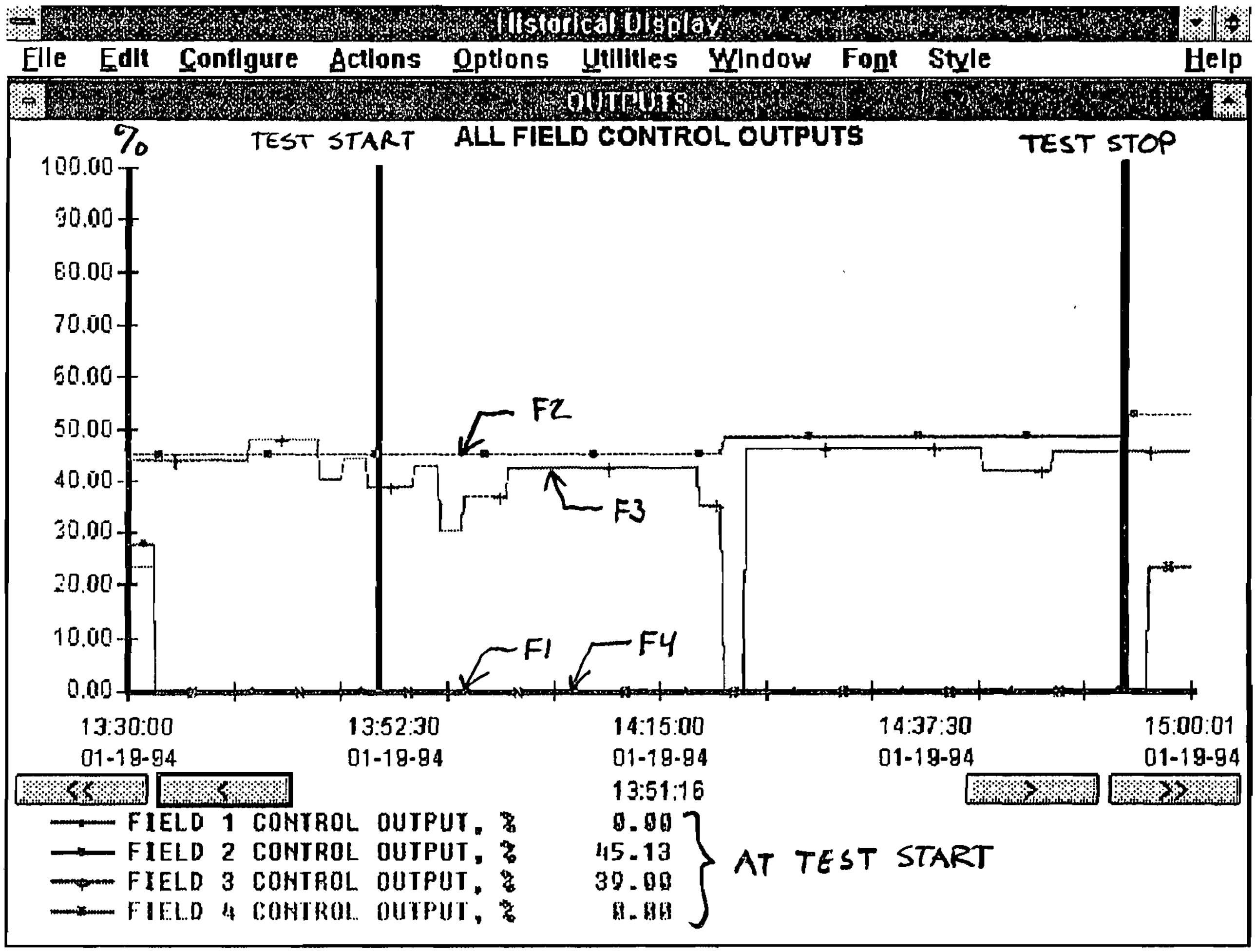

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
Kv
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2
F3
F1
F4
13:30:00 01-19-94
13:52:30 01-19-94
14:15:00 01-19-94
14:37:30 01-19-94
15:00:01 01-19-94
13:51:16
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 34.16
FIELD 3 VOLTAGE, KV 24.72
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

WEP TEST 5.



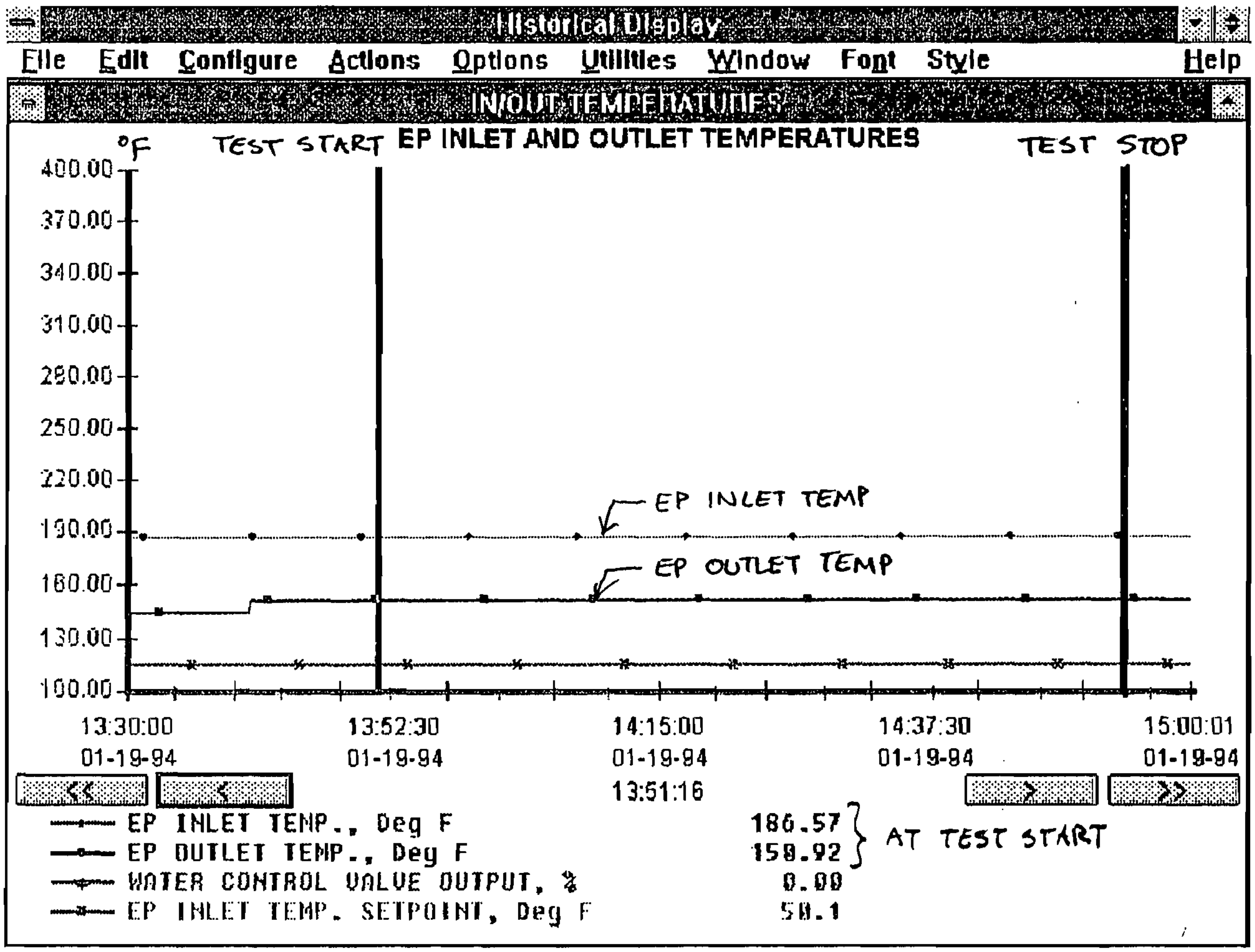
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F2
F3
F1
F4
13:30:00 01-19-94
13:52:30 01-19-94
14:15:00 01-19-94
14:37:30 01-19-94
15:00:01 01-19-94
13:51:16
FIELD 1 CURRENT, MA 0.34
FIELD 2 CURRENT, MA 11.87
FIELD 3 CURRENT, MA 12.58
FIELD 4 CURRENT, MA 0.37
AT TEST START

WEP TEST 5.

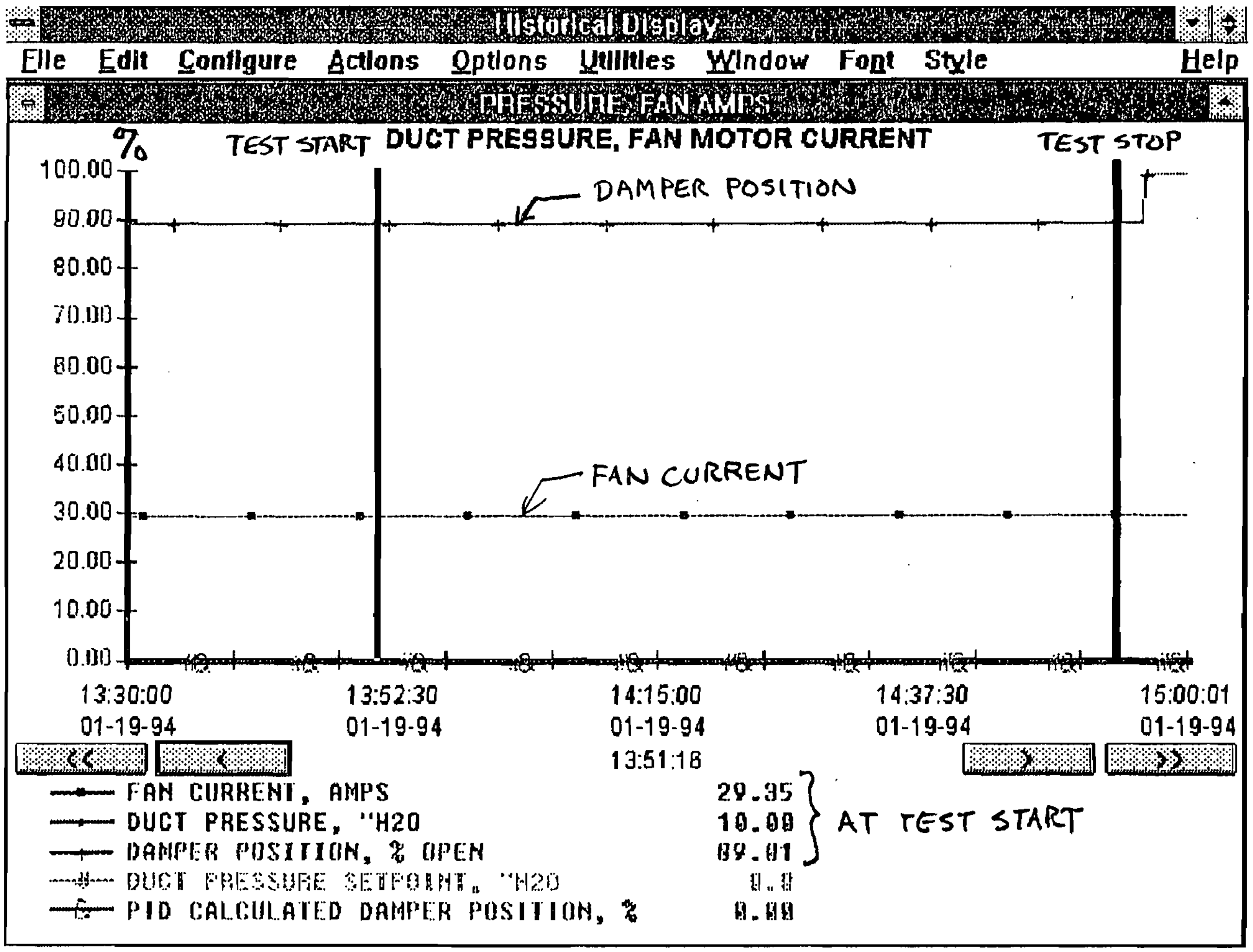


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
%
TEST START
ALL FIELD CONTROL OUTPUTS
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F2
F3
F1
F4
13:30:00
01-19-94
13:52:30
01-19-94
14:15:00
01-19-94
14:37:30
01-19-94
15:00:01
01-19-94
13:51:16
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 45.13
FIELD 3 CONTROL OUTPUT, % 39.00
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

WEP TEST 5.

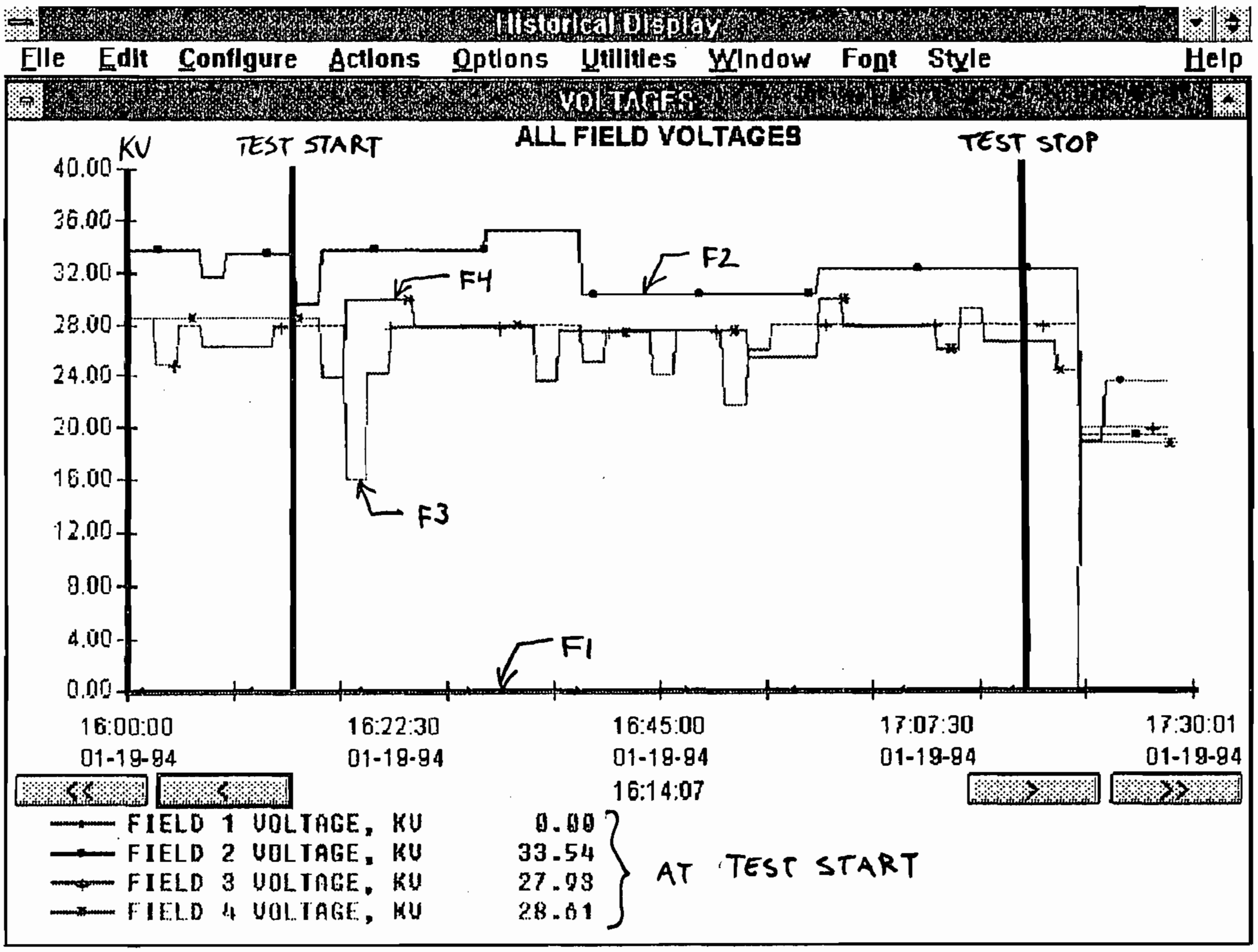

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
13:30:00 01-19-94
13:52:30 01-19-94
14:15:00 01-19-94
14:37:30 01-19-94
15:00:01 01-19-94
13:51:16
EP INLET TEMP., Deg F 186.57
EP OUTLET TEMP., Deg F 158.92
AT TEST START
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 58.1

WEP TEST 5.



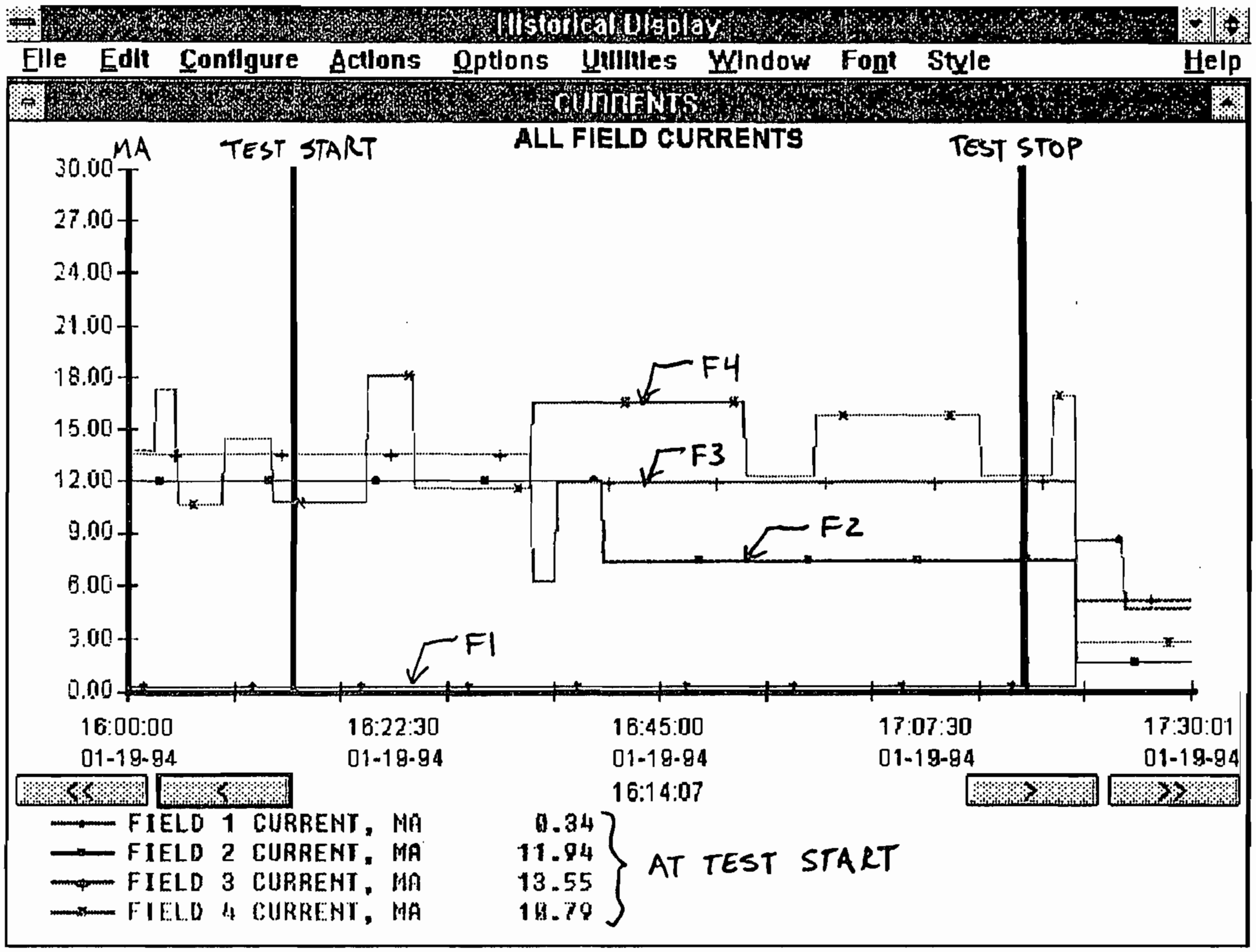
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
DAMPER POSITION
FAN CURRENT
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
13:30:00 01-19-94
13:52:30 01-19-94
14:15:00 01-19-94
14:37:30 01-19-94
15:00:01 01-19-94
13:51:16
FAN CURRENT, AMPS 29.35
DUCT PRESSURE, "H20 10.00
DAMPER POSITION, % OPEN 89.01
AT TEST START
DUCT PRESSURE SETPOINT, "H20 0.0
PID CALCULATED DAMPER POSITION, % 0.00

WEP TEST 5.

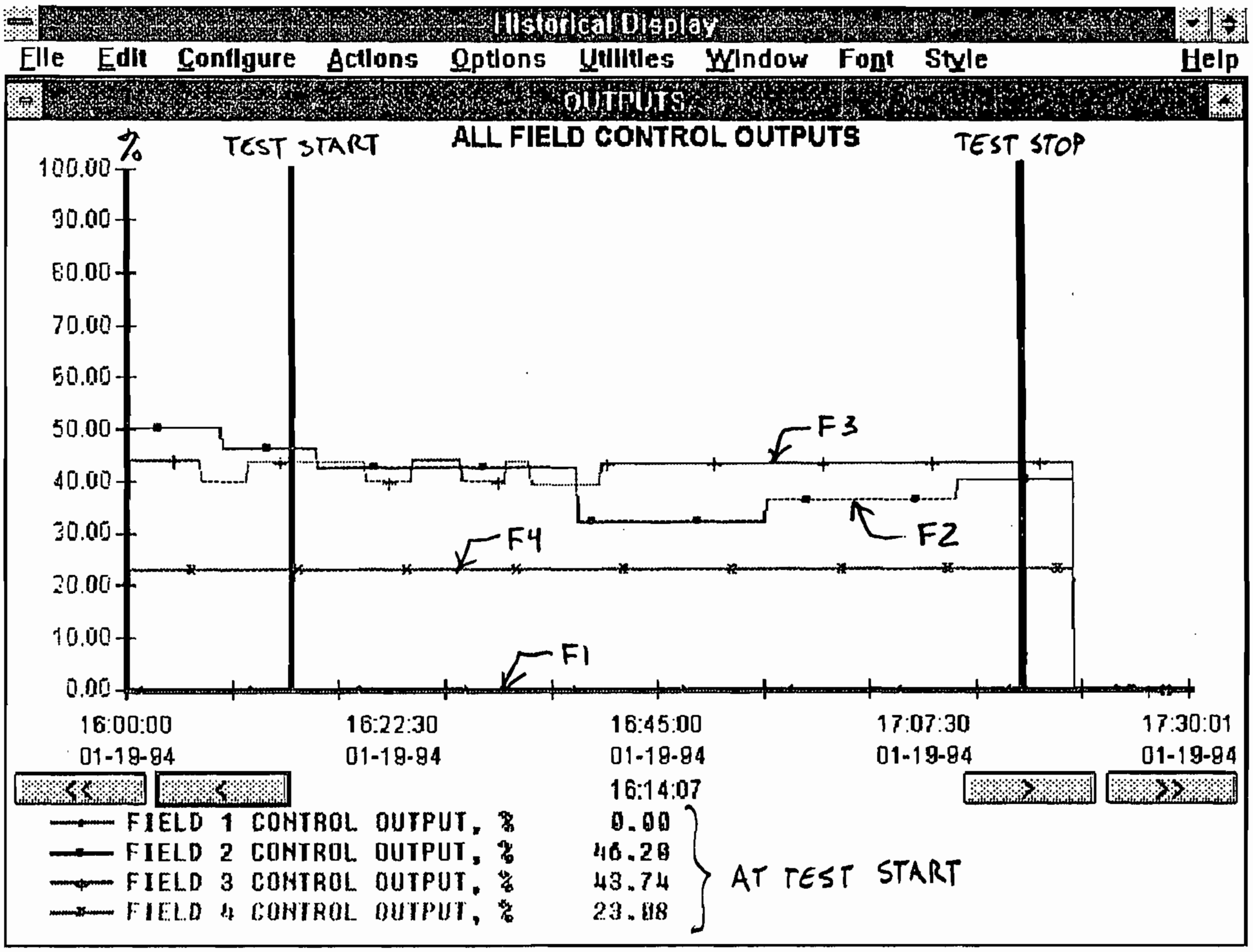


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F1
F2
F3
F4
16:00:00
01-19-94
16:22:30
01-19-94
16:45:00
01-19-94
16:14:07
17:07:30
01-19-94
17:30:01
01-19-94
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 33.54
FIELD 3 VOLTAGE, KV 27.93
FIELD 4 VOLTAGE, KV 28.61
AT TEST START

WEP TEST 6.

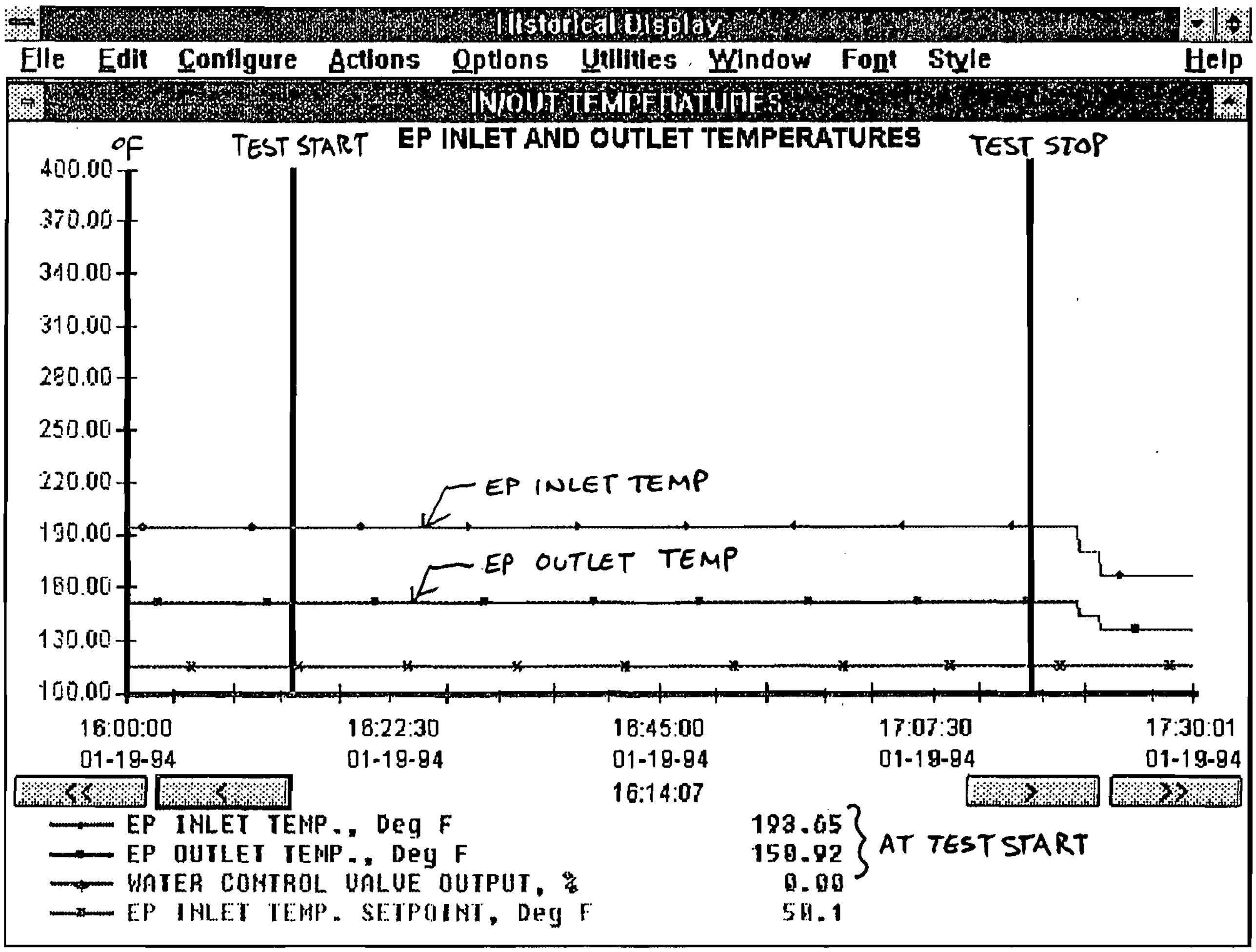

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F4
F3
F2
F1
16:00:00 01-19-94
16:22:30 01-19-94
16:45:00 01-19-94
17:07:30 01-19-94
17:30:01 01-19-94
16:14:07
FIELD 1 CURRENT, MA 0.34
FIELD 2 CURRENT, MA 11.94
FIELD 3 CURRENT, MA 13.55
FIELD 4 CURRENT, MA 10.79
AT TEST START

WEP TEST 6.



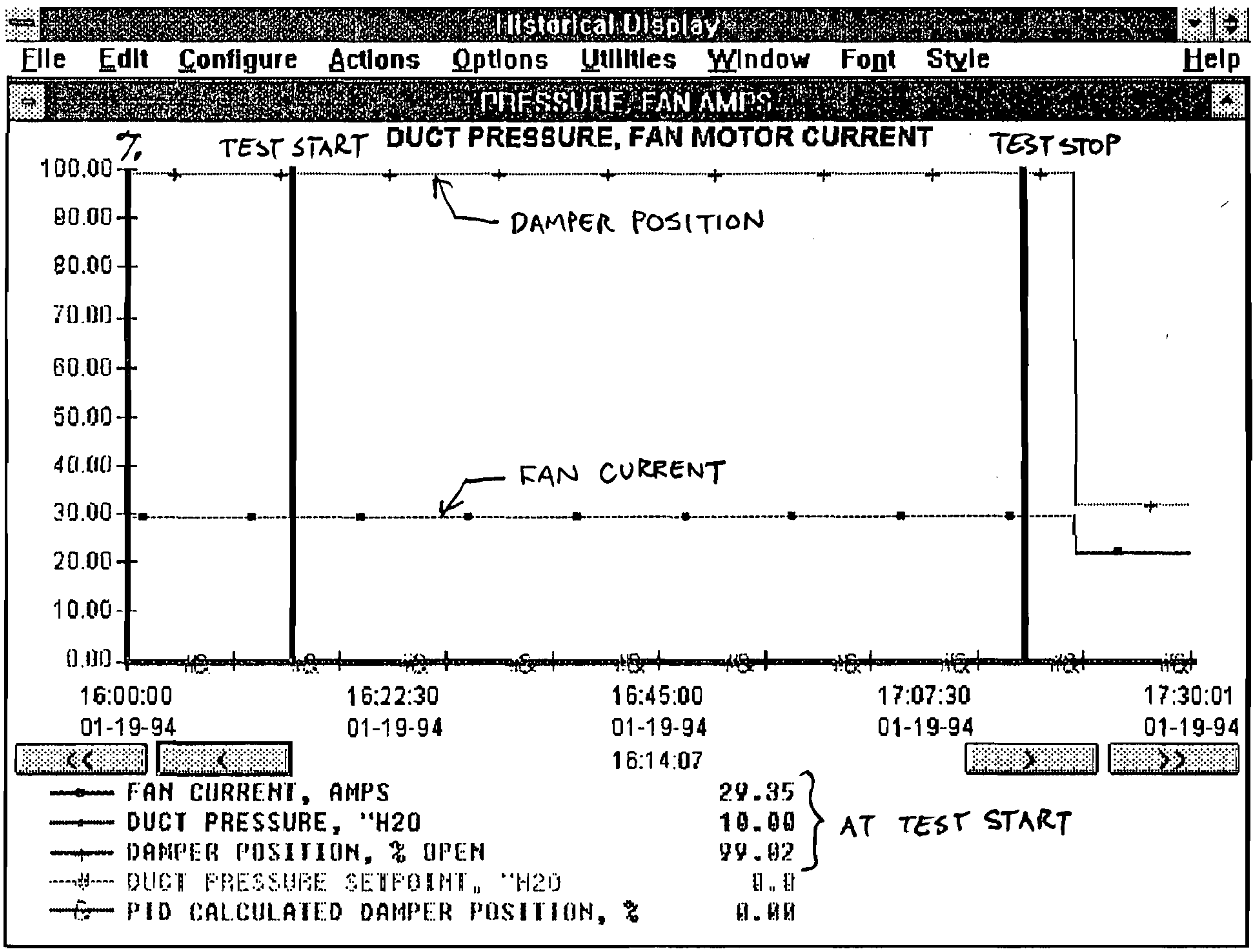
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F3
F2
F4
F1
16:00:00 01-19-94
16:22:30 01-19-94
16:45:00 01-19-94
17:07:30 01-19-94
17:30:01 01-19-94
16:14:07
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 46.28
FIELD 3 CONTROL OUTPUT, % 43.74
FIELD 4 CONTROL OUTPUT, % 23.08
AT TEST START

WEP TEST 6.

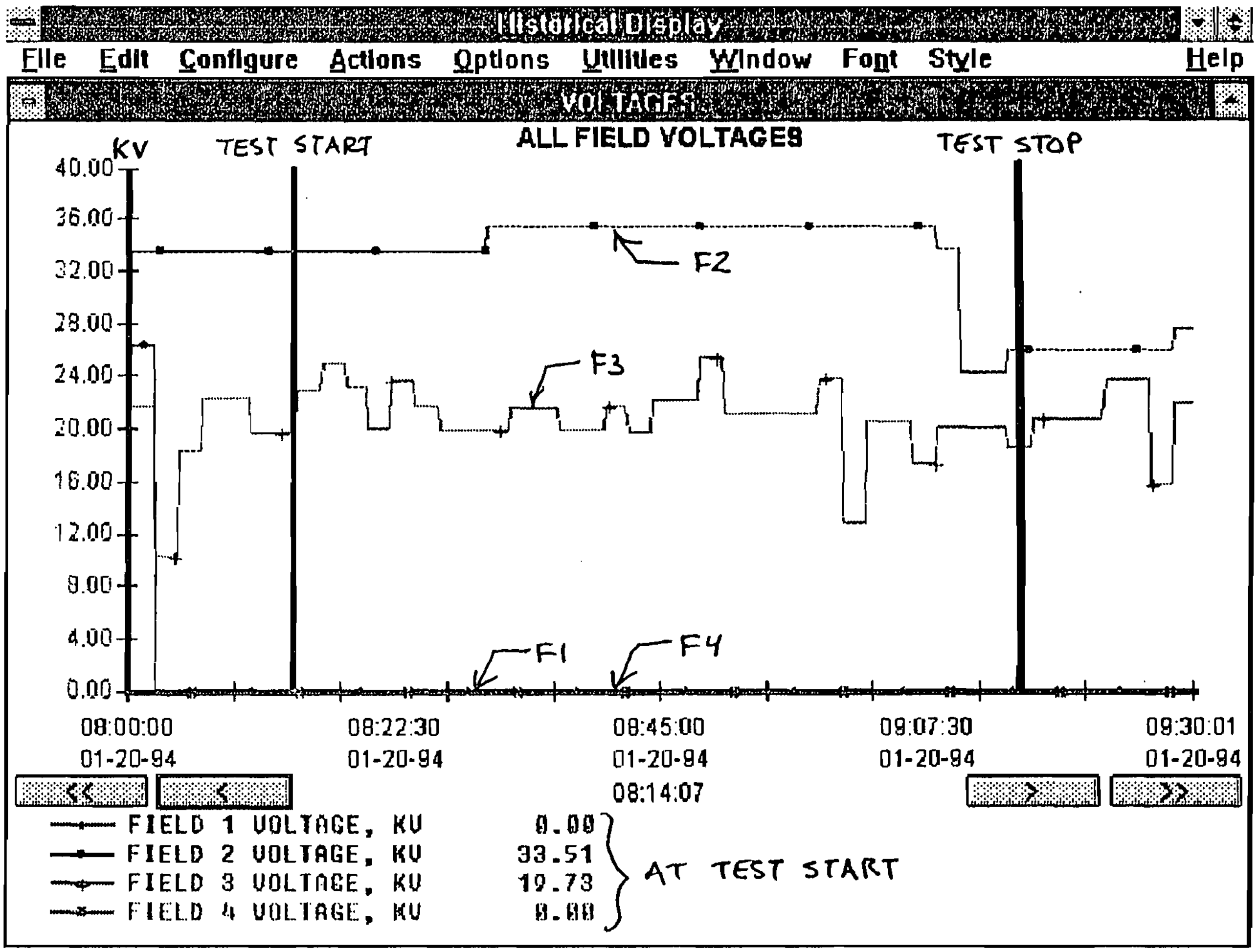


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
°F
TEST START
EP INLET AND OUTLET TEMPERATURES
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
16:00:00 01-19-94
16:22:30 01-19-94
16:45:00 01-19-94
17:07:30 01-19-94
17:30:01 01-19-94
16:14:07
EP INLET TEMP., Deg F 193.65
EP OUTLET TEMP., Deg F 158.92
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

WEP TEST 6.

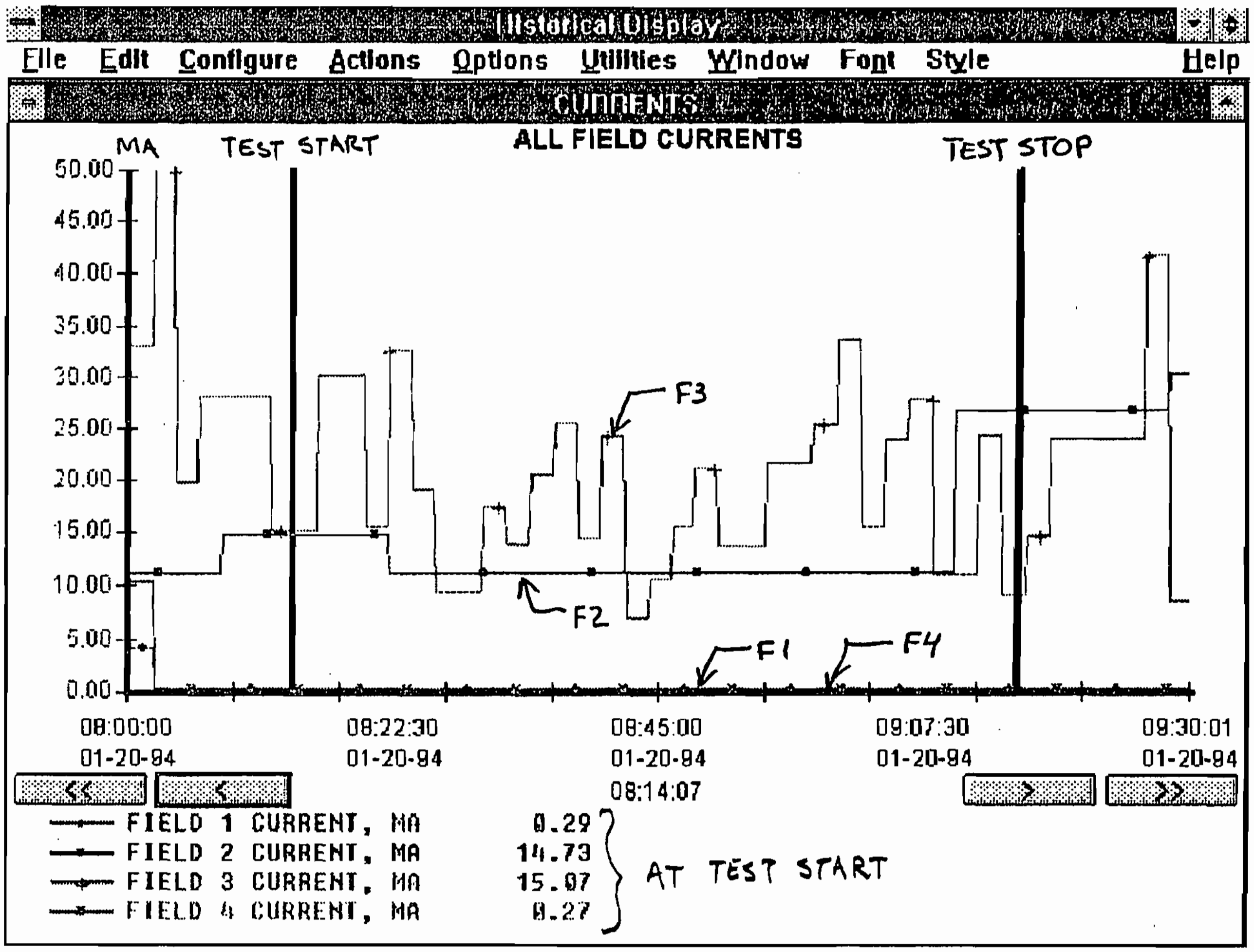

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
DAMPER POSITION
FAN CURRENT
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
16:00:00 01-19-94
16:22:30 01-19-94
16:45:00 01-19-94
17:07:30 01-19-94
17:30:01 01-19-94
16:14:07
FAN CURRENT, AMPS 29.35
DUCT PRESSURE, "H20 10.00
DAMPER POSITION, % OPEN 99.02
AT TEST START
DUCT PRESSURE SETPOINT, "H20 0.0
PID CALCULATED DAMPER POSITION, % 0.00

WEP TEST 6.



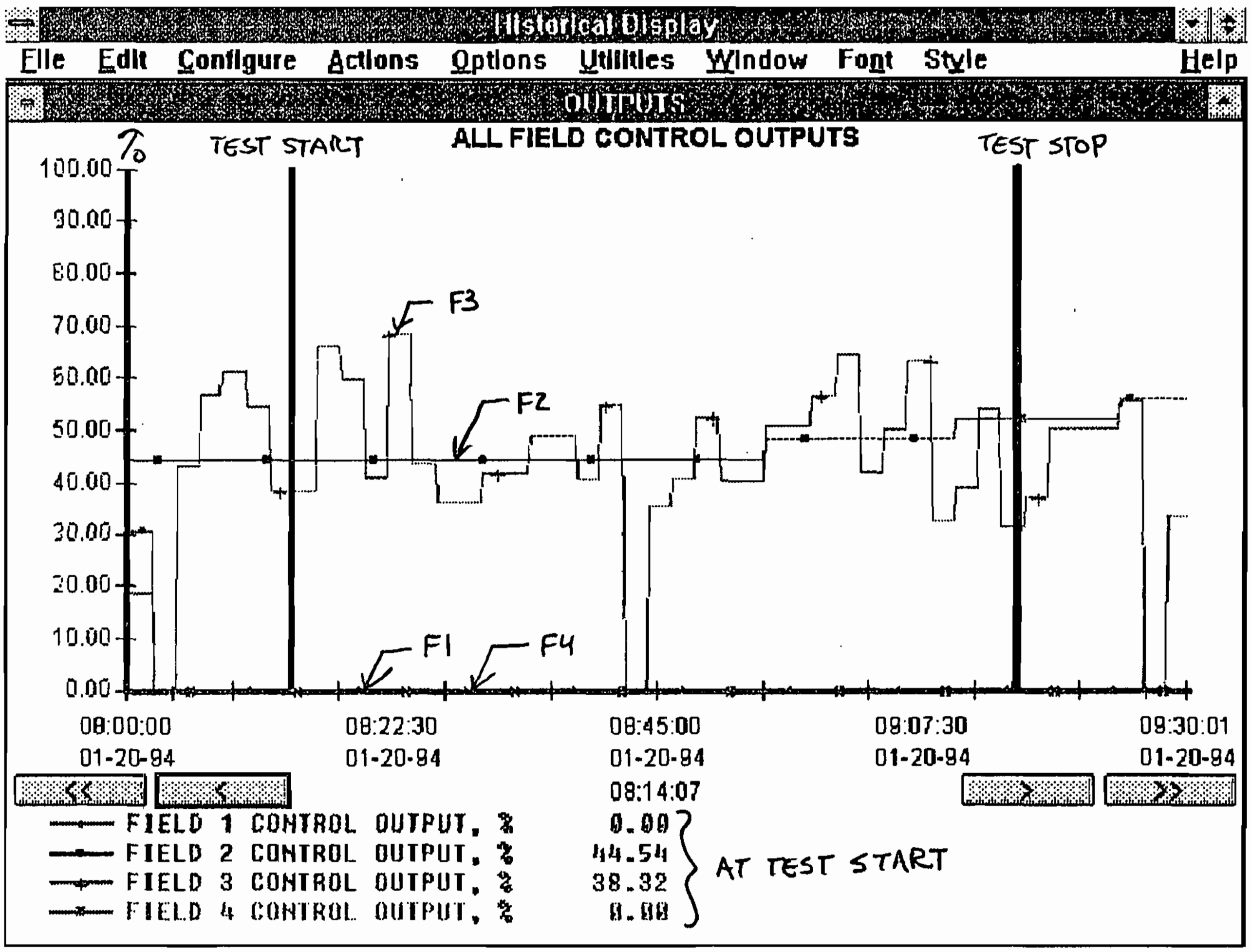
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
F2
F3
F1
F4
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
08:00:00 01-20-94
08:22:30 01-20-94
08:45:00 01-20-94
09:07:30 01-20-94
09:30:01 01-20-94
08:14:07
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 33.51
FIELD 3 VOLTAGE, KV 19.73
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

WEP TEST 7.



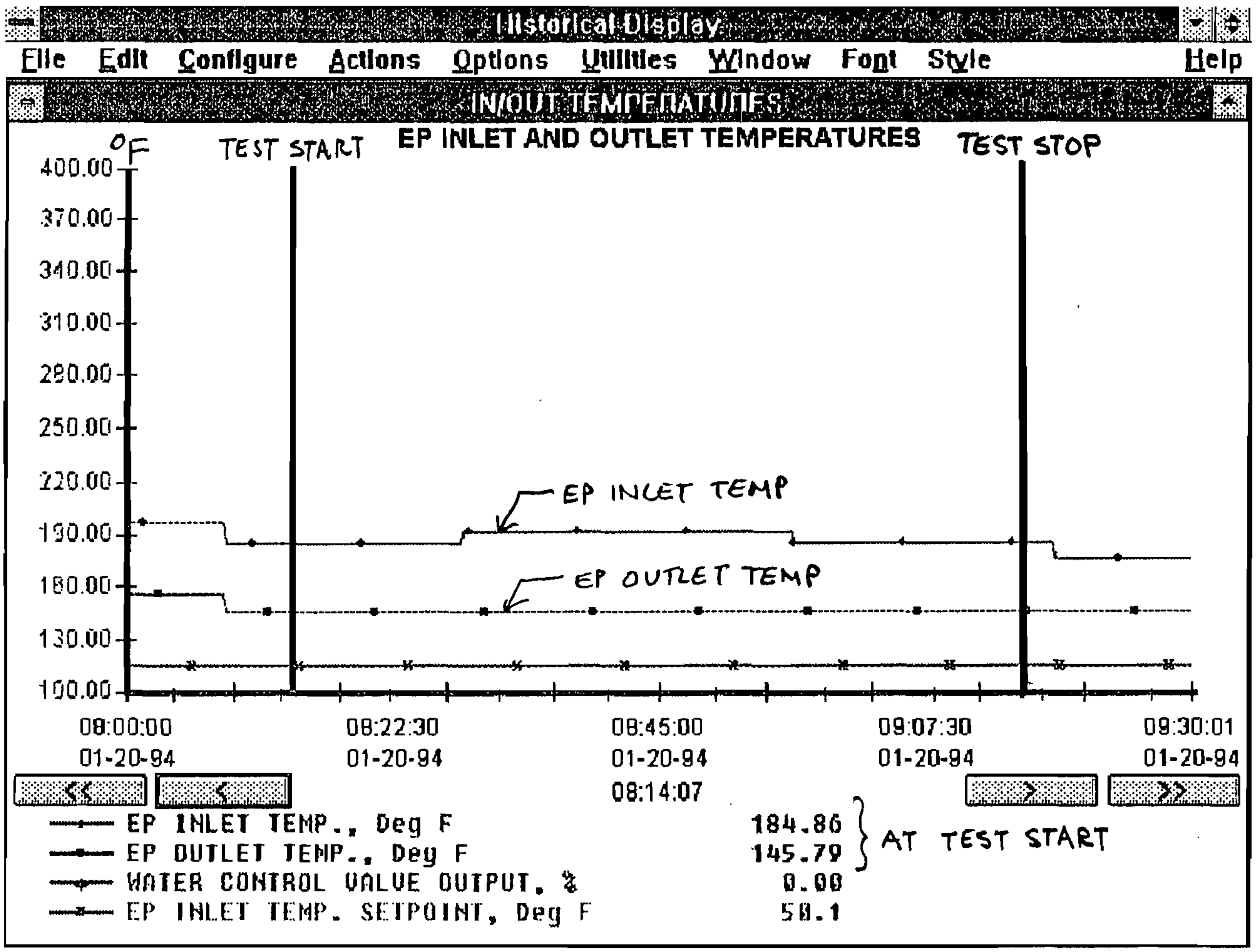
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
F3
F2
F1
F4
08:00:00 01-20-94
08:22:30 01-20-94
08:45:00 01-20-94
09:07:30 01-20-94
09:30:01 01-20-94
08:14:07
FIELD 1 CURRENT, MA 0.29
FIELD 2 CURRENT, MA 14.73
FIELD 3 CURRENT, MA 15.07
FIELD 4 CURRENT, MA 0.27
AT TEST START

WEP TEST 7.



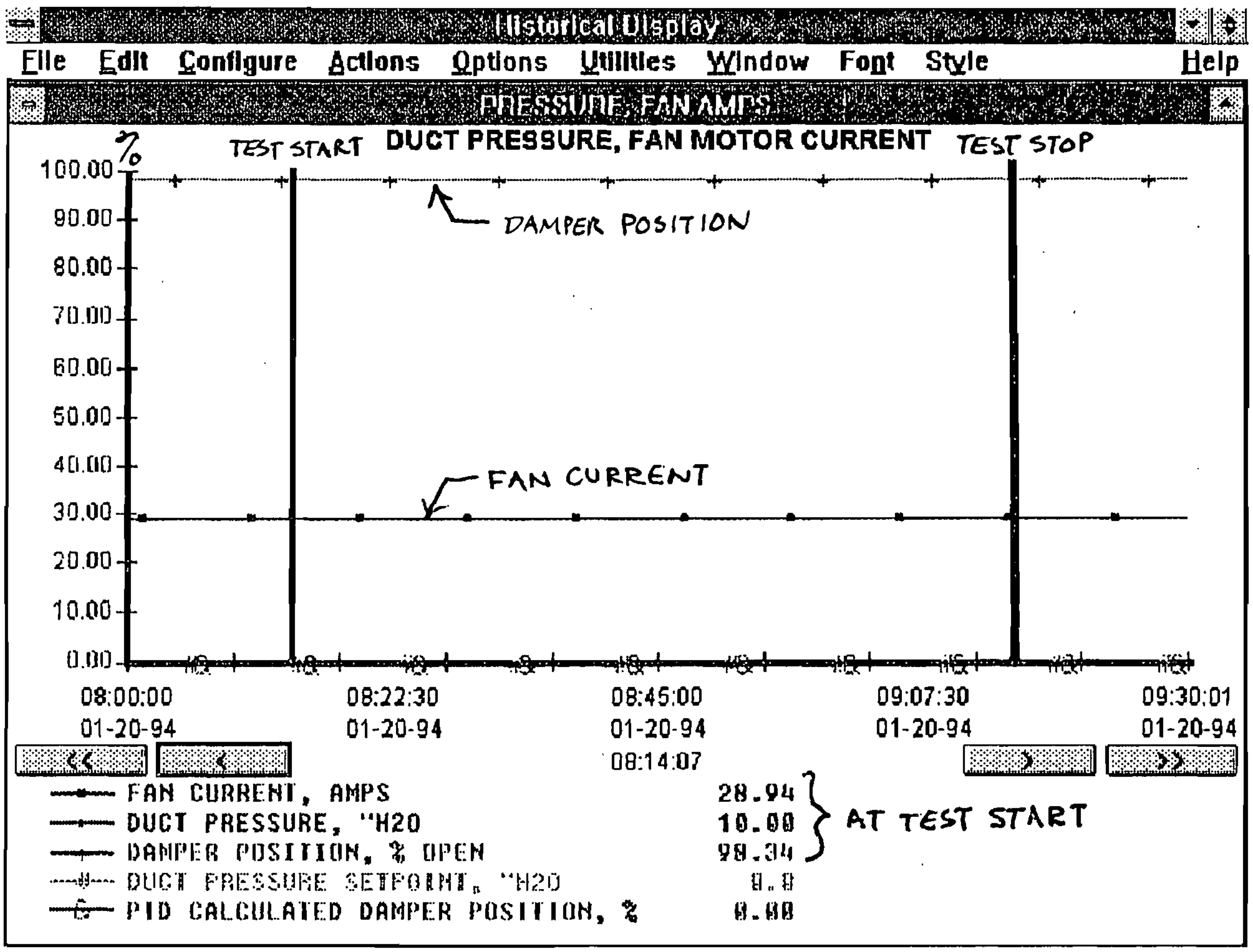
Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
F3
F2
F1
F4
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
08:00:00
01-20-94
08:22:30
01-20-94
08:45:00
01-20-94
09:07:30
01-20-94
09:30:01
01-20-94
08:14:07
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 44.54
FIELD 3 CONTROL OUTPUT, % 38.32
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

WEP TEST 7.

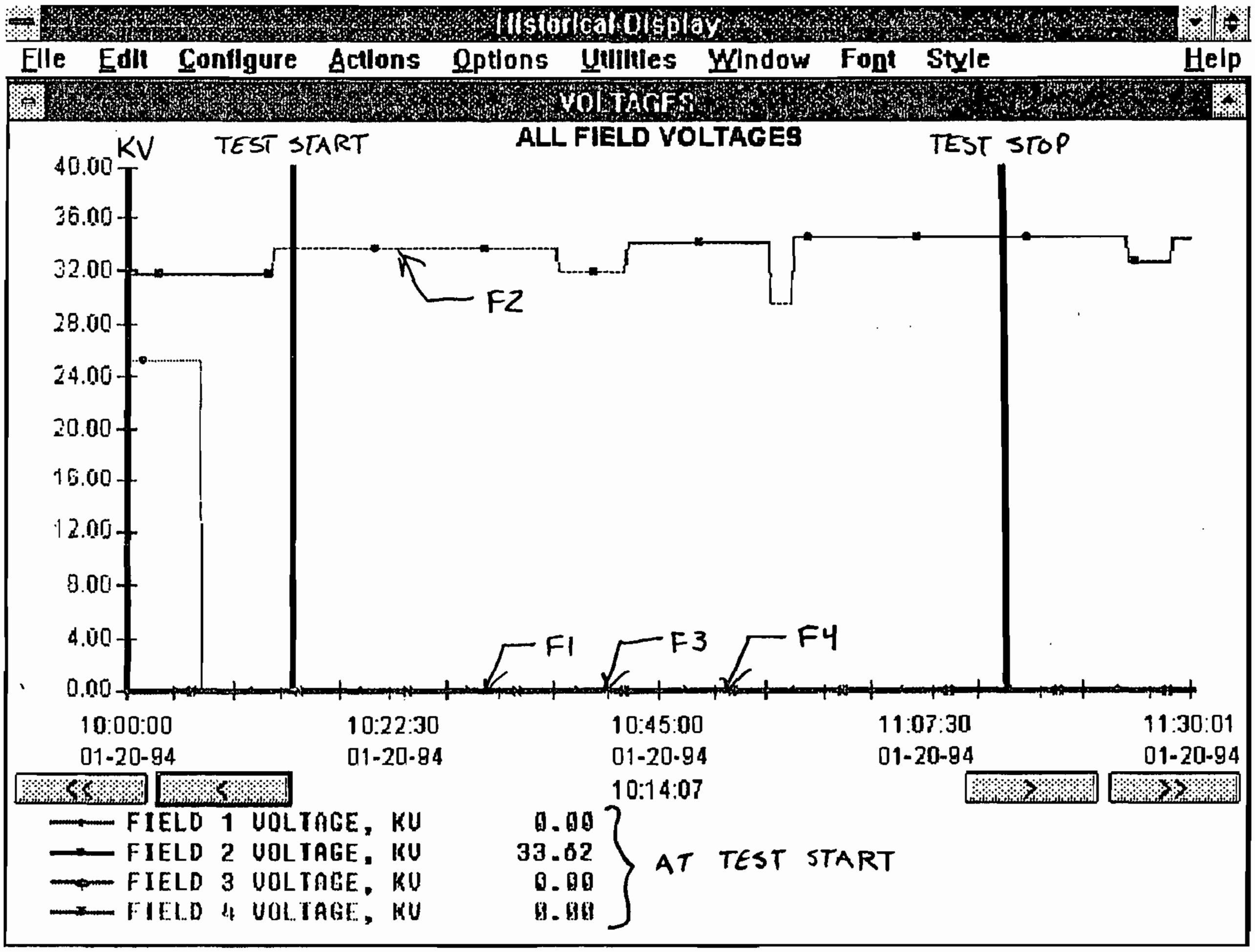


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
08:00:00 01-20-94
08:22:30 01-20-94
08:45:00 01-20-94
09:07:30 01-20-94
09:30:01 01-20-94
08:14:07
EP INLET TEMP., Deg F 184.86
EP OUTLET TEMP., Deg F 145.79
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

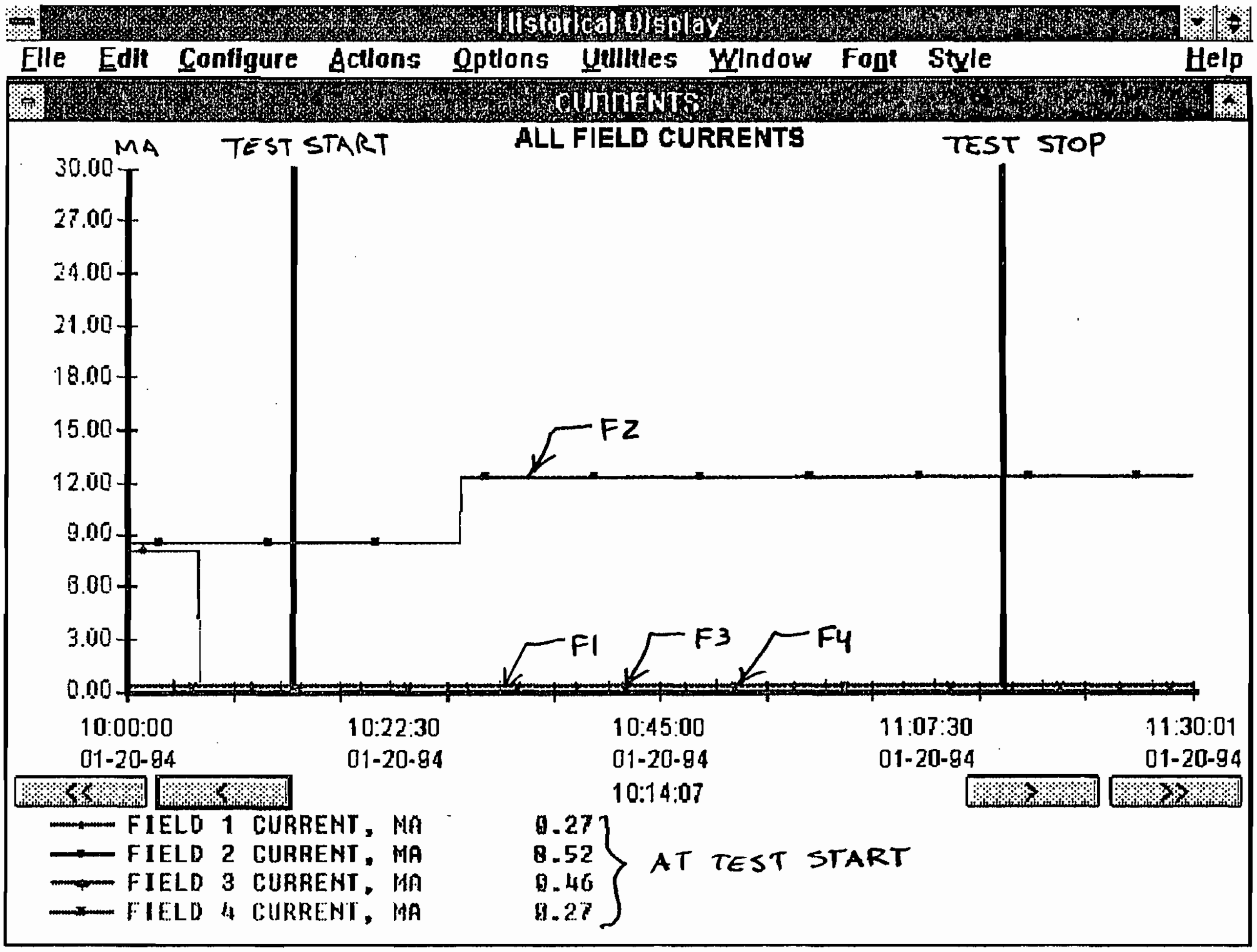
WEP TEST 7.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
DAMPER POSITION
FAN CURRENT
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
08:00:00 01-20-94
08:22:30 01-20-94
08:45:00 01-20-94
09:07:30 01-20-94
09:30:01 01-20-94
08:14:07
FAN CURRENT, AMPS 28.94
DUCT PRESSURE, "H20 10.00
DAMPER POSITION, % OPEN 98.34
DUCT PRESSURE SETPOINT, "H20 0.0
PID CALCULATED DAMPER POSITION, % 0.00
AT TEST START

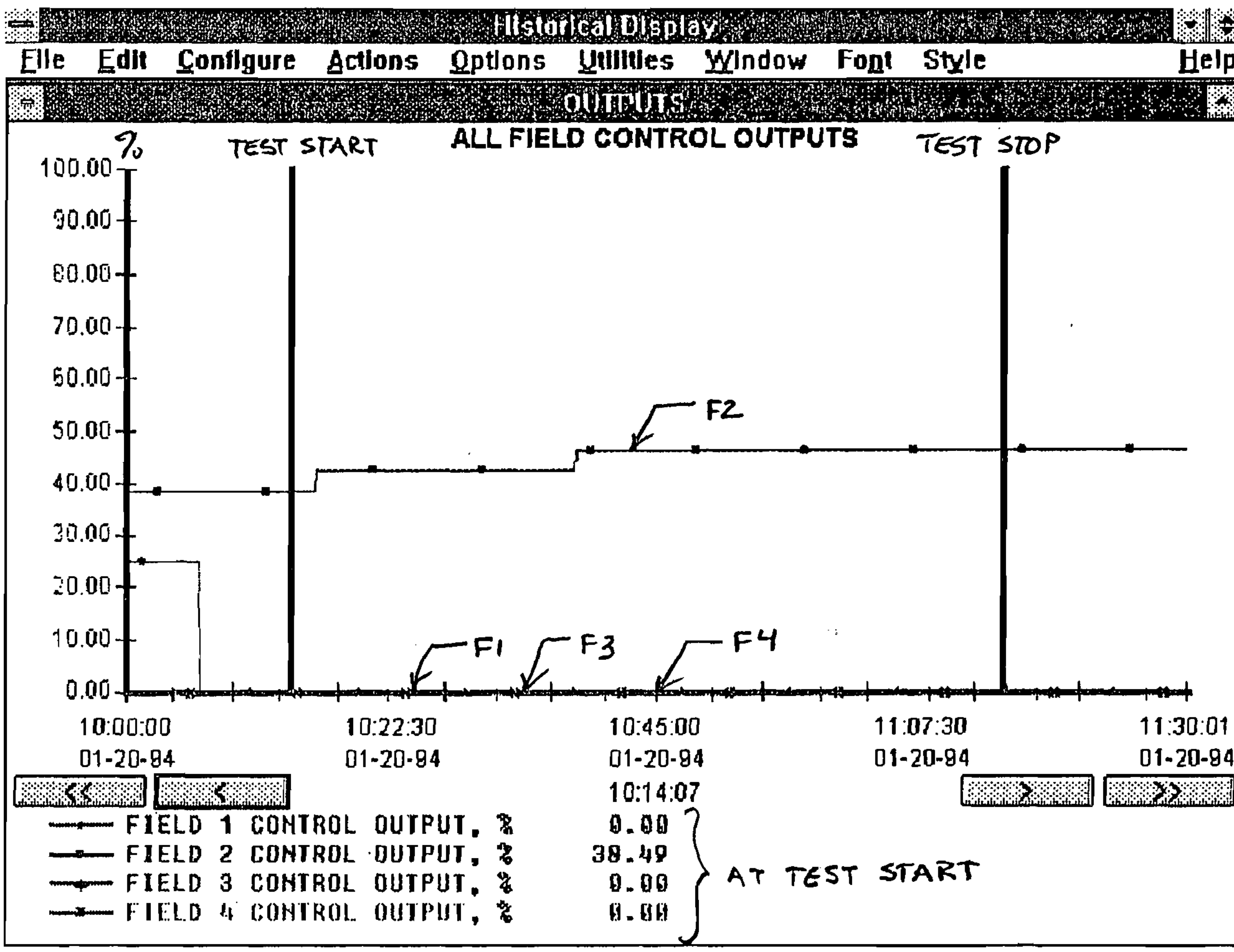
WEP TEST 7.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2
F1
F3
F4
10:00:00 01-20-94
10:22:30 01-20-94
10:45:00 01-20-94
11:07:30 01-20-94
11:30:01 01-20-94
10:14:07
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 33.62
FIELD 3 VOLTAGE, KV 0.00
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

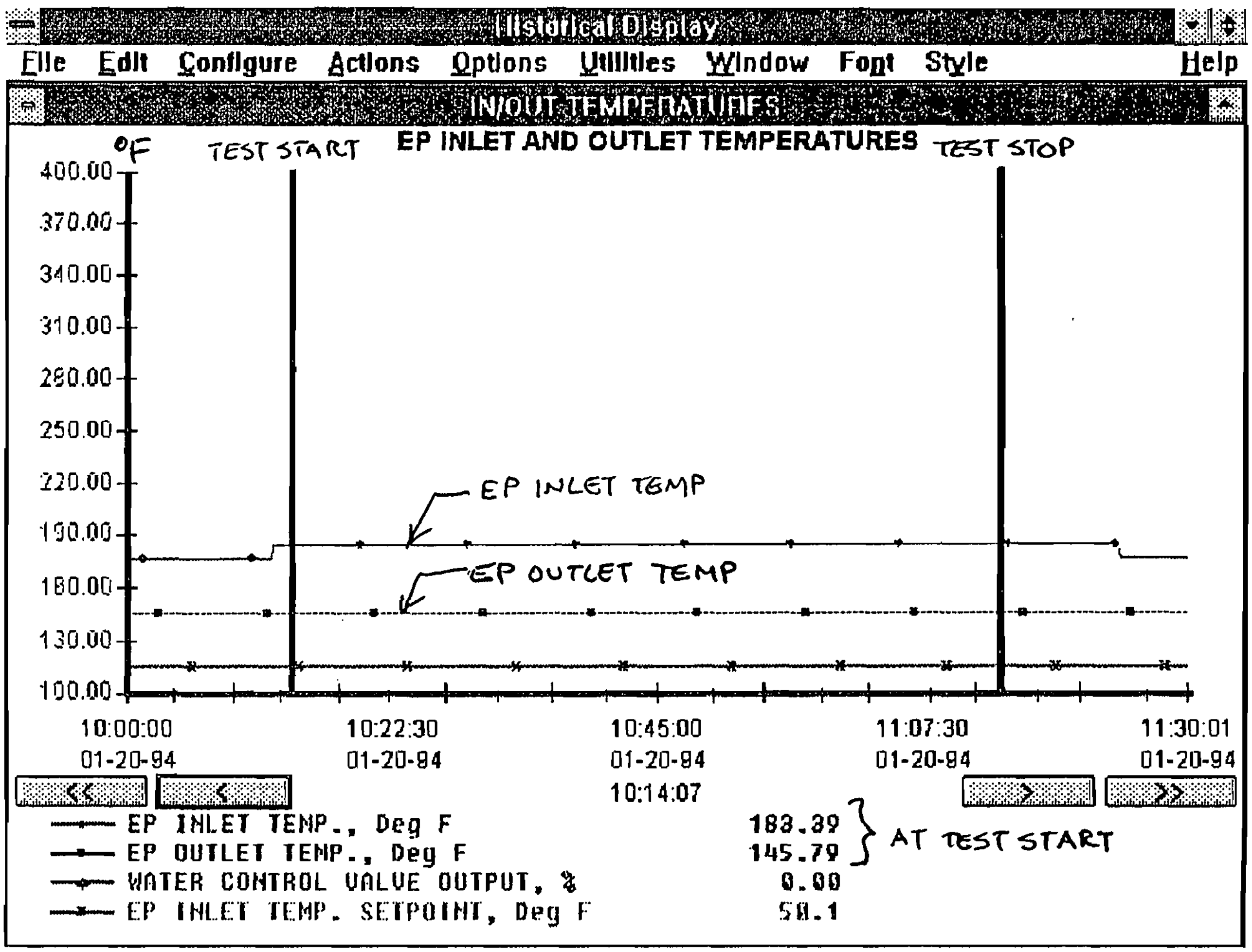
WEP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
F2
F1
F3
F4
10:00:00 01-20-94
10:22:30 01-20-94
10:45:00 01-20-94
11:07:30 01-20-94
11:30:01 01-20-94
10:14:07
FIELD 1 CURRENT, MA 0.27
FIELD 2 CURRENT, MA 8.52
FIELD 3 CURRENT, MA 0.46
FIELD 4 CURRENT, MA 0.27
AT TEST START

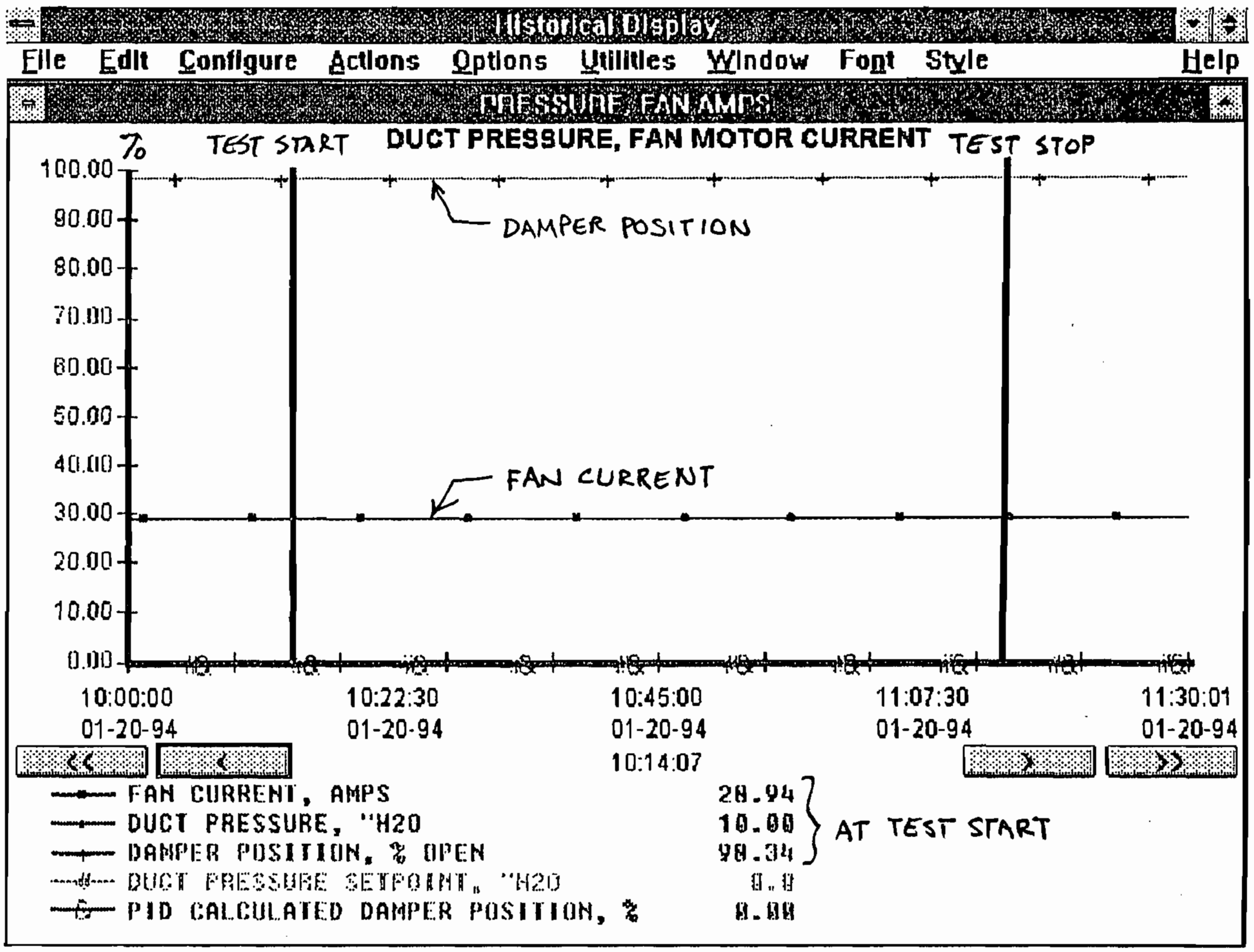
WEP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
F2
F1
F3
F4
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
10:00:00 01-20-94
10:22:30 01-20-94
10:45:00 01-20-94
11:07:30 01-20-94
11:30:01 01-20-94
10:14:07
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 38.49
FIELD 3 CONTROL OUTPUT, % 0.00
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

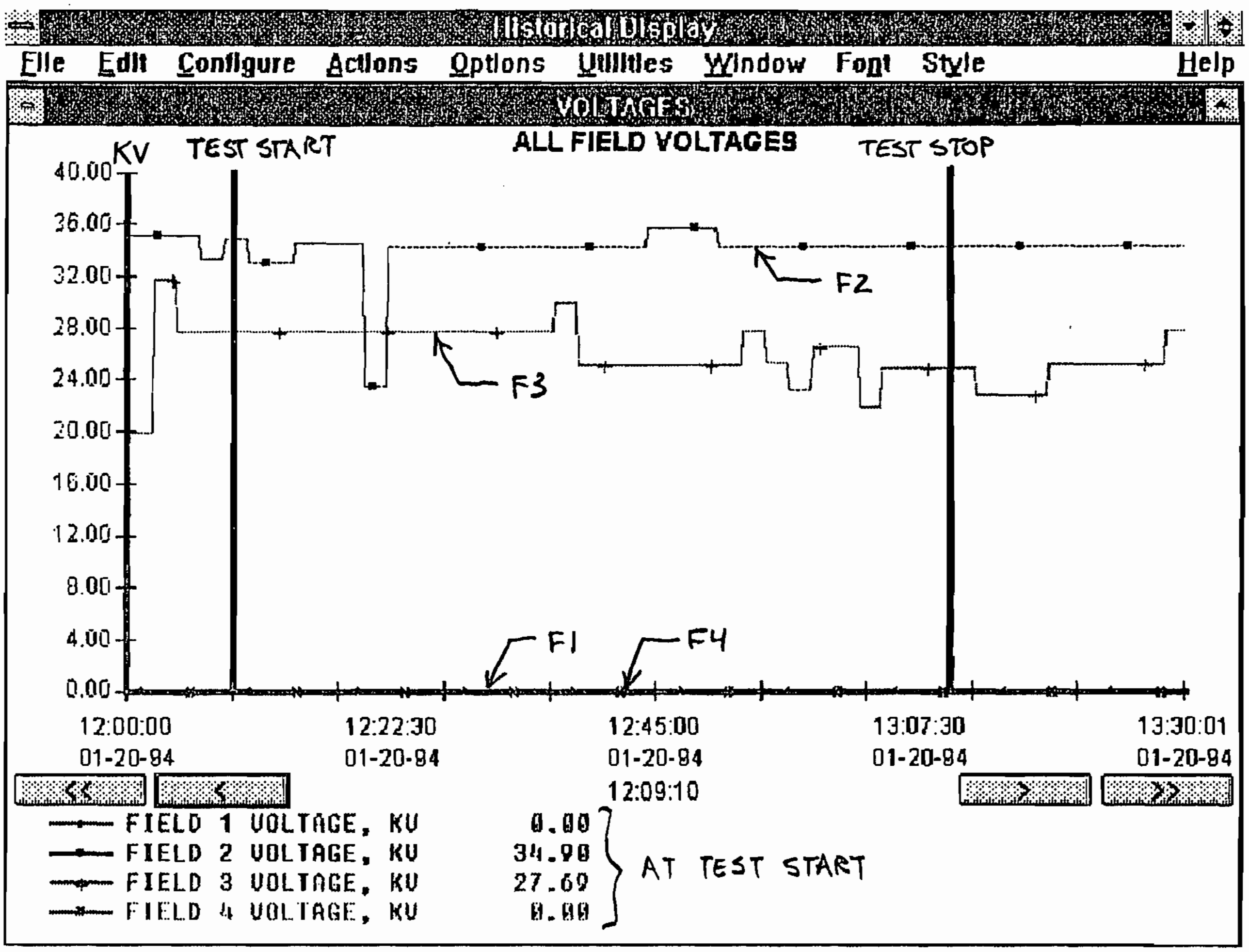
WEP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
EP INLET TEMP
EP OUTLET TEMP
10:00:00 01-20-94
10:22:30 01-20-94
10:45:00 01-20-94
11:07:30 01-20-94
11:30:01 01-20-94
10:14:07
EP INLET TEMP., Deg F 183.39
EP OUTLET TEMP., Deg F 145.79
AT TEST START
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1

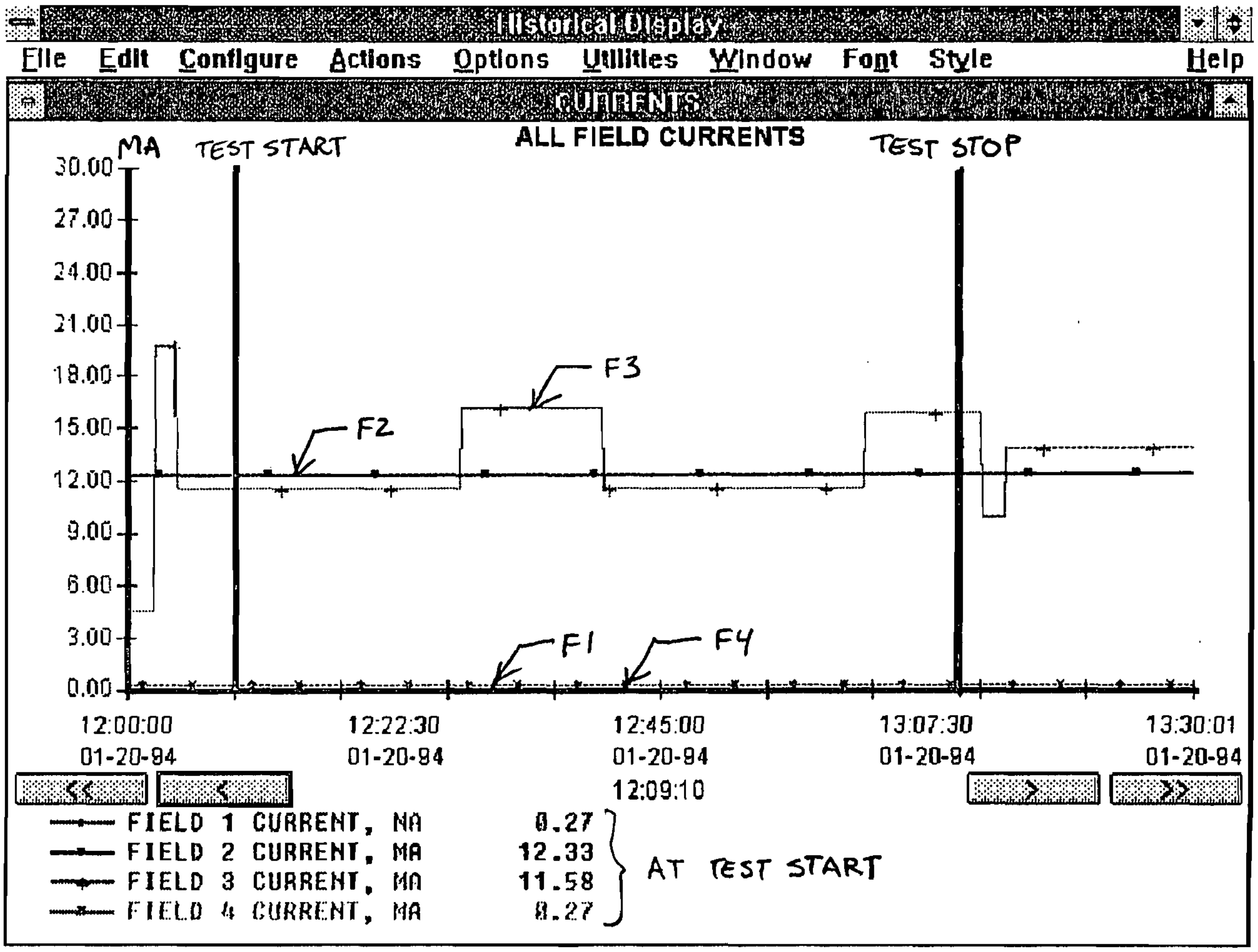
WEP TEST 8.


Historical Display
File
Edit
Configure
Actions
Options
Utilities
Window
Font
Style
Help
PRESSURE, FAN AMPS
%
TEST START
DUCT PRESSURE, FAN MOTOR CURRENT
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DAMPER POSITION
FAN CURRENT
10:00:00 01-20-94
10:22:30 01-20-94
10:45:00 01-20-94
11:07:30 01-20-94
11:30:01 01-20-94
10:14:07
FAN CURRENT, AMPS 28.94
DUCT PRESSURE, "H2O 10.00
DAMPER POSITION, % OPEN 98.34
DUCT PRESSURE SETPOINT, "H2O 0.0
PID CALCULATED DAMPER POSITION, % 0.00
AT TEST START

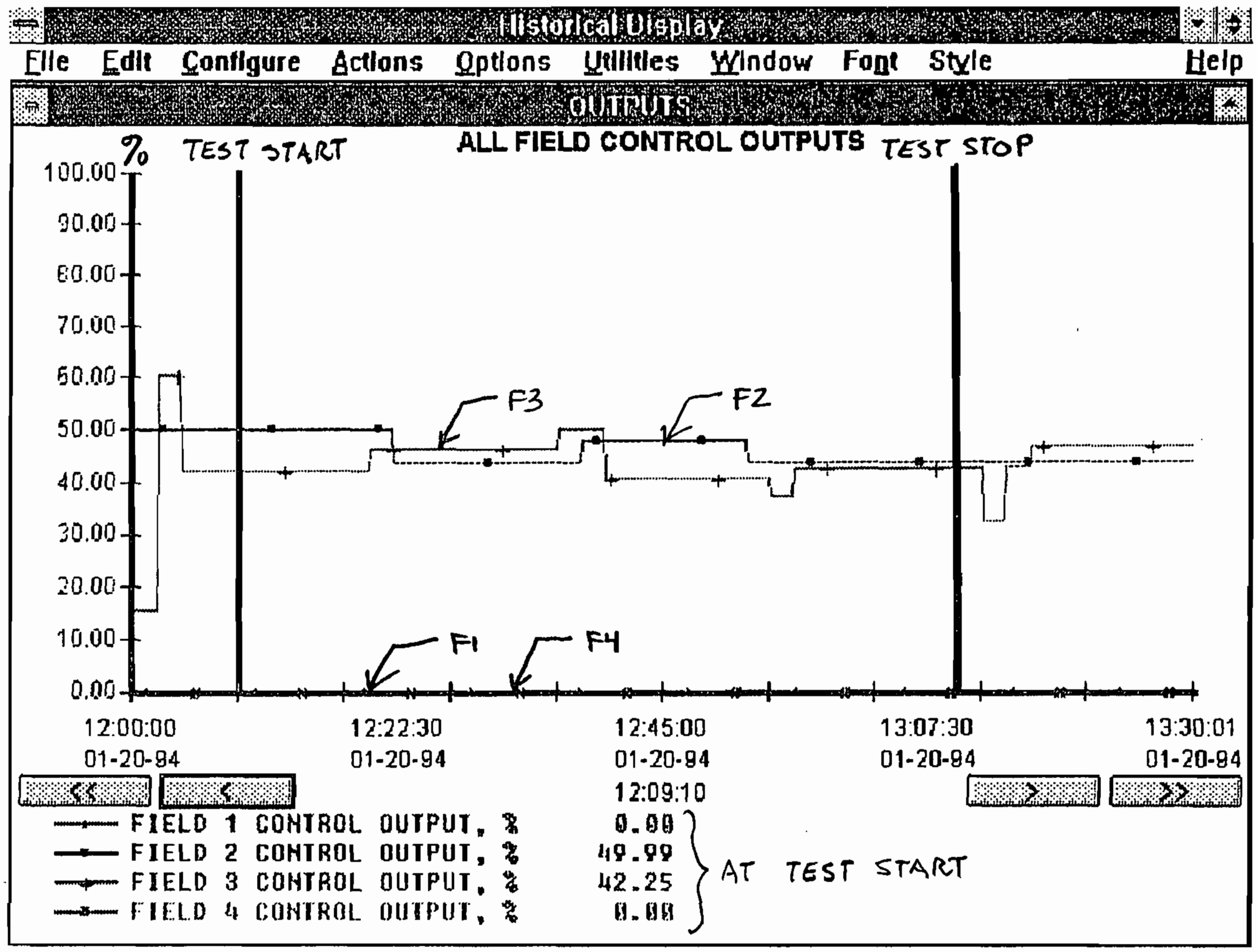
WEP TEST 8.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
VOLTAGES
ALL FIELD VOLTAGES
KV
TEST START
TEST STOP
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
0.00
F2
F3
F1
F4
12:00:00 01-20-94
12:22:30 01-20-94
12:45:00 01-20-94
13:07:30 01-20-94
13:30:01 01-20-94
12:09:10
FIELD 1 VOLTAGE, KV 0.00
FIELD 2 VOLTAGE, KV 34.90
FIELD 3 VOLTAGE, KV 27.69
FIELD 4 VOLTAGE, KV 0.00
AT TEST START

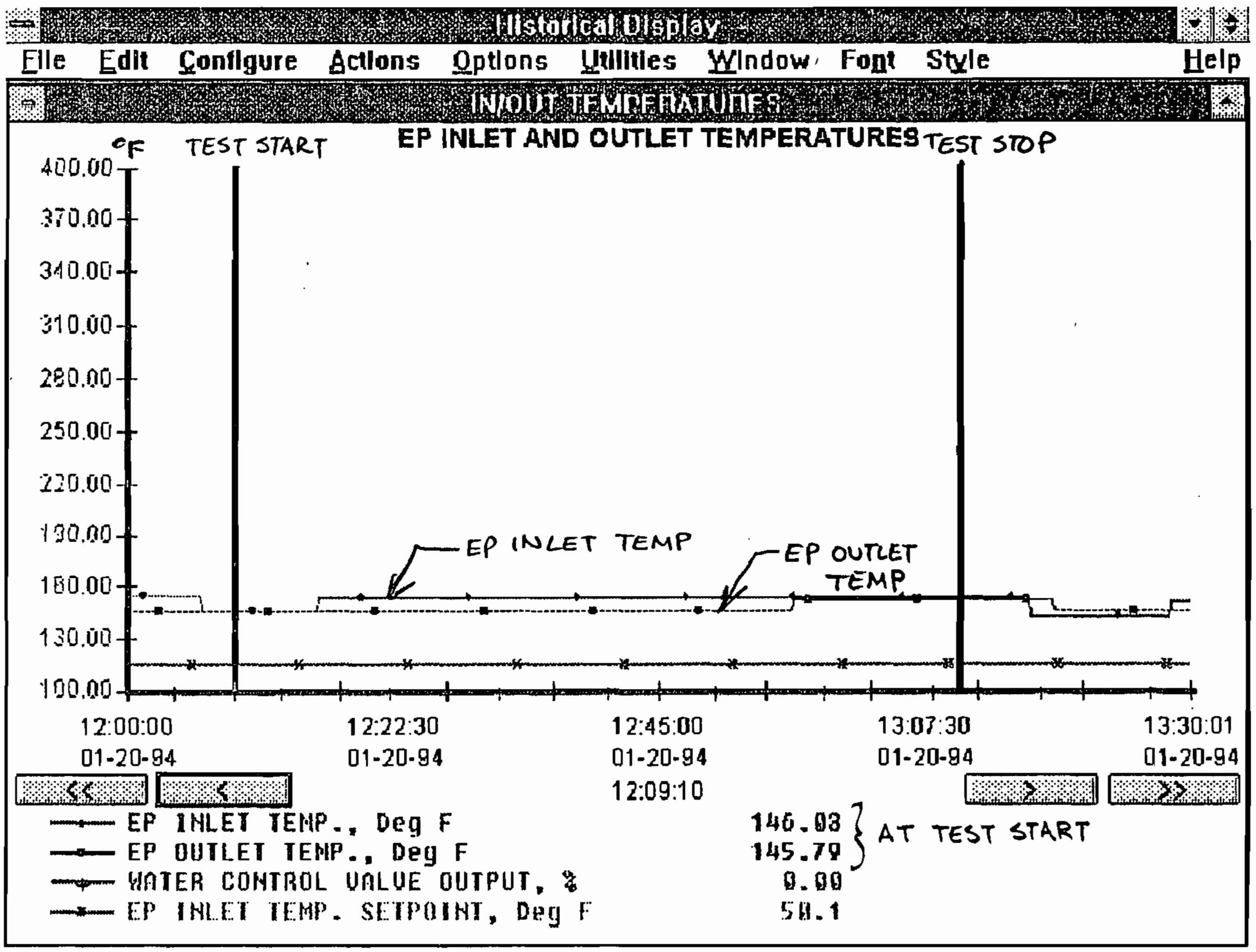
WEP TEST 9.


Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
CURRENTS
ALL FIELD CURRENTS
MA
TEST START
TEST STOP
F1
F2
F3
F4
30.00
27.00
24.00
21.00
18.00
15.00
12.00
9.00
6.00
3.00
0.00
12:00:00 01-20-94
12:22:30 01-20-94
12:45:00 01-20-94
13:07:30 01-20-94
13:30:01 01-20-94
12:09:10
FIELD 1 CURRENT, MA 0.27
FIELD 2 CURRENT, MA 12.33
FIELD 3 CURRENT, MA 11.58
FIELD 4 CURRENT, MA 0.27
AT TEST START

WEP TEST 9.

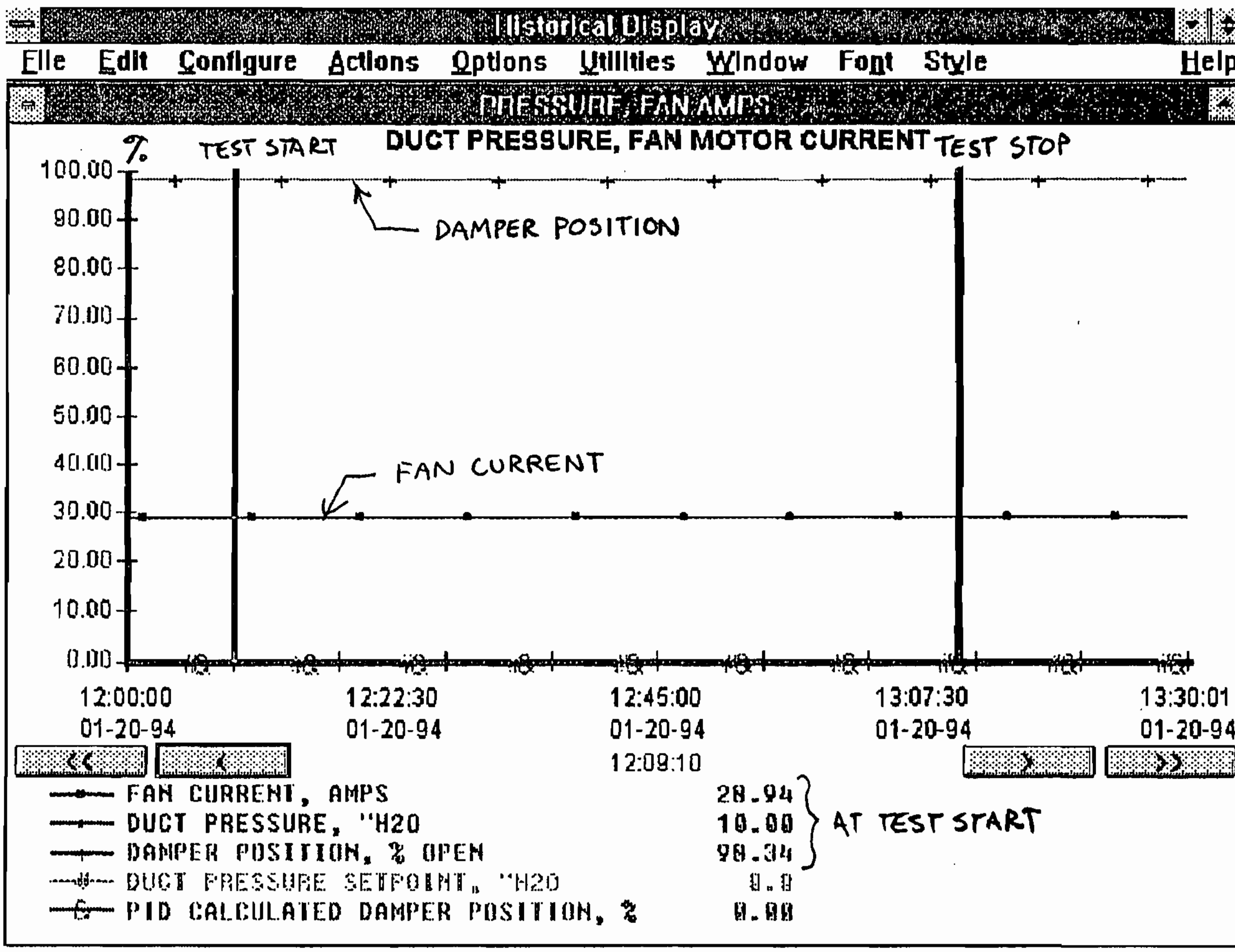

Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
OUTPUTS
ALL FIELD CONTROL OUTPUTS
%
TEST START
TEST STOP
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
F3
F2
F1
F4
12:00:00 01-20-94
12:22:30 01-20-94
12:45:00 01-20-94
13:07:30 01-20-94
13:30:01 01-20-94
12:09:10
FIELD 1 CONTROL OUTPUT, % 0.00
FIELD 2 CONTROL OUTPUT, % 49.99
FIELD 3 CONTROL OUTPUT, % 42.25
FIELD 4 CONTROL OUTPUT, % 0.00
AT TEST START

WEP TEST 9.



Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
IN/OUT TEMPERATURES
EP INLET AND OUTLET TEMPERATURES
°F
TEST START
TEST STOP
EP INLET TEMP
EP OUTLET TEMP
400.00
370.00
340.00
310.00
280.00
250.00
220.00
190.00
160.00
130.00
100.00
12:00:00 01-20-94
12:22:30 01-20-94
12:45:00 01-20-94
13:07:30 01-20-94
13:30:01 01-20-94
12:09:10
EP INLET TEMP., Deg F 146.08
EP OUTLET TEMP., Deg F 145.79
WATER CONTROL VALVE OUTPUT, % 0.00
EP INLET TEMP. SETPOINT, Deg F 50.1
AT TEST START

WEP TEST 9.



Historical Display
File Edit Configure Actions Options Utilities Window Font Style Help
PRESSURE, FAN AMPS
DUCT PRESSURE, FAN MOTOR CURRENT
%
TEST START
TEST STOP
DAMPER POSITION
FAN CURRENT
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
12:00:00 01-20-94
12:22:30 01-20-94
12:45:00 01-20-94
13:07:30 01-20-94
13:30:01 01-20-94
12:08:10
FAN CURRENT, AMPS 28.94
DUCT PRESSURE, "H2O 10.00
DAMPER POSITION, % OPEN 98.34
AT TEST START
DUCT PRESSURE SETPOINT, "H2O 0.0
PID CALCULATED DAMPER POSITION, % 0.00

WEP TEST 9.

ATTACHMENT 1

5.3.3 Nitrogen Dioxide

Only the annual averaging time must be considered for NO_x impact analysis, since the only NO_x AAQS is an annual standard. Maximum annual emissions of NO_x are estimated at 206 tons per year for the proposed Boiler 4, and occur due to maximum fuel oil burning conditions with the remainder of steam capacity from bagasse firing (see Appendix G). To estimate the annual average NO_x impact due to Boiler 4 only, the SO_2 annual impacts of Boiler 4 only were adjusted by the ratio of SO_2 to NO_x emissions. The modeled SO_2 emissions were 642.9 lb/hr or 1,404 tons (for 182-day crop-year). The resulting maximum annual average NO_x concentration due to Boiler 4 operation is 0.5 ug/m^3 (3.1 x 206 ÷ 1,404). This impact is less than the NO_x significance level of 1 ug/m^3, annual average; therefore, no further impact analysis is required for NO_x.

5.3.4 Carbon Monoxide

CO impacts from the proposed Boiler 4 only were determined with the ISCST model. Worst-case CO emissions occur under total bagasse burning (136.4 lb/hr). Both the 1-hour and 8-hour averaging times were assessed. Maximum predicted impacts were determined to be 39 ug/m^3, 1-hour average, and 17 ug/m^3, 8-hour average. These impacts are well below the significance levels of 2,000 ug/m^3, 1-hour average, and 500 ug/m^3, 8-hour average. Therefore, these impacts are minimal, should not cause or contribute to violations of the CO AAQS, and no further impact analysis is required.

5.3.5 Increment Consumption

Both federal and state PSD regulations require a demonstration that a proposed source will not cause or contribute to increases in ambient concentrations of PM or SO_2 greater than a specified amount over a baseline concentration. Since January 1, 1975 (the baseline date for major sources as established by EPA and Florida DER), construction permits were issued for PM scrubbers for Boilers 5 and 6 at the Clewiston mill (Table 5-3). This means that for the baseline situation,

Table 5-3. Permit History of U.S. Sugar Corporation--Clewiston Mill

Unit	Permit No.	Date Issued	Comments
Boiler 1	A026-2028	5/16/73	Operating permit
	AC26-2028A	7/12/74	Added Joy scrubber
Boiler 2	AO-26-2029	5/16/73	Operating permit
	AC26-2029A	7/12/74	Added Joy scrubber
Boiler 3	A026-2030	5/16/73	Operating permit
	AC26-2030A	7/15/74	Added Joy scrubber
Boiler 5	A026-2031	5/16/73	Operating permit
	AC26-2031A	1/15/75	Added Joy scrubber
Boiler 6	A026-2032	5/16/73	Operating permit
	AC26-2032A	1/15/75	Added Joy scrubber
East Pellet Plant	AC502	11/07/72	
	A026-2035A	4/15/76	Operating permit--changed furnace type
	A026-50204	9/16/82	Operating permit renewal
West Pellet Plant	AC26-2141	11/18/74	Upgrade dryer and add scrubber
	A026-2141	5/27/75	Operating permit for scrubber
	A026-50205	9/16/82	Operating permit renewal

Source: ESE, 1983.

these boilers were uncontrolled for PM and SO_2 emissions, and baseline emissions for PM would be on the order of 10 times the controlled amount, and for SO_2 two times the controlled amount.

The East and West Pellet plants will be shut down in conjunction with the proposed Boiler 4 operation. These changes will provide increment expansion and will act to offset the increment consumption due to the proposed Boiler 4 only. The maximum impacts of Boiler 4 only will be less than 25 percent of the Class II PSD increments for PM and less than 20 percent of the Class II PSD increments for SO_2 under normal operating conditions (i.e., total bagasse burning). These relatively small increment-consuming impacts, the increment expansion provided by the East and West Pellet plants, the high baseline emissions for Boilers 5 and 6, and the lack of any other increment-consuming emissions in the vicinity of the Clewiston mill demonstrate that the proposed Boiler 4 will not cause or contribute to violation of any PSD Class II allowable increments.

6.0 ADDITIONAL IMPACT ANALYSIS

6.1 IMPACTS UPON VEGETATION

The site of the proposed U.S. Sugar facility at Clewiston is less than 3 miles southwest of Lake Okeechobee and approximately 10 miles north of the Everglades border. The major crops grown in the vicinity of the site are sugar cane, vegetables, and some pasture grasses. Maximum concentrations of criteria pollutants are predicted to occur approximately 1 km from the source.

6.1.1 Total Suspended Particulates

Predicted maximum levels of total suspended particulates (TSP) are a 24-hour average concentration of 149 ug/m^3 and an annual average concentration of 52 ug/m^3. Plants are adversely affected by particulate matter only at grossly high concentrations that result in surface depositions of 1 to 4 $g/m^2/day$ (Lerman and Darley, 1975). Surface deposition from the predicted maximum levels of particulates would be a small fraction of the levels known to impact plant growth and will have no significant effect on vegetation in the region of the site. The wet scrubbers controlling particulate matter emissions at the Clewiston mill will effectively capture large particles in the exhaust gas streams of the boilers. Particulates which are not collected by the scrubbers will be primarily of small particle size and will tend to remain suspended in the atmosphere.

6.1.2 Nitrogen Oxides

The predicted maximum increase in annual concentrations of nitrogen oxides due to the proposed Boiler 4 is less than 1 ug/m^3. No information is available on the sensitivity of sugar cane to nitrogen oxides; however, Ashenden (1979) reported no effect on orchard grass after exposure to 127 ug/m^3 NO_2 for 20 weeks. Bluegrass, in contrast, showed growth reduction when exposed to the same doses. These concentrations are much greater than those expected from the proposed facility, and no adverse impacts on vegetation from nitrogen oxides are expected.

6.1.3 Sulfur Dioxide

The total maximum predicted 3-hour average concentration of SO_2 is 590 ug/m^3; the total maximum predicted 24-hour average is 248 ug/m^3. Concentrations which are at or near the maximum levels will occur infrequently during the year. Concentrations will decrease sharply beyond the distance to the maximum concentrations (i.e., about 1 km). The predicted maximum annual average SO_2 concentration is 32.5 ug/m^3.

No information is available on the sensitivity of sugar cane to SO_2. There has been no discernible damage to cane surrounding the present facilities. Table 6-1 presents concentrations of SO_2 known to adversely affect grasses which have been tested. Concentrations of SO_2 which affect sweet corn and tomatoes are also provided in Table 6-1, since these crops are grown in the region. Orchard grass exhibited reduced growth at concentrations approximating the predicted annual average, but all other species were adversely affected at SO_2 doses much higher than those predicted. At worst, localized growth reduction of cane may occur about 1 km from the facility.

6.2 IMPACTS UPON SOILS

Soils in the vicinity of the site consist primarily of peats and mucks. Mucks near the rim of Lake Okeechobee are organic soils mixed with silt and clay; they contain microelements which the peats lack and are highly valued for agriculture. Sandy soils also occur in the region.

Organic soils act as nutrient traps and can adsorb sulfates, nitrates, and any metals resulting from deposition of sulfur dioxide, nitrogen oxides, and particulates with little change in pH. Deposition of these gases can increase acidity of sandy soils; however, the low concentrations resulting from the proposed source will have a negligible effect on soil pH. Soils in this area that are utilized for agriculture are commonly amended with lime, thus any tendency towards lower pH would be neutralized. Area crops may benefit from the additional sulfur and nitrogen in the soil.

Table 6-1. Lowest Doses of SO_2 Reported to Affect Growth of Sweet Corn, Tomato, and Some Grasses

Species	Lowest SO_2 Dose Known to Affect Species (ug/m^3)	Reference
Rye Grass	367, for 131 days reduced growth	Ayazloo and Bell, 1981
Orchard Grass	37 to 62, for 72 days reduced growth	Crittenden and Read, 1979
Oats	1,048, for 3 hours four times during life cycle reduced growth	Heck and Dunning, 1978
Sweet Corn	812, for 7 days causes chlorosis, but no yield effects	Mandl _et al._, 1975
Tomato	1,258, for 5 hours on each of 57 days reduced growth	Kohut _et al._, 1982

Source: ESE, 1983.

6.3 VISIBILITY IMPACTS

A Level I visibility screening analysis (EPA, 1980) was conducted which confirmed that no visibility impairment should occur in the Everglades National Park Class I area. The absolute values of the three Level I contrast parameters (C1--plume contrast against the sky, C2--plume contrast against terrain, and C3--change in the sky/terrain contrast caused by primary and secondary aerosol) are well below 0.10. Thus, it is highly unlikely that the emissions source would cause adverse visibility impairment in Class I areas. Locally, the emissions from the proposed Boiler 4 must meet the State of Florida opacity standard of 20 percent. Compliance with this standard should ensure no significant impacts to local visibility conditions.

REFERENCES

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Larsen, R.I. 1971. A Mathematical Model for Relating Air Quality Measurements to Air Quality Standards. Pub. No. AP-89. U.S. EPA, Office of Air Programs, Research Triangle Park, North Carolina.

Lerman, S.L., and Darley, E.F. 1975. Particulates. In: Responses of Plants to Air Pollution. pp. 141-158. J.B. Mudd and T.T. Kozlowski, editors. Academic Press, Inc., New York.

Monsanto Research Corporation. 1980. Nonfossil Fueled Boilers, Emission Test Report, U.S. Sugar Company, Bryant, Florida. Project No. 80-WFB-6.

U.S. Environmental Protection Agency. 1982. Stack Height Regulations. Federal Register, Vol. 47, No. 26, 5864. February 8, 1982.

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U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. 1978. Guideline on Air Quality Models. EPA-450/2-78-027.

APPENDIX A

FUEL ANALYSIS INFORMATION
U.S. SUGAR CORPORATION

file
WC 6

BEST AVAILABLE COPY

U.S. Sugar Corp (Mr. T. Brinson - Superintendent
Bryant Sugar House)

(Mr. J.R. Orsenigo)

A.N. (PID) Raw Lab TJG

RILEY | RILEY STOKER CORPORATION

POST OFFICE BOX 547, WORCESTER, MASS. 01613
A SUBSIDIARY OF THE RILEY COMPANY

FUELS LABORATORY

TEST REPORT

Laboratory No. 22,318 Sample of Bagasse Date Rec'd 2/9/79

Received From U.S. Sugar Corp. Bryant Sugar House Clewiston, Fla

Sample Data Bagasse Sample #1 2/6/79 1 pm Bourne Plantation Field #18 - B - 19
Variety CL - 59 - 1052 Hand Cut

Contract No. (641-91110) P.O. #82566 Field Sample By Customer

Air Drying Loss 30.6 %

Proximate Analysis	As Rec'd	Dry	Ultimate Analysis	As Rec'd	Dry
Moisture	33.2 %	------	Moisture	%	-------
Volatile	57.6 %	86.3 %	Carbon	%	48.6
Ash	0.5 %	0.7 %	Hydrogen	%	6.1
Fixed Carbon	8.7 %	13.0 %	Nitrogen *	%	0.3
	100.0 %	100.0 %	Oxygen (diff.)	%	44.1
British Thermal Units	5,444	8,150	Sulfur	%	0.2
Fusibility of Ash			Ash	%	0.7
Initial Deformation		F		100.0 %	100.0
Softening		F	Free Swelling Index		
Fluid		F	Grindability Index		

(*Skinner & Sherman)

Date March 20, 1979 Thomas J. Gallagher

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FUELS LABORATORY

TEST REPORT

Laboratory No. 22,319 Sample of Bagasse Date Rec'd 2/9/79

Received From U.S. Sugar Corp. Bryant Sugar House Clewiston, Fla

Sample Data Bagasse Sample #2 2/6/79 4 pm Bryant Plantation Field #17-L-26 Variety CL-49-172 Hand Cut

Contract No. (641-91110) P.O. #82566 Field Sample By Customer

Air Drying Loss		13.2 %			
Proximate Analysis	As Rec'd	Dry	Ultimate Analysis	As Rec'd	Dry
Moisture	16.2 %	------	Moisture	%	-------
Volatile	74.9 %	89.4 %	Carbon	%	48.5 %
Ash	0.2 %	0.2 %	Hydrogen	%	6.0 %
Fixed Carbon	8.7 %	10.4 %	Nitrogen *	%	0.24 %
	100.0 %	100.0 %	Oxygen (diff.)	%	44.86 %
British Thermal Units	6,922	8,260	Sulfur	%	0.2 %
Fusibility of Ash			Ash	%	0.2 %
Initial Deformation		F		100.0 %	100.0 %
Softening		F	Free Swelling Index		
Fluid		F	Grindability Index		

(*Skinner & Sherman)

Date March 20, 1979 Thomas J. Gallagher

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FUELS LABORATORY

TEST REPORT

Laboratory No. 22,320 Sample of Bagasse Date Rec'd 2/9/79

Received From U.S. Sugar Corp. Bryant Sugar House Clewiston, Fla

Sample Data Bagasse Sample #3 2/7/79 9:20 am South Okeechobee Grower
Field #46-PJ-10W Variety CP-57-603 Hand Cut

Contract No. (641-91110) P.O. #82566 Field Sample By Customer

Air Drying Loss		20.1 %			
Proximate Analysis	As Rec'd	Dry	Ultimate Analysis	As Rec'd	Dry
Moisture	23.3 %	------	Moisture	%	--------
Volatile	66.1 %	86.1 %	Carbon	%	47.2 %
Ash	2.5 %	3.3 %	Hydrogen	%	5.8 %
Fixed Carbon	8.1 %	10.6 %	Nitrogen *	%	0.31 %
	100.0 %	100.0 %	Oxygen (diff.)	%	43.29 %
British Thermal Units	5,979	7,795	Sulfur	%	0.1 %
Fusibility of Ash			Ash	%	3.3 %
Initial Deformation		F		100.0 %	100.0 %
Softening		F	Free Swelling Index		
Fluid		F	Grindability Index		

(*Skinner & Sherman)

Date March 20, 1979 Thomas J. Gallagher

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FUELS LABORATORY

TEST REPORT

Laboratory No. 22,321 Sample of Bagasse Date Rec'd 2/9/79

Received From U.S. Sugar Corp. Bryant Sugar House Clewiston, Fla

Sample Data Bagasse Sample #4 2/7/79 10:00 AM Runyon Plantation Field #37-L-8 Variety CL - 41 - 233 Machine Cut

Contract No. (641-91110) P.O. #82566 Field Sample By Customer

Air Drying Loss	0.4 %				
Proximate Analysis	As Rec'd	Dry	Ultimate Analysis	As Rec'd	Dry
Moisture	2.9 %	------	Moisture	%	--------
Volatile	82.2 %	84.7 %	Carbon	%	47.5 %
Ash	3.1 %	3.2 %	Hydrogen	%	6.0 %
Fixed Carbon	11.8 %	12.1 %	Nitrogen *	%	0.34 %
	100.0 %	100.0 %	Oxygen (diff.)	%	42.86 %
British Thermal Units	7,593	7,820	Sulfur	%	0.1 %
Fusibility of Ash			Ash	%	3.2 %
Initial Deformation		F		100.0 %	100.0 %
Softening		F	Free Swelling Index		
Fluid		F	Grindability Index		

(*Skinner and Sherman)

Date March 20, 1979

Thomas J. Gallagher

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RM40-11737

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POST OFFICE BOX 547, WORCESTER, MASS. 01613
A SUBSIDIARY OF THE RILEY COMPANY

FUELS LABORATORY

TEST REPORT

Laboratory No. 22,322 Sample of Bagasse Date Rec'd 2/9/79

Received From U.S. Sugar Corp. Bryant Sugar House Clewiston, Fla

Sample Data Bagasse Sample #5 2/7/79 11:50 AM Bryant Plantation
Field #17-C-34 Variety CL-65-260 Hand Cut

Contract No. (641-91110) P.O. # 82566 Field Sample By Customer

Air Drying Loss		18.2 %			
Proximate Analysis	As Rec'd	Dry	Ultimate Analysis	As Rec'd	Dry
Moisture	21.1 %	------	Moisture	%	--------
Volatile	68.6 %	86.9 %	Carbon	%	47.8 %
Ash	1.3 %	1.7 %	Hydrogen	%	5.9 %
Fixed Carbon	9.0 %	11.4 %	Nitrogen *	%	0.26 %
	100.0 %	100.0 %	Oxygen (diff.)	%	44.24 %
British Thermal Units	6,391	8,100	Sulfur	%	0.1 %
Fusibility of Ash			Ash	%	1.7 %
Initial Deformation		F		100.0 %	100.0 %
Softening		F	Free Swelling Index		
Fluid		F	Grindability Index		

(*Skinner & Sherman)

Date March 20, 1979 Thomas J. Gallagher

PM40-11777

Belcher

ANALYSIS OF 2.5% BUNKER "C"

TANK #201

AT PORT EVERGLADES, FLORIDA

OCTOBER 29, 1981

API, GRAVITY @ 60* F.	12.0
SULFUR, TOTAL WT.	2.41%
VISCOSITY, CTS @ 50* C.	390 SECS
VANADIUM, PPM	204
B S & W	0.1%
FLASH, POINT *F.	+200
POUR, POINT *F.	+40
HEAT OF COMBUSTION, BTU/GAL.	147,258

Carl Bloomberg
Area Manager

BELCHER OIL COMPANY, P.O. BOX 8296, 1733 HILL AVENUE, MANGONIA PARK,
WEST PALM BEACH, FLORIDA 33407 PHONE(305) 848-1495

Belcher®

NOV 1981
RECEIVED
Clewiston
Sugar House

ANALYSIS OF 2.5% BUNKER "C"

TANK #201

AT PORT EVERGLADES, FLORIDA

NOVEMBER 3, 1981

API, GRAVITY @ 60*F.	12.5
SULFUR, TOTAL WT.	2.39%
VISCOSITY, CTS @ 50* C.	452 SECS.
VANADIUM, PPM	250
B S & W	0.1%
FLASH, POINT *F.	+200
POUR, POINT *F.	+45
HEAT OF COMBUSTION, BTU/GAL.	146,760

Carl Bloomberg
Area Manager

BELCHER OIL COMPANY, P.O. BOX 8296, 1733 HILL AVENUE, MANGONIA PARK, WEST PALM BEACH, FLORIDA 33407 PHONE(305) 848 1495

Belcher

NOV 1982
RECEIVED
CLEWISTON
SUGAR HOUSE

OCTOBER 29, 1982

ANALYSIS OF BUNKER C TANK #201 AT
PORT EVERGLADES FOR WEST PALM BEACH

API GRAVITY, @ 60* F.	10.5
SULPHUR	2.36%
FLASH POINT, * F	+200
POUR POINT, * F	+35
BS&W	0.2%
VISCOSITY, CTS@50 * C	429
VANADIUM, PPM	380
BTU'S PER GALLON	148,805
BTU'S PER POUND	17,970

Carl Bloomberg

CARL BLOOMBERG
Area Manager

BELCHER OIL COMPANY, P.O. BOX 8296, 1733 HILL AVENUE, MANGONIA PARK,
WEST PALM BEACH, FLORIDA 33407 PHONE(305) 848-1495

APPENDIX B

SPECIFICATIONS FOR PROPOSED BOILER 4

Note: The manufacturer data presented herein is for the 250,000 PPH Bryant mill, Boiler No. 5 (Permit A-050-7096 - dated Oct. 16, 1980) which is of similar furnace and boiler configuration and overall heat transfer surface since no data is available for the boiler for this permit application when fired with bagasse.

Attached are comparison data and general arrangement drawings for each boiler showing the similarity in general design between these two boilers.

PROJECTED PERFORMANCE ON BAGASSE
FOR CONVERTED COAL FIRED FOSTER WHEELER BOILER

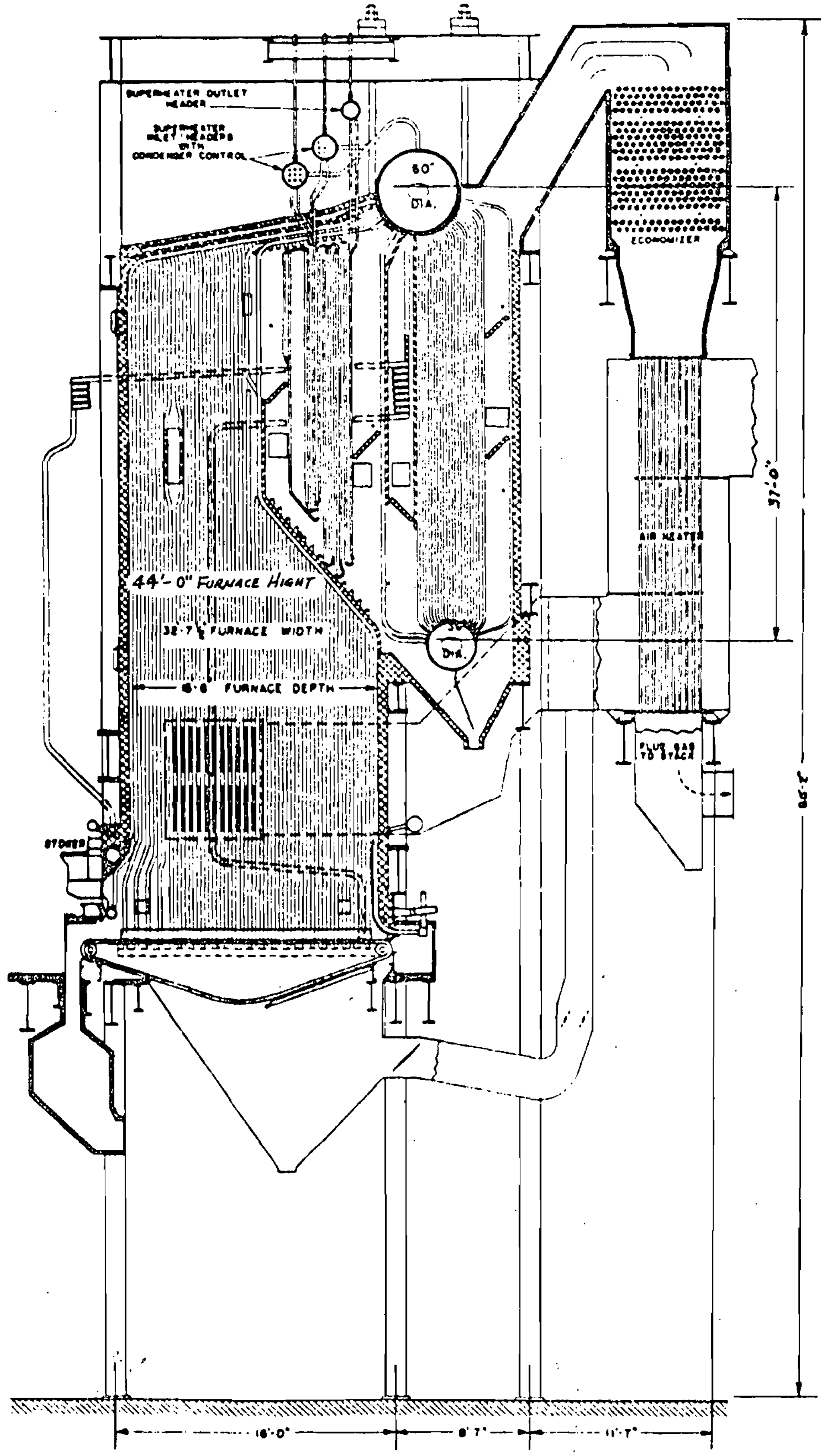
This boiler is similar in furnace design and overall configuration to the 250,000 T/Hr. No. 5 Boiler at the Bryant mill.

	Bryant #5 Boiler	Foster Wheeler Boiler
Boiler Bank H.S.- ft^2	28,150	24,635
Water Wall H.S.- ft^2	1,850	2,300
Superheater H.S.- ft^2	6,594	10,800
Overall Boiler H.S.- ft^2	36,594	37,735
Furnace Volume - ft^3	14,600	17,200
Grate Area - ft^2	406	506
Capacity - #/hr	250,000	Approx 250,000

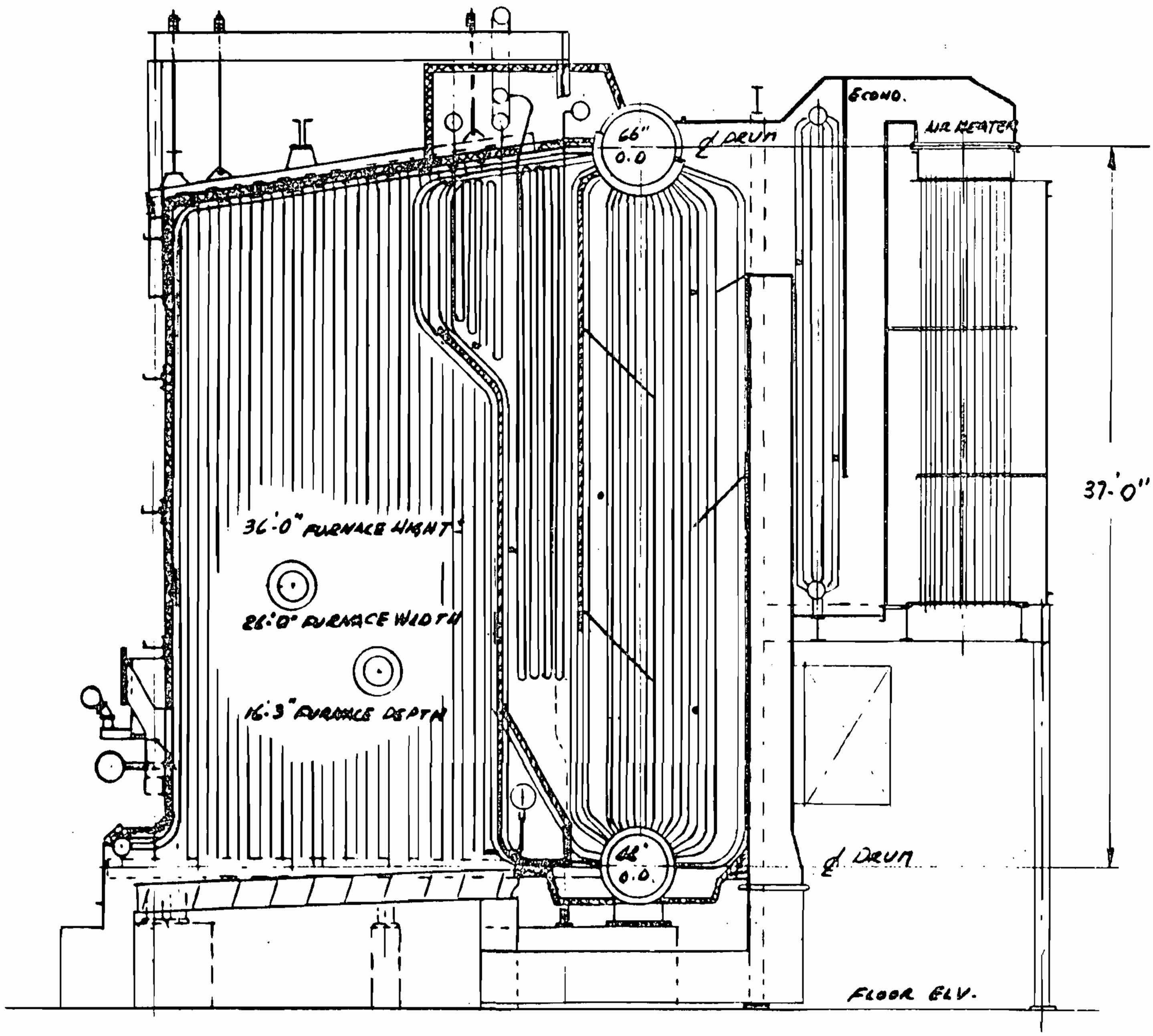
Based on the above primary parameters and controlled as to capacity by the overall boiler heating surface the capacity of this boiler is expected to be similar to the No. 5 boiler at Bryant, or approximately 250,000 #/hr.

-- CLEWISTON --

PROPOSED BOILER NO: 4



BRYANT BOILER NO. 5



250,000 #/hr. Bigelow Boiler

Best Available Copy

U. S. SUGAR CORPORATION, CLEWISTON, FLORIDA

BRYANT BOILER NO. 5

Item TYPE FUEL Bagasse w/55% Moisture				
1. Output @ 900 Deg. F.T.T. Steam	Lbs./Hr.	100,000	200,000	150,000
2. Operating Pressure	Psig	875	875	875
3. Feed Water Temperature	Deg.F	250	250	250
4. Excess Air	%	35	35	35
5. CO_2	%	15.16	15.16	15.16
6. Boiler Draft Loss Incl. Suphtr.	"H2O		2.05	
7. Furnace Pressure	"H2O	0.20	0.20	0.20
8. Flue Gas Temperature Exit from Air P	Deg.F	400	400	400
9. Moisture in Steam	%	0.50	0.50	0.50
0. Temp. of Combustion Air	Deg.F.	415	450	430
1. Fuel Burned @ 3722 BTU/Lb	Lbs/Hr.	51,936	105,964	78,027
2. Efficiency	%	63.82	62.56	63.71
3. HEAT BALANCE				
4. Loss Due to Dry Gas	%	8.06	8.06	8.06
5. Loss Due to H2, Moist. in air & Fuel	%	24.98	24.98	24.98
6. " " "Carbon in Ash	%	1.00	2.50	1.25
7. " " " Radiation	%	0.64	0.40	0.50
8. " " " Unaccountables	%	1.50	1.50	1.50
9. Total Losses	%	36.18	37.44	36.29
0. MISCELLANEOUS DATA				
1. Input	M BTU/Hr	193,306	394,399	290,418
2. Output 1452.16 - 218.48 = 1233.68 BTU/# Stm	M Btu/Hr	123,368	246,736	185,052
3. Heat Release	BTU/CuFt.Hr			
4. Combustion Air @ 3.73#s/#Fuel	Lbs/Hr	193,721	395,246	291,011
5. " " @ 13.6 CuFt/#	Λ CFM	43,910	89,589	65,969
6. Flue Gas 4.69#s/#Fuel	Lbs/Hr	243,580	496,971	365,947
7. " " Exit Temp. @23.01CuFt/#	Λ CFM	81,234	190,589	122,043

[illegible] plus 15% capacity and 32% static be added [illegible]

Best Available Copy

Foster Wheeler Boiler

COMBINED PERFORMANCE DATA

Data marked with an asterisk (*) furnished by ~~Bidder—Seller~~ Contractor

The predicted performance of the steam generating equipment in continuous commercial operation shall be as follows with guaranteed items marked with a cross (+):

Steam Generating Unit

Fuel burned	Coal	Coal	Coal	
Steam generated, M lb per hr -Continuous	150	225	300	
Working steam pressure at superheater outlet, psi gage	875	875	+875	
Working drum pressure, psi gage	*880	*885	*894	*
Temperature, steam at ~~boiler~~ superheater outlet, F	*870	900	+900	
~~Steam reheated, M lb per hr~~	-	-	-	
~~Working steam pressure at reheater outlet, psi gage~~	* -	* -	* -	
~~Working steam pressure at reheater inlet, psi gage~~	-	-	-	
~~Temperature steam from reheater, F~~	* -	* -	* -	*
~~Temperature steam to reheater, F~~	-	-	-	
†Temperature feed water to unit, F	300	325	350	
Fuel to ~~burners~~ stoker, M lb per hr	*19.35	*28.50	*38.00	*
Excess air leaving, Economizer %	*39	*33	*33	*
Overall efficiency of unit, %	*85.89	*85.61	+*84.17	*
Furnace heat release, M Btu per cu ft per hr	*12.0	*17.7	*23.4	*
Flue gas from ~~unit~~ economizer, M lb per hr	*232.0	*331.0	*434.0	*
††Flue gas from air heater, M lb per hr	*232.0	*331.0	*434.0	*
Air to ~~burners~~ Plenum Chamber, M lb per hr at F	*196.0	*270.0	*348.0	*
	221 F	257 F	285 F	
Air to ~~wind-box~~, % of total required for combustion	*94%	*92%	*90%	*
††Air to air heater, M lb per hr at 60 F	*202.9	*285.3	*375.7	*
Working water pressure at economizer inlet, psi gage	* -	* -	*≠2360	*
CO_2 in flue gas at economizer exit, %	*13.2	14.0	14.0	
Flue Gas, Draft (−), Pressure (+), In. of Water				
a. ~~At~~ In furnace ~~outlet~~	*-.10	*-.10	*-.10	*
b. ~~At reheater outlet~~	* -	* -	* -	*
c. At ~~superheater~~ boiler outlet	*-.75	*-1.41	*-2.33	*
d. At economizer outlet	*-1.53	*-2.01	*-5.03	*
e. At air preheater inlet	*-1.56	*-2.07	*-5.13	*
f. At air preheater ~~boiler~~ outlet	*-2.35	*-4.69	+*-7.88	*

†Temperatures stated are normal expected. Actual temperatures may be ±5 F than stated and subject to swings with changing loads.

††Leakage of regenerative type heaters, if used, included.

≠Adjusted for condenser control

A 3031.1 (7-62)

Combustion Data

Air Pressure, In. of Water				
a. In ~~wind-box~~ plenum chamber	.73	1.38	2.40	
b. At air preheater outlet	.89	1.69	2.93	
c. At air preheater inlet	1.97	3.81	6.73	
d. ~~At steam-air heater inlet~~	-	-	-	
Supplementary Temperatures, F				
a. Feed water at economizer outlet	395	435	490	
Flue gas at:				
b. Furnace outlet	1,700	1,880	2,000	
c. Boiler ~~superheater~~ outlet	630	695	750	
d. Reheater outlet	-	-	-	
e. .... superheater outlet	-	-	-	
f. Economizer outlet	385	440	500	
g. Air preheater-boiler outlet††	245	280	320	
Air at:				
h. Steam-air heater inlet	-	-	-	
i. Air preheater inlet	60	60	60	
j. Air preheater outlet††	225	257	285	
~~**Desuperheating — Attemperating Water**~~				
~~a. Required for superheater, lb per hr~~				
b. Based on water temperature, F				
c. Required for reheater, lb per hr				
~~d. Based on water temperature, F~~				
~~**Auxiliary Power Input**~~				
~~a. Recirculating pumps fans, kw~~				
Heat Balance††				
a. Dry gas loss, %	4.63	5.50	6.50	
b. Moisture in flue gas loss, %	5.83	5.92	6.04	
c. Unburned carbon loss, %	* 1.15	1.25	1.30	
d. Radiation loss, %	1.00	.62	.49	
e. Unaccounted for loss, %	1.50	1.50	1.50	
f. Total losses, %	14.11	14.79	15.83	
Solids in steam with concentration of 1,250 ppm in boiler water and 100 ppm in feed water, ppm	1	1	1	
Moisture carryover, %	-	-	-	

††With leakage of regenerative type heaters, if used.

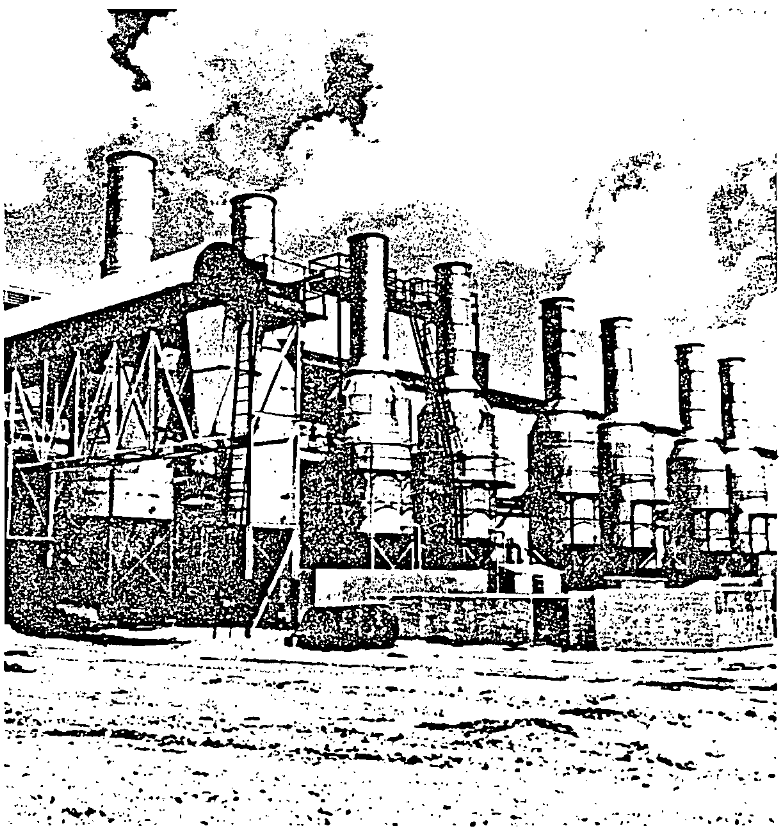
**By Detroit Stoker Co.

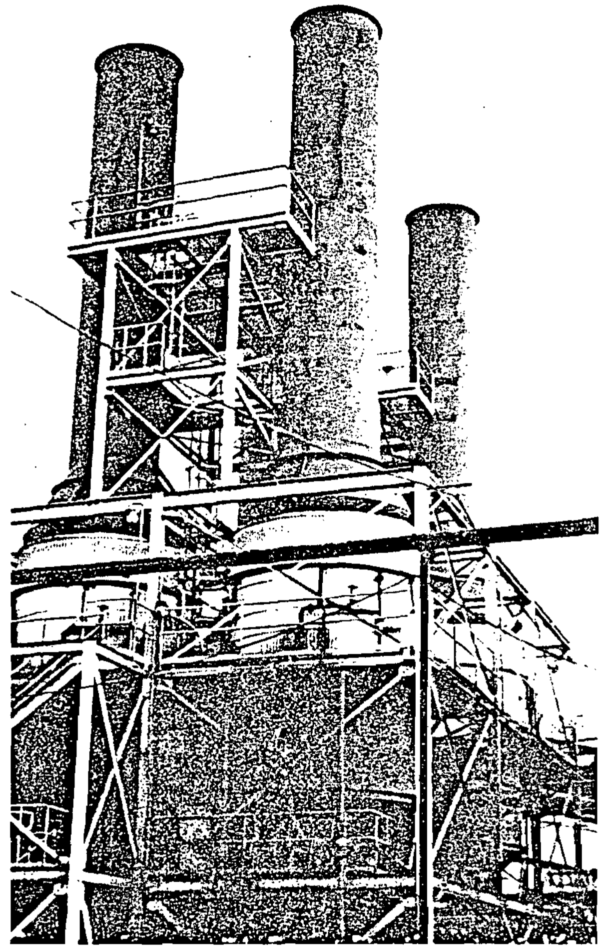
APPENDIX C

BOILER 4
SPRAY IMPINGEMENT SCRUBBER DESIGN DETAILS

Type "D" Turbulaire® Scrubber

High efficiency / low energy / non-plugging / for large volumes.





Type "D" Turbulaire® Scrubbers are used where dust particle sizing and process conditions require low energy inputs (Scrubber pressure drops less than 14 inches of water). These energy requirements are below the range in which the collecting mechanisms of conventional venturi scrubbers begin to take full effect. Hence, our Type "D" units often match the performance of venturi scrubbers while saving 20 to 50 percent in operating horsepower.

The Type "D" model has a vertical flow design which requires a minimum of floor space. The cylindrical configuration improves rigidity with light gage "unitized" construction.

How It works

A patented peripheral gas nozzle (U.S. patent 3726513) combines a low energy venturi effect with collection by impingement on the liquid bath. This combination provides optimum energy utilization at low pressure drop.

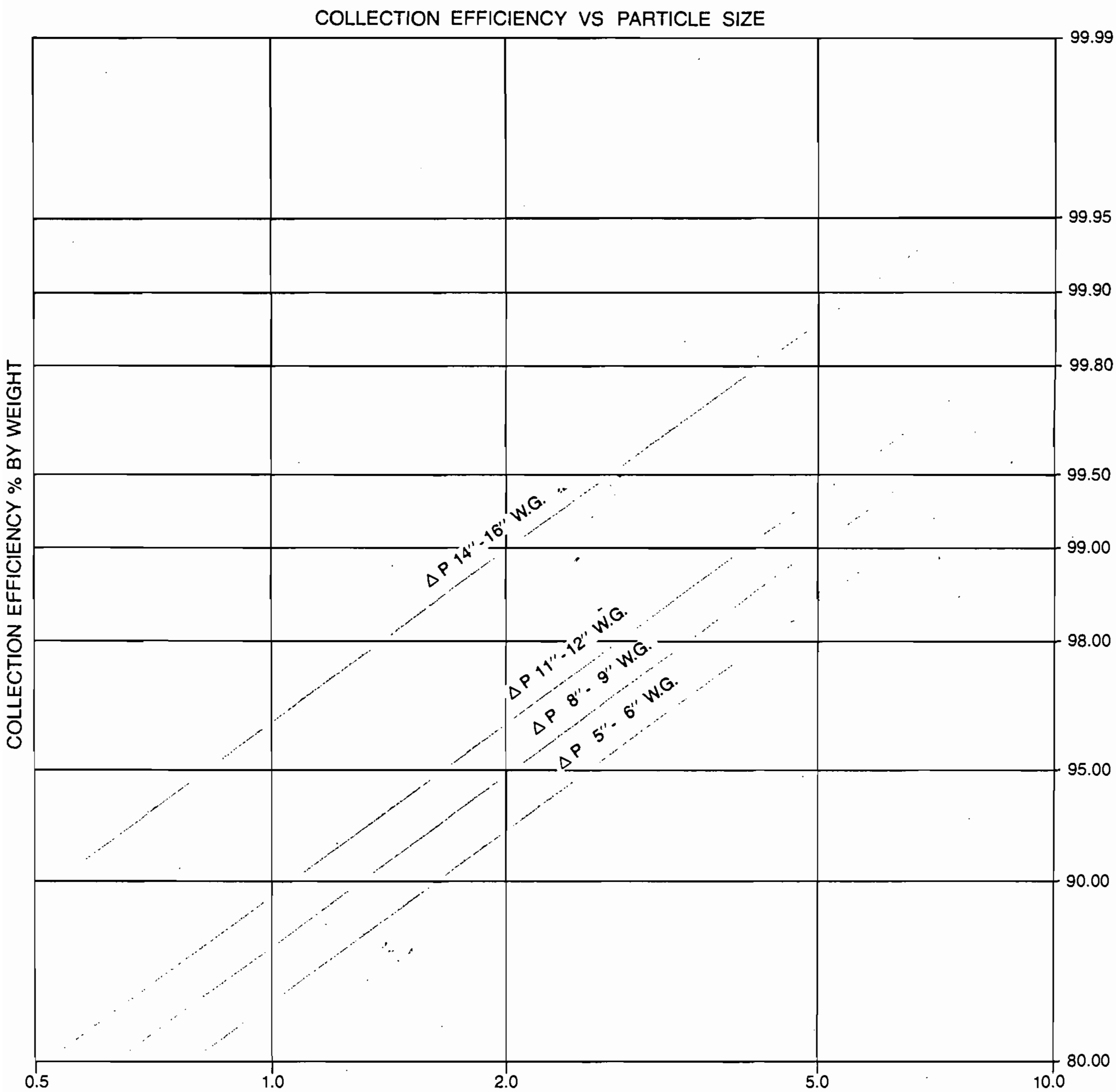
In order to accommodate changes in process conditions or more stringent emission codes, the unit is designed to allow for variations in pressure drop by means of a simple internal adjustment of the peripheral gas nozzle.

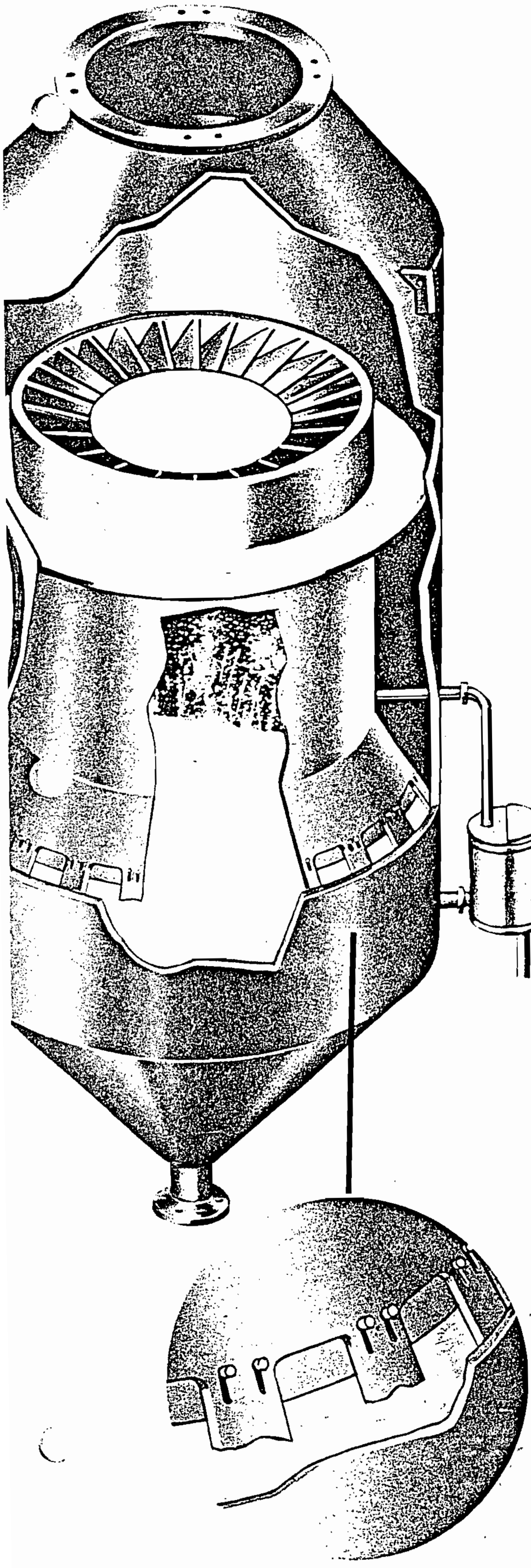
Slurries are kept in suspension in the sump by the action of the gases being scrubbed. Mist elimination is accomplished with the centrifugal action of a set of swirl vanes, and the droplets once separated from the gas stream are returned by gravity into the sump.

Water needs are kept to a minimum by the unit's ability to recirculate the heavily concentrated slurries often containing as much as 5.0% solids by weight. The top gas outlet configuration makes stack connection simple; the flanged slurry drain can be connected to settling tanks or piped for disposal with ease.

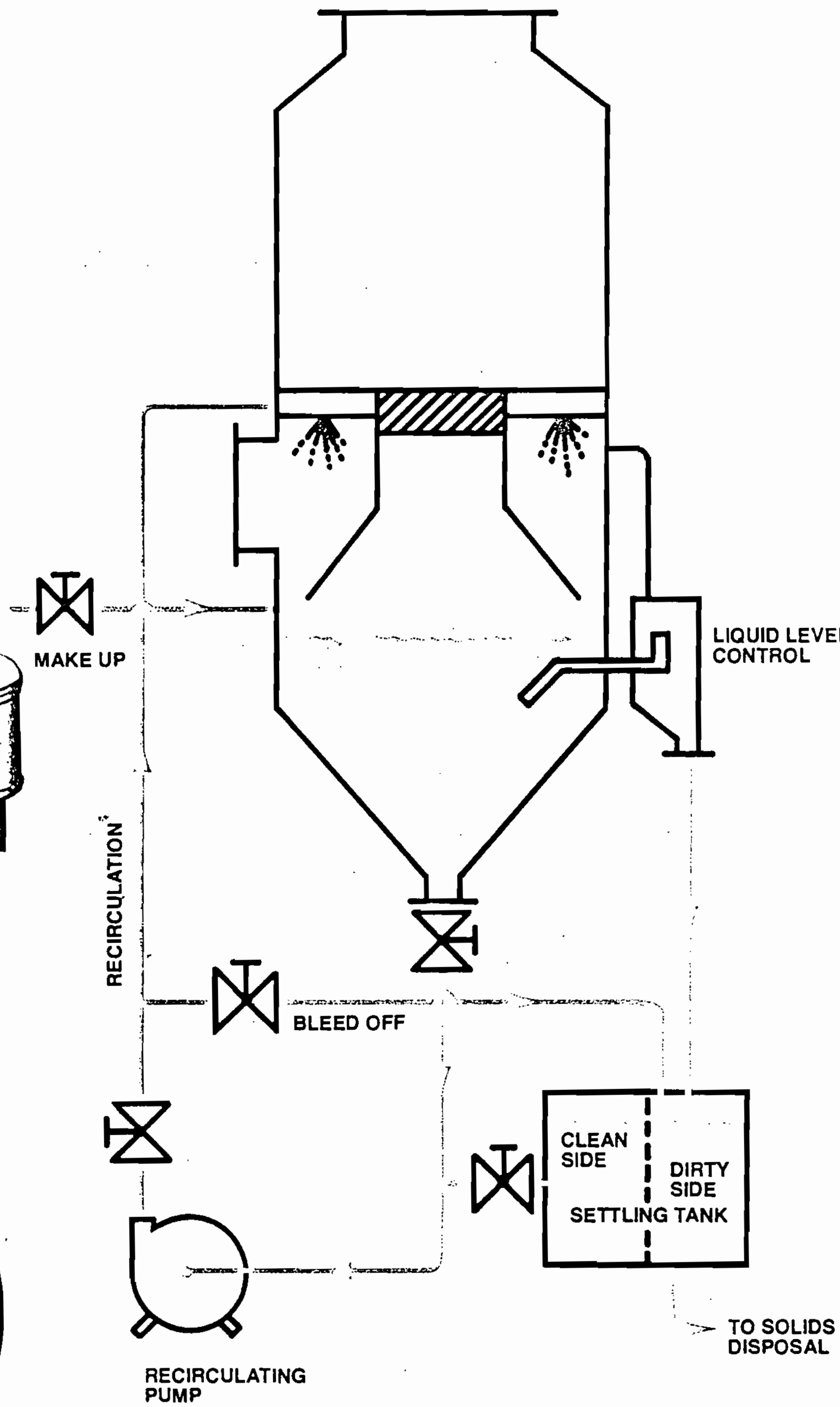
The Type "D" is simple, rugged, with no moving parts and excellent non-plugging characteristics, and it can be made of a variety of corrosion-resistant metals as well as lightweight, low cost fiberglass reinforced polyester (FRP).

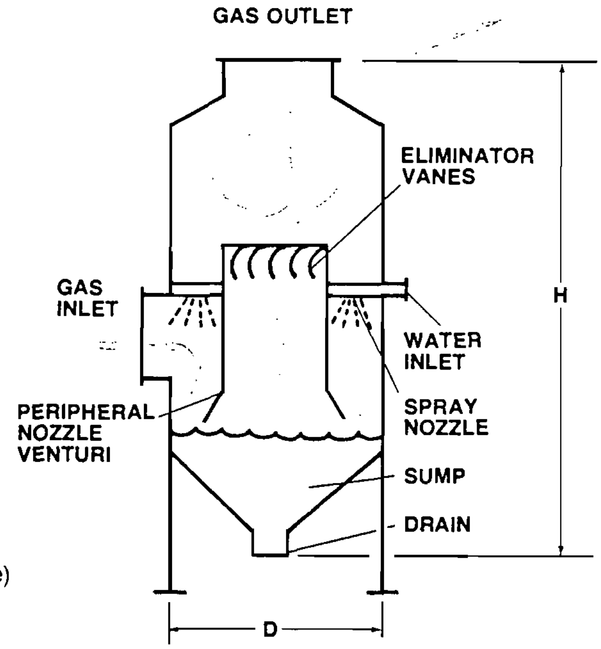
Scrubbers Comparative Fractional Efficiency





Type "D" Process Flow Diagram





AVAILABLE OPTIONS

Support Assembly (Drain flange 2′-6″ to grade)
Discharge valve, Cast iron or Rubber lined
Automatic water supply control
Manometer and Fittings
Pump and Motor
Fan and Motor

EQUIPMENT SIZING

SCRUBBER SIZE	DESIGN ACFM OUTLET	DRAIN SIZE (IN)	SUMP CAPACITY (GAL)	DIAMETER D	HEIGHT H	INLET DIAMETER	OUTLET DIAMETER
4	6,900	3	157	4′-0″	10′-3″	1′-7″	2′-9″
4.5	8,700	3	208	4′-6″	11′-1″	1′-9″	3′-1″
5	10,700	3	269	5′-0″	12′-1″	2′-0″	3′-5″
5.5	13,000	3	340	5′-6″	13′-0″	2′-2′	3′-9″
6	15,500	3	423	6′-0″	13′-11″	2′-4″	4′-1″
6.5	18,200	3	517	6′-6″	14′-11″	2′-7″	4′-5″
7	21,100	3	624	7′-0″	15′-10″	2′-9″	4′-9″
7.5	24,300	4	744	7′-6″	16′-8″	2′-11″	5′-1″
8	27,600	4	877	8′-0″	17′-8″	3′-2″	5′-5″
8.5	31,100	4	1,026	8′-6″	18′-8″	3′-4″	5′-9″
9	34,900	4	1,189	9′-0″	19′-7″	3′-6″	6′-1″
9.5	38,900	4	1,370	9′-6″	20′-5″	3′-9″	6′-5″
10	43,100	4	1,566	10′-0″	21′-4″	3′-11″	6′-9″
10.5	47,600	4	1,781	10′-6″	22′-4″	4′-1″	7′-1″
11	52,200	6	2,014	11′-0″	23′-2″	4′-4″	7′-6″
11.5	57,100	6	2,266	11′-6″	24′-1″	4′-6″	7′-10″
12	62,200	6	2,537	12′-0″	25′-0″	4′-8″	8′-2″
12.5	67,400	6	2,830	12′-6″	26′-0″	4′-11″	8′-6″
13	72,900	6	3,144	13′-0″	26′-10″	5′-1″	8′-10″

EQUIPMENT SPECIFICATIONS

Scrubber of cylindrical shape shall be of the high efficiency inertial-orifice type with radial inlet. The gas to be cleaned passes through a peripheral nozzle and is jetted in a near vertical direction and at high velocity into a static liquid bath, the level of which is maintained slightly below the bottom of the gas nozzle by means of an adjustable weir. Weir box shall be equipped with a gas-lock release mechanism. After leaving liquid bath, gases shall pass through a centrifugal type spray eliminator and exit the scrubber through the top vertical discharge.

World-Wide Response/Ability

WESTERN PRECIPITATION DIVISION JOY™

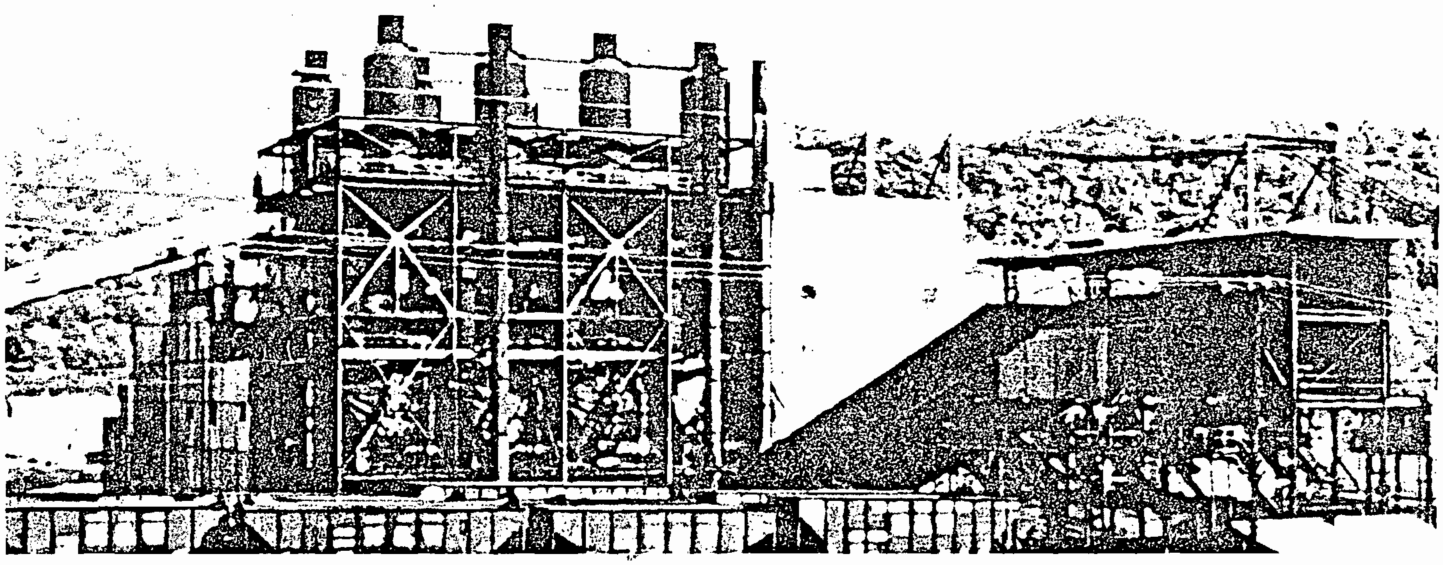
Joy Industrial Equipment Company
P.O. Box 2744, Terminal Annex
Los Angeles, California 90051
(213) 240-2300

BEST AVAILABLE COPY

Proven performance in a wide range of applications

Because we have pioneered the air pollution control field since 1907, we have within arm's reach more answers to your pollution control problems than anyone else. So no matter how peculiar your air pollution problem, our engineers will evaluate many workable solutions—and before they're through, they'll narrow all of the alternatives to the one solution that's best for your particular case.

"Turbulaire" scrubbers have been used successfully to control emissions from many industrial process operations, including combustion, chemical, mining, metallurgical, etc.



Some "Turbulaire®" features

Scrubbing slurry processing expenses (clarifiers, pumps, etc.) are kept down by making every drop count. Special sump designs maintain high turbulence within the scrubbing liquid. The high turbulence permits higher slurry concentrations reducing the possibilities of solid build-up or system stoppage. (Most of our units operate at liquid to gas ratios of less than 3GPM/1,000 ACFM.) Therefore less processing equipment is required.

Simple, compact designs save valuable in-plant space and make minimum operating and maintenance demands.

"Turbulaire" scrubbers are often used in conjunction with other collection equipment. Flexibility in space needs and efficiency make "Turbulaire" scrubbers excellent add-on units, especially for already tight plant layouts.

Each "Turbulaire" scrubber model can be adapted to meet virtually any corrosion problem. For example, units can be made of mild or stainless steel, FRP, or with corrosion resistant plastics, rubber, lead or acid brick liners.

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Scrubber Application List by Industry

WP™ scrubbers have solved air pollution control problems in a wide variety of industries. If your particular application is included on our list below, chances are that we can help you.

ASPHALT
- Kiln (Batch Process)
- Kiln (Continuous Mix)

COAL
- Dryers
- Pulverizers
- Handling, Transfer Points
- Underground Ventilation

COMBUSTION PROCESSES
- Bagasse Boilers
- Bark and Wood Boilers
- Bagasse Residue Boilers
- Coal-fired Boilers
- Kraft Recovery Boilers
- Incinerators
- Oil-fired Boilers

FERTILIZERS
- Ammoniators
- Coolers
- Dryers
- Evaporators
- Prill Towers
- Product Handling and Ventilation
- Reactors and Granulators

INORGANIC CHEMICALS
- Coolers and Dryers
- Pyrites Roasting
- Sulphuric Acid Mist

IRON AND STEEL
- Blast Furnaces
- Coke Ovens
- Cupolas
- Crushing and Handling
- Electric Furnaces
- Foundry Clean-up
- Open Hearth Furnaces
- Taconite Nodulizing Furnaces
- Sintering Systems
- Ventilation Systems

MINING
- Ore Crushing and Handling
- Mine Ventilation
- Screening and Sizing

NON-FERROUS METALS
- Alumina Calcining
- Antimony Smelters
- Bauxite Dryers
- Chromium Smelters
- Copper Smelters
- Gold, Mercury Smelters
- Lead Smelters
- Magnesium Smelters
- Molybdenum Smelters
- Nickel Smelters
- Vanadium, Uranium Smelters
- Zinc Smelters

NON-METALLIC MINERALS
(Cement, Lime, Rock Products, etc.)
- Calciners
- Clean-up and Ventilation
- Clinker Coolers
- Dryers
- Kilns
- Preheaters
- Pulverizers

ORGANIC CHEMICALS
- Carbon Black
- Food, Glue, etc.
- Insecticides
- Paint and Resins
- Pharmaceuticals

ORGANIC CHEMICALS CONTINUED
- Plastics
- Sewage Sludge Dryers

PETROCHEMICALS
- Catalytic Cracking Regenerators
- Catalytic Cracking Reactors
- Fluidized Coke
- Shale Oil

PULP AND PAPER
- Kraft Recovery Boilers
- Magnesia Red Liquor Acid Recovery
- Magnesia Red Liquor—Dry Dust Collection
- Magnesium Oxide from Bi-Sulfite Recovery
- Dissolving Tank Ventilation
- Slaker Tank Ventilation

INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS

FOR

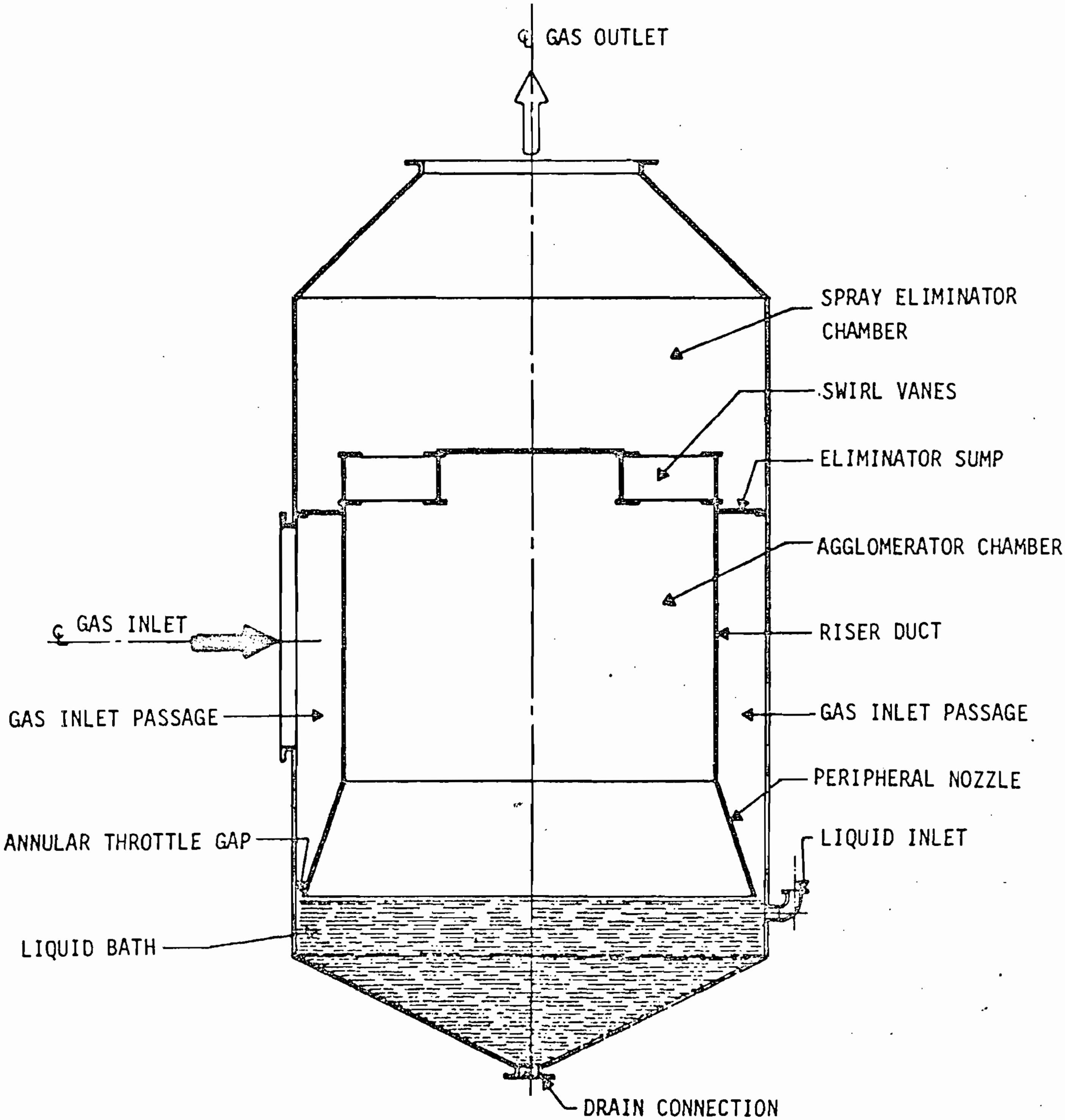
TURBULAIRE® SCRUBBER

TYPE D

JOY MANUFACTURING COMPANY
Western Precipitation Division
1000 W. Ninth St.
Los Angeles, California 90015

CONTENTS

FIGURES



SECTION THRU SCRUBBER
(Weir Box Not Shown)

Figure 1. Turbulaire® Scrubber, Type D-B, Sizes 20 thru 64

DESCRIPTION

The Type D Turbulaire® Scrubber (Figure 1) consists of a vertical cylindrical shell with conical top and conical hopper on the lower end. The scrubber is divided into two chambers; the agglomerator chamber and the eliminator chamber.

The agglomerator chamber is in the lower portion of the scrubber and consists of the hopper with liquid bath, the gas inlet passage with conical throttle and the liquid level regulating assembly.

The eliminator chamber is above the agglomerator chamber and consists of a set of swirl vanes and a sump preceding the gas outlet.

TYPE & SIZE DESIGNATION

1 D B MS R 32

- 32 — Size
- R — Shell Lining if specified
- MS — Shell Material
- B — Hopper Type
- D — Design Type
- 1 — Number of Units

The scrubber has the gas inlet located radially on the side of the shell and the gas outlet at the top center. The agglomerator cylinder is surrounded by the gas inlet passage. The shell and the peripheral nozzle of the agglomerator chamber form an annular throttling gap at the bottom of the gas inlet passage. The normal operating level of the scrubbing liquid bath is just below the throttling gap.

Swirl vanes are mounted in the top of the agglomerator cylinder. A horizontal plate joining the agglomerator with the shell forms the eliminator sump. Weep holes drain the liquid from the eliminator sump into the scrubbing liquid bath in the hopper.

A liquid level regulating assembly is mounted on the lower exterior region of the shell. This assembly consists of a gas lock release pipe, weir box with liquid level control, and a seal pipe with overflow. The liquid inlet is located just above the hopper. Access doors are provided in the hopper and in the upper region of the shell.

Construction material for the standard scrubber is mild steel. Optional materials of construction may be: mild steel lined with rubber, lead or coated with epoxy resin; 304 or 306 stainless steel; and fiber reinforced polyester.

FIELD INSTALLATION

Field installation of the scrubber is as follows:

1. Set the unit on the foundation and attach the anchor bolts. Level unit by shimming between unit and foundaticn.

NOTE: Vertical and horizontal alignment of the scrubber is important to ensure an even circumferential dimension between the peripheral nozzle and quiescent liquid level.

2. Connect the inlet and outlet flues to the unit. It is recommended that inspection doors, adjacent to the scrubber, be included in the customer's flues.

NOTE: Dynamic and dead load forces from customer's fan, equipment and flues must not be transmitted to the scrubber equipment.

3. Attach the sight glass and weir box to the scrubber, then connect the seal pipe overflow to a drain line.

4. Connect the hopper outlet to a drain line. The drain line should contain a valve for flow balancing purposes.

PREPARATION OF THE SCRUBBER FOR OPERATION

The scrubber is designed to operate under the conditions in the operating data sheet in the front of the manual.

Prior to turning on the flue gas, liquid flow and liquid level should be established as follows:

1. Remove the weir box cover.

2. Turn on the liquid supply. By means of a flow meter or other measuring device, adjust the flow of the inlet liquid until the rate prescribed on the data sheet is attained.

3. Open the valve at the hopper outlet and establish a flow of liquid adequate to remove the slurry from the hopper.

4. Raise or lower the liquid level control as required until the liquid in the scrubber reaches and maintains a steady level, approximately 1/2-inch below the peripheral nozzle. This level is indicated by a red line painted on the weir box. Tighten the clamp which secures the level control in place.

NOTE: The liquid level control and liquid inlet rate may require adjustment to comply with rated pressure drop and outlet gas conditions.

5. Replace the weir box cover. The scrubber is now ready to receive flue gas.

If the tank is lined with lead, rubber, epoxy resins or other material which may deteriorate at high temperatures, the temperature of the inlet gas must be adjusted within limits compatible with these materials as noted after operating instruction.

OPERATION

Operation of the scrubber requires only that the fan be turned on to move flue gas through the scrubber.

As flue gas enters the scrubber through the inlet, its speed is increased to the desired operating velocity as it passes through the throttling gap. The dust-laden gas is then discharged at high velocity and penetrates deeply into the liquid bath wherein the dust combines with the liquid to form a slurry which is discharged through the hopper outlet valve. The turbulence resulting from the entrance of the high velocity gas into the scrubbing bath is sufficient to produce a dense spray. This spray is removed from the gas by the swirl vanes.

The scrubber should continue to operate at constant efficiency if the gas volume, temperature and dust load do not change. If there is an increase in the dust load, it may be necessary to increase the flow rate of the scrubbing liquid, in which case, the hopper outlet valve must be adjusted to maintain the operating liquid level. A decrease in the dust load will permit decreasing the scrubbing liquid flow rate.

The efficiency of the unit may be increased by: increasing pressure drop through unit, cooling inlet gases if necessary, and increasing the inlet liquid rate, described as follows:

1. Increase pressure drop through the unit by restricting the nozzle opening or by increasing the gas flow through the unit.

The nozzle opening can be restricted by adding material to the nozzle opening and thus cut down the size of the opening. The opening is designed so that at the gas density and volume specified, the required pressure drop should be obtained. Sometimes the gas density or the volume are not that which is calculate and, if the pressure drop is low, it is necessary to close down on the opening. This is fairly easily accomplished and, by doing this, the velocity of the jet is increased into the liquid pool and, therefore, increases the efficiency of the unit.

The volume of air should never exceed the maximum allowable outlet gas volume as specified on the data sheet. This maximum volume cannot be exceeded without entraining some of the scrubbing liquid, and carrying it into the outlet flue.

Gas flow through the unit can be increased by opening the fan dampers or by introducing infiltration air into the flue through a damper.

If the scrubber is operating well below the maximum outlet gas volume, the simplest way to increase the pressure drop through the unit is to increase the fan delivery until the design pressure drop is reached.

2. Introduce liquid sprays ahead of the scrubber inlet to humidify the gases entering the scrubber. This system is employed whenever inlet gas temperatures are high enough to damage the lining of the shell. Changing the specified water flow to the spray nozzles is not recommended since this will change inlet gas density beyond scrubber design limits.

3. Increase the inlet liquid rate. This will also bring the temperatures of the gas down to saturation quickly. However, as the liquid rate is increased, the liquid level control will have to be reset until equilibrium conditions are maintained without gas passing through the unit. Increase of the liquid rate will give lower outlet gas temperatures and also lower outlet liquid temperatures.

MAINTENANCE

Although the scrubber should operate continuously with minimum maintenance some may be required. This includes: removing any build-up of dust on the peripheral nozzle which would impair operation, and periodically cleaning out the scrubber and liquid seal pipe to prevent clogging of the outlet.

In addition, situations may be encountered which may impair the operation of the scrubber:

1. Plugging of the Overflow Pipe
   Occasionally on some dusts (generally those associated with fluorides), there may be some plugging of the overflow pipe which leads from the scrubber to the weir box. This plugging is due to settling out or deposition of particles in the pipe and can generally be relieved by one or two methods.

   One method is to periodically clean out the pipe with a reamer or a scraper of some sort. For those scrubbers with rubber, lead, or plastic lining, care should be taken that the lining is not pierced.

   Another method is to increase the velocity of liquid through the pipe by closing down on the cross sectional area. This is accomplished by laying pieces of tubing in the overflow pipe and building up enough tubing so that the cross sectional area of the pipe is gradually reduced. The velocity of liquid for materials which tend to settle out should be a minimum of 2 to 3 fps or higher.

2. Cold Weather Operation
   During periods of cold weather, care must be taken to prevent freezing of the liquid in the scrubber and in the supply lines. It may be necessary to insulate one or both. During periods of shutdown, the scrubber and liquid lines should be drained unless some method is employed to keep temperatures above the freezing point.

AUTOMATIC CONTROL RECOMMENDATION

An automatic liquid level control system is available as an optional extra from Western Precipitation Division.

The system consists of the following components:

a. Displacer type level control unit (Magnetrol)

b. Solenoid valve

c. Strainer

d. Piping and pipe fittings as required for field assembly.

The system is normally shipped loose for field assembly by the customer. Hook-up connections are provided on the hopper and the scrubber body.

OPERATION

The liquid level control unit uses a solid block displacer - heavier than the liquid - which is suspended from a helical spring. A rising liquid level imparts buoyancy to the displacer, lessening the load on the spring, thus, the displacer moves upward. A magnetic sleeve connected to the displacer also moves upward inside a non-magnetic enclosing tube, attracting a permanent magnet attached to a mercury switch (or pneumatic pilot valve). This actuates and closes the solenoid valve, and make-up water to the scrubber is shut-down. As the liquid level recedes, the magnetic sleeve and displacer drops allowing the magnet and switch element to return to the normal operating level. This actuates and opens the solenoid valve allowing flow of makeup water to the scrubber.

Thus, there is no possibility of excessive high or low liquid levels in the scrubber.

A cross is provided in the line to allow periodic flushing and cleanout of the system.

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ATTACHMENT TO QUESTION 20

WESTERN PRECIPITATION DIVISION
JOY MANUFACTURING COMPANY
[illegible] BOULEVARD
LOS ANGELES, CALIFORNIA 90039
Phone: (213) 240-2300

February 8, 1974

Florida Sugar Cane League, Inc.
P.O. Box 1148
Clewiston, Florida 33440

Attention: Mr. J. Nelson Fairbanks
Vice President & General Manager

Gentlemen:

Confirming our conversations of January 30, 1974, we wish to present, herewith, the guarantees we are prepared to make to any member of the Sugar Cane League on the performance of our Type D "TURBULAIRE" Scrubber when used in conjunction with bagasse fired boilers.

With an inlet loading to the scrubber of 1 gr/dry standard CFM (DSCFM), we will guarantee a particulate outlet not to exceed .05 gr/DSCFM. If the condensables are to be included with particulate emission, we will then guarantee an outlet not to exceed .06 gr/DSCFM. These guarantees are based on operating the equipment at a pressure drop across the unit of not less than 5" water column (w.c.) and not more than 9" w.c. In addition, these guarantees are based on sampling with the EPA Train, Method 5, described in the Federal Register, Volume 36, No. 247, Thursday, December 23, 1971, copy enclosed.

The aforementioned guarantees are made on our equipment as originally designed or as modified with our approval. Any unauthorized modifications will abrogate these guarantees.

Very truly yours,

Allen H. Jones
Vice President, Standard Products

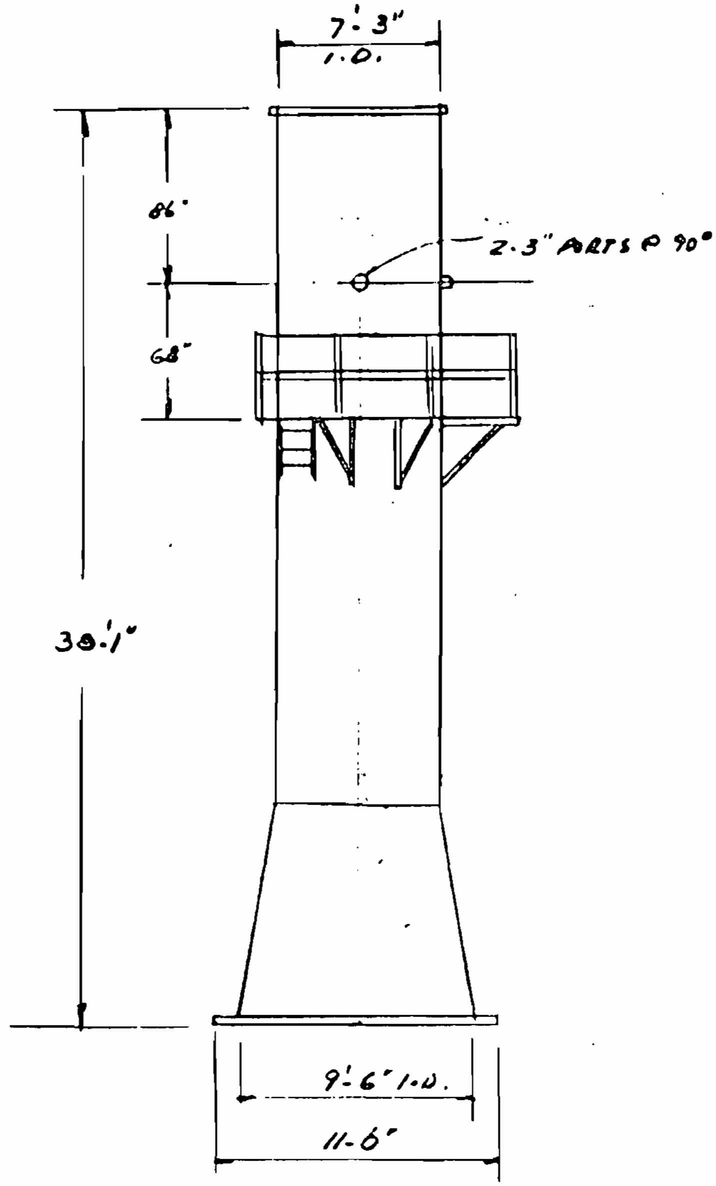
AHJ:js

Encl. EPA Train, Method 5.

cc: F. Arroyo - Arroyo Process Equipment
cc: L. Newton - Western Precipitation
cc: R. Fernandez - Western Precipitation

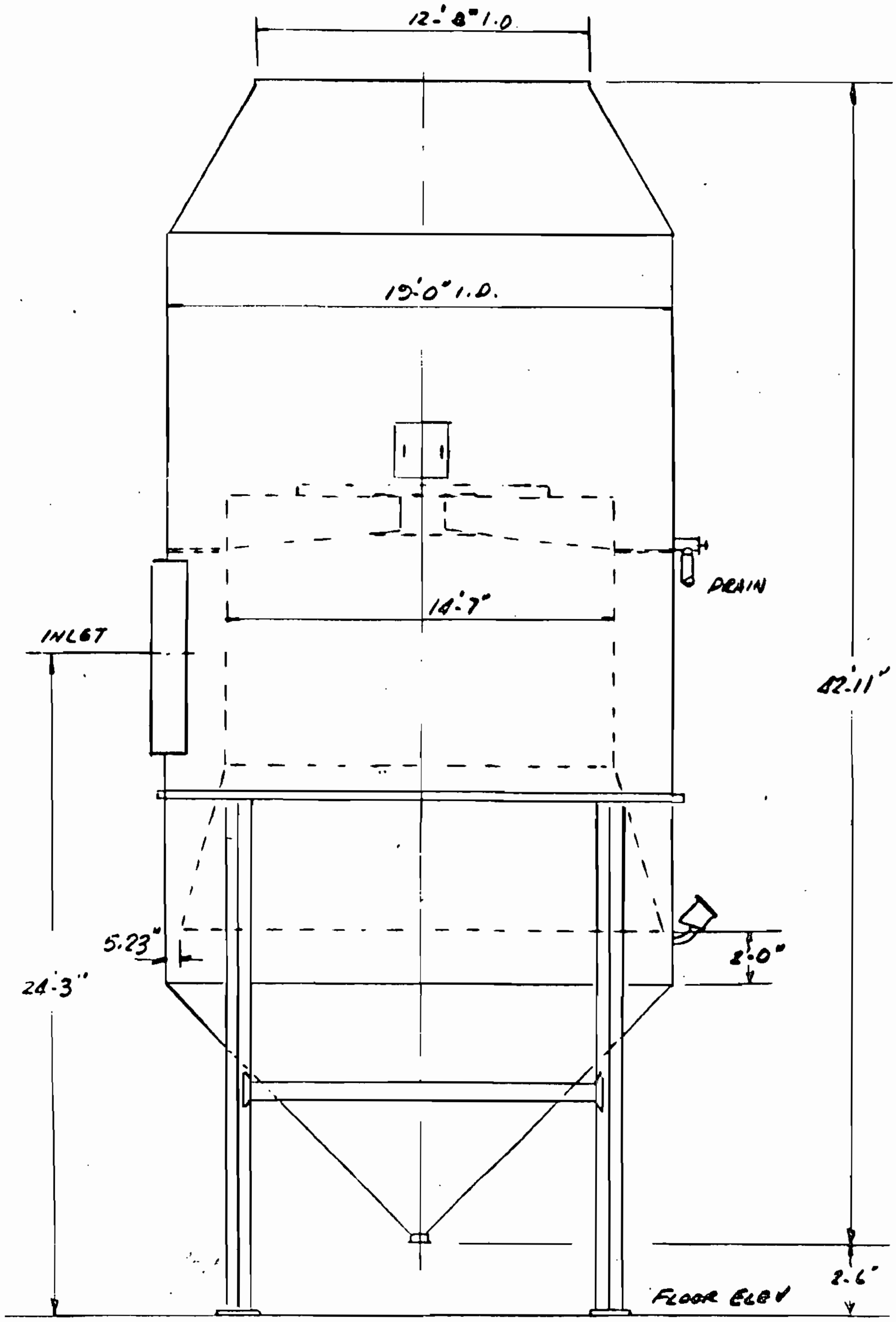
Best Available Copy

STACK BOILER No 4



Best Available Copy

SCRUBBER BOILER NO 4
SIZE D-150



APPENDIX D

COMPILATION OF PARTICULATE EMISSION TESTS
U. S. SUGAR CORPORATION, CLEWISTON MILL AND BRYANT 5

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5

Test Number	Date	Steam Production (lb/hr)	Heat Input (10^6 Btu/hr) Bagasse	Heat Input (10^6 Btu/hr) Oil	Particulate Emissions ($lb/10^6$ Btu) Actual (Avg.)†	Particulate Emissions ($lb/10^6$ Btu) Allowable	Particulate Emissions (lb/hr) Actual	Particulate Emissions (lb/hr) Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					CLEWISTON BOILER 1					
1	11/16/76	186,600	367.1	0	0.166	0.3	60.9	110.1		
2	11/16/76	179,000	352.1	0	0.164 (0.166)	0.3	57.8	105.6		
3	11/16/76	179,200	318.3	35.1	0.168	0.28	59.3	99.0		
4	02/09/78	206,100	408.6	0	0.131	0.3	53.7	122.6		
5	02/13/78	197,200	378.3	10.4	0.151 (0.145)	0.3	58.8	114.5		
6	02/13/78	218,000	425.7	0	0.152	0.3	64.6	127.7		
7	01/05/79	213,100	412.9	0	0.149	0.3	61.7	123.9		
8	01/05/79	205,200	395.0	0	0.168 (0.164)	0.3	66.4	118.5		
9	01/05/79	209,300	394.4	0	0.176	0.3	69.5	119.8		
10	12/03/79	210,201	404.3	0	0.173	0.3	70.1	121.3		
11	12/03/79	222,928	405.3	0	0.192 (0.197)	0.3	77.7	121.6		
12	12/03/79	225,000	409.1	0	0.225	0.3	92.1	122.7		
13	12/20/80	223,228	432.3	0	0.179	0.3	77.5	129.7	135,805	159
14	12/20/80	221,564	422.4	0	0.156 (0.165)	0.3	66.0	126.7	129,154	160
15	12/20/80	223,977	427.2	0	0.160	0.3	68.2	128.2	140,192	160
16	11/19/81	210,750	393.6	0	0.253	0.3	99.5	118.1	139,301	161
17	11/20/81	218,892	421.6	0	0.164 (0.222)	0.3	69.2	126.5	146,264	157
18	11/20/81	220,729	428.5	0	0.250	0.3	106.9	128.6	137,885	165
19	11/15/82	236,250	462.3	0	0.199	0.3	91.9	138.7	147,022	162
20	11/15/82	220,798	393.9	0	0.220 (0.203)	0.3	86.8	118.2	141,764	158
21	11/15/82	210,375	412.7	0	0.191	0.3	79.0	123.8	145,712	160

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5
(Continued, Page 2 of 6)

Test Number	Date	Steam Production (lb/hr)	Heat Input (10^6 Btu/hr) Bagasse	Oil	Particulate Emissions ($lb/10^6$ Btu) Actual (Avg.)†	Allowable	Particulate Emissions (lb/hr) Actual	Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					CLEWISTON BOILER 2					
1	11/10/75	175,000	314.2	33.3	0.147	0.28	52.1	97.6		
2	11/10/75	175,000	303.4	50.8	0.146 (0.156)	0.27	51.8	96.1		
3	11/10/75	175,000	315.9	49.3	0.175	0.27	63.8	99.7		
4	01/04/77	185,780	343.6	50.0	0.202	0.28	79.6	108.1		
5	01/04/77	186,876	358.3	18.0	0.165 (0.180)	0.29	62.0	109.3		
6	01/05/77	174,558	328.9	14.9	0.172	0.29	59.0	100.2		
7	02/08/78	198,200	361.0	0	0.123	0.3	44.4	108.3		
8	02/08/78	206,300	379.5	0	0.127 (0.143)	0.3	48.3	113.9		
9	02/08/78	211,000	388.8	0	0.180	0.3	70.1	116.6		
10	01/15/79	209,400	401.6	0	0.213	0.3	85.5	120.5		
11	01/15/79	215,100	410.4	0	0.129 (0.192)	0.3	52.9	123.1		
12	01/15/79	183,800	351.1	0	0.234	0.3	82.3	105.3		
13	12/04/79	203,450	370.0	0	0.198	0.3	73.2	111.0		
14	12/04/79	201,159	376.5	0	0.202 (0.192)	0.3	76.1	113.0		
15	12/04/79	207,360	377.0	0	0.175	0.3	65.8	113.1		
16	12/22/80	199,452	361.2	0	0.147	0.3	53.3	108.4	137,360	159
17	12/22/80	204,750	371.6	0	0.118 (0.151)	0.3	43.8	111.5	142,915	157
18	12/22/80	203,067	368.3	0	0.188	0.3	69.3	110.5	141,986	161
19	02/11/82	208,319	369.0	62.8	0.144	0.27	62.0	117.0	158,489	157
20	02/11/82	204,750	380.6	42.8	0.156 (0.136)	0.28	66.1	118.4	155,621	155
21	02/11/82	212,318	384.3	40.5	0.107	0.28	41.1	119.3	152,127	156
22	11/17/82	203,097	416.2	0	0.189	0.3	78.8	124.9	153,869	162
23	11/17/82	204,750	423.2	0	0.139 (0.165)	0.3	58.8	127.0	153,891	163
24	11/17/82	214,817	453.2	0	0.167	0.3	75.9	136.0	149,671	158

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5
(Continued, Page 3 of 6)

Test Number	Date	Steam Production (lb/hr)	Heat Input (10^6 Btu/hr) Bagasse	Heat Input (10^6 Btu/hr) Oil	Particulate Emissions (lb/10^6 Btu) Actual (Avg.)†	Particulate Emissions (lb/10^6 Btu) Allowable	Particulate Emissions (lb/hr) Actual	Particulate Emissions (lb/hr) Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					CLEWISTON BOILER 3					
1	11/12/75	100,000	146.2	47.4	0.114	0.25	21.6	48.6		
2	11/12/75	100,000	123.5	77.5	0.134 (0.185)	0.22	27.0	44.8		
3	11/12/75	100,000	135.1	61.7	0.306	0.24	60.3	46.7		
4	11/19/76	87,600	145.3	24.7	0.144	0.27	24.5	46.1		
5	11/19/76	88,200	146.6	25.6	0.156 (0.153)	0.27	26.8	46.5		
6	11/19/76	81,000	130.7	21.2	0.158	0.27	24.0	41.3		
7	02/14/78	82,600	160.5	0	0.122	0.3	19.6	48.2		
8	02/14/78	82,500	160.5	0	0.149 (0.140)	0.3	23.9	48.2		
9	02/14/78	81,800	155.2	2.5	0.150	0.3	23.7	46.8		
10	12/18/78	111,800	125.8	102.8	0.107	0.21	24.5	48.0		
11	12/19/78	107,500	168.5	42.2	0.105 (0.118)	0.26	22.1	54.8		
12	12/19/78	105,600	148.4	63.5	0.142	0.24	30.0	50.9		
13	12/12/79	90,426	186.4	0	0.260	0.3	48.4	55.9		
14	12/12/79	91,969	189.4	0	0.264 (0.248)	0.3	50.0	56.8		
15	12/12/79	93,462	183.8	8.9	0.219	0.29	42.2	56.0		
16	12/23/80	107,693	203.1	18.9	0.127	0.28	28.5	62.8	81,798	159
17	12/23/80	107,432	206.8	14.6	0.118 (0.123)	0.28	26.5	63.5	83,018	161
18	12/23/80	107,156	199.2	21.7	0.123	0.27	28.0	61.9	78,292	158
19	11/23/81	110,455	205.9	5.6	0.222	0.3	47.0	62.3	89,348	151
20	11/23/81	109,929	190.6	2.0	0.218 (0.204)	0.3	41.9	57.4	77,278	152
21	11/23/81	117,149	201.4	3.9	0.172	0.3	35.4	60.8	87,779	153
22	11/16/82	177,900	246.9	0	0.181	0.3	44.6	74.1	95,944	156
23	11/17/82	125,337	268.1	0	0.163 (0.170)	0.3	43.8	80.4	104,168	154
24	11/17/82	128,483	275.0	0	0.167	0.3	46.0	82.5	101,931	156

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5
(Continued, Page 4 of 6)

Test Number	Date	Steam Production (lb/hr)	Heat Input (10^6 Btu/hr) Bagasse	Oil	Particulate Emissions ($lb/10^6$ Btu) Actual (Avg.)†	Allowable	Particulate Emissions (lb/hr) Actual	Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					CLEWISTON BOILER 5					
1	01/04/78	60,000	119.6	0	0.244	0.3	29.2	35.9		
2	01/04/78	59,016	118.2	0	0.256 (0.256)	0.3	29.5	35.5		
3	01/04/78	54,104	108.2	0	0.267	0.3	28.9	32.5		
4	12/05/79	65,000	122.1	0	0.246	0.3	30.0	36.6		
5	12/05/79	65,000	122.2	0	0.234 (0.269)	0.3	28.6	36.7		
6	12/05/79	60,000	112.9	0	0.328	0.3	37.0	33.9		
7	01/13/81	64,565	124.6	0	0.275	0.3	34.3	37.4	63,836	153
8	01/13/81	70,667	136.0	0	0.183 (0.238)	0.3	24.9	40.8	63,620	152
9	01/13/81	66,353	128.0	0	0.257	0.3	32.9	38.4	61,850	155
10	11/24/81	61,177	122.1	0	0.247	0.3	30.2	36.6	54,677	151
11	11/24/81	65,934	131.6	0	0.288 (0.244)	0.3	37.9	39.5	55,780	153
12	11/24/81	65,161	129.7	0	0.197	0.3	25.6	38.9	56,671	149
13	11/18/82	51,724	102.4	0	0.207	0.3	21.2	30.7	58,290	139
14	11/18/82	60,000	117.7	0	0.154 (0.179)	0.3	18.1	35.3	56,200	141
15	11/18/82	54,838	108.8	0	0.175	0.3	19.0	32.6	57,640	142

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5
(Continued, Page 5 of 6)

			Heat Input (10^6 Btu/hr)		Particulate Emissions ($lb/10^6$ Btu)		Particulate Emissions (lb/hr)			
Test Number	Date	Steam Production (lb/hr)	Bagasse	Oil	Actual (Avg.)†	Allowable	Actual	Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					CLEWISTON BOILER 6					
1	02/19/76	57,400	118.7	0	0.164	0.3	19.5	35.6		
2	02/19/76	57,000	117.7	0	0.177 (0.161)	0.3	20.8	35.3		
3	02/20/76	60,000	124.0	0	0.141	0.3	17.5	37.2		
4	01/13/77	50,026	100.1	0	0.262	0.3	26.3	30.0		
5	01/13/77	49,773	99.5	0	0.287 (0.270)	0.3	28.5	29.9		
6	01/13/77	51,906	103.1	0	0.262	0.3	27.0	30.9		
7	01/05/78	59,381	118.7	0	0.217	0.3	25.7	35.6		
8	01/05/78	59,558	119.1	0	0.250 (0.256)	0.3	29.8	35.7		
9	01/05/78	60,000	119.1	0	0.302	0.3	36.3	36.0		
10	03/13/79	61,026	116.6	0	0.327	0.3	38.1	35.0		
11	03/13/79	60,000	111.9	0	0.288 (0.284)	0.3	32.2	33.6		
12	03/13/79	62,376	116.3	0	0.236	0.3	27.5	34.9		
13	12/13/79	55,579	104.4	0	0.325	0.3	33.9	31.3		
14	12/13/79	55,385	104.0	0	0.263 (0.299)	0.3	27.3	31.2		
15	12/13/79	49,756	93.5	0	0.310	0.3	29.0	28.1		
16	01/03/81	60,571	113.4	0	0.261	0.3	29.6	34.0	64,344	161
17	01/03/81	66,976	126.5	0	0.243 (0.290)	0.3	30.7	38.0	60,370	164
18	01/03/81	63,750	119.9	0	0.366	0.3	44.0	36.0	65,866	167
19	11/24/81	54,495	107.6	0	0.214	0.3	23.0	32.3	45,666	143
20	11/24/81	53,394	105.9	0	0.257 (0.221)	0.3	27.2	31.8	44,806	145
21	11/24/81	65,106	129.0	0	0.192	0.3	24.8	38.7	49,757	148
22	01/15/83	60,674	118.1	0	0.184	0.3	21.7	35.4	60,403	145
23	01/15/83	70,588	138.1	0	0.208 (0.218)	0.3	28.7	41.4	61,294	149
24	01/15/83	68,764	134.5	0	0.261	0.3	35.1	40.4	61,177	150

COMPILATION OF PARTICULATE EMISSION TESTS
U.S. Sugar Corporation, Clewiston Mill and Bryant 5
(Continued, Page 6 of 6)

Test Number	Date	Steam Production (lb/hr)	Heat Input (106 Btu/hr) Bagasse	Oil	Particulate Emissions (lb/106 Btu) Actual (Avg.)†	Allowable	Particulate Emissions (lb/hr) Actual	Allowable	Actual Flow Rate (ACFM)	Stack Temperature (°F)
					BRYANT BOILER 5*					
1	03/06/81	169,898	387.6	0	0.098	0.15	38.03	58.1	180,907	153
2	03/06/81	167,368	381.0	0	0.090 (0.093)	0.15	34.34	57.2	179,213	153
3	03/06/81	172,959	393.4	0	0.090	0.15	35.35	59.0	177,161	152
4	02/15/82	202,000	459.3	0	0.110	0.15	50.59	68.9	165,783	153
5	02/15/82	190,116	430.6	0	0.158 (0.145)	0.15	68.21	64.6	168,560	152
6	02/15/82	193,125	434.9	0	0.167	0.15	72.59	65.2	165,557	154
7	03/04/83	187,037	409.5	0	0.148	0.15	60.78	61.4	166,329	154
8	03/04/83	185,625	404.8	0	0.144 (0.154)	0.15	58.48	60.7	168,412	152
9	03/04/83	185,625	404.8	0	0.169	0.15	68.39	60.7	170,018	151

* Last three compliance tests only.
† Compliance test results, i.e., average of three test runs.

U.S. Sugar Corporation, Bryant 5
Additional Test Results

Test Number	Date	Steam Production (lb/hr)	Heat Input (10^6 Btu/hr)		Particulate Emissions ($lb/10^6$ Btu)			Particulate Emissions (lb/hr)	
			Bagasse	Oil	Actual	(Avg.)*	Allowable	Actual	Allowable
1	02/27/80	117,857	255.8	0	0.151		0.15	38.6	38.4
2	02/27/80	106,250	236.2	0	0.415	(0.225)	0.15	98.1	35.4
3	02/27/80	118,605	265.0	0	0.110		0.15	29.1	39.8
4	02/27/80	135,000	300.4	0	0.096		0.15	28.7	45.1
5	02/27/80	157,143	354.4	0	0.056	(0.080)	0.15	19.7	53.2
6	02/27/80	156,977	356.0	0	0.087		0.15	31.0	53.4
7	02/29/80	165,789	368.9	0	0.158		0.15	58.4	55.3
8	02/29/80	155,405	345.0	0	0.128	(0.141)	0.15	44.3	51.8
9	02/29/80	169,068	377.2	0	0.136		0.15	51.4	56.6
10	03/02/81	167,797	376.8	0	0.153		0.15	57.6	56.5
11	03/02/81	161,111	361.8	0	0.200	(0.181)	0.15	72.4	54.3
12	03/02/81	169,091	379.7	0	0.190		0.15	72.0	57.0
13	12/14/81	200,893	441.2	0	0.281		0.15	123.9	66.2
14	12/14/81	201,923	442.5	0	0.141	(0.211)	0.15	62.5	66.4
15	12/18/81	201,923	445.1	0	0.189		0.15	84.3	66.8
16	12/18/81	198,462	437.5	0	0.139	(0.137)	0.15	60.7	65.6
17	12/18/81	196,622	433.1	0	0.083		0.15	35.9	65.0
18	12/21/82	194,318	434.5	0	0.202		0.15	87.9	65.2
19	12/21/82	195,570	437.1	0	0.225	(0.202)	0.15	98.3	65.6
20	12/21/82	194,444	434.6	0	0.179		0.15	77.6	65.2
21	01/02/83	186,145	410.0	0	0.240		0.15	98.3	61.5
22	01/02/83	190,244	416.0	0	0.221	(0.231)	0.15	92.0	62.4
23	02/26/83	191,250	413.9	0	0.105		0.15	43.3	62.1
24	02/26/83	186,145	404.2	0	0.176	(0.169)	0.15	71.0	60.6
25	02/26/83	190,000	412.0	0	0.226		0.15	93.3	61.8

* Compliance test results, i.e., average of three test runs, except for 12/14/81 and 1/02/83 tests are average of two tests.

APPENDIX E

ANALYSIS OF SO_2 EMISSION FROM BAGASSE BOILERS EQUIPPED WITH SPRAY IMPINGEMENT SCRUBBERS

APPENDIX E

ANALYSIS OF SO_2 EMISSION FROM BAGASSE BOILERS EQUIPPED WITH SPRAY IMPINGEMENT SCRUBBERS

Measurements of SO_2 emissions from bagasse-burning boilers has been performed at the U.S. Sugar Bryant mill by EPA (Monsanto Research Corporation, 1980), at the Sugar Cane Growers Cooperative (SCGC) mill by ESE, and at the Osceola Farms mill by Kleeman Engineering. The results of these tests are summarized in Table E-1. All tests were conducted by EPA and/or DER source test methods. The U.S. Sugar Bryant and Osceola Farms tests were conducted while burning 100-percent bagasse. However, the SCGC tests were conducted while burning approximately 50 x 10^6 Btu/hr of oil (approximately 330 gallons per hour). The heat inputs shown in Table E-1 for SCGC Boiler 8 reflect only the heat input due to bagasse. The oil usage, and associated SO_2 produced, has been ignored in developing the SO_2 removal efficiency for this boiler; therefore, the results are extremely conservative. Nevertheless, the SCGC tests show an overall SO_2 removal efficiency of the system of 97.7 percent and greater. The test results for U.S. Sugar Bryant and Osceola Farms, which were based on conservative assumptions for the sulfur content of bagasse, also reflect overall removals of greater than 98 percent.

The only concurrent test data for scrubber inlet and outlet were obtained at SCGC. The data show better than 90-percent removal of SO_2 within the scrubber itself. The data also reflect an estimated 60-percent loss of theoretical SO_2 before reaching the scrubber. This is probably a result of SO_2 absorption in the bottom ash and fly ash produced in the boiler.

The data presented in the analysis substantiate that an assumed 50-percent SO_2 removal in the bagasse boiler/spray impingement scrubber system when burning bagasse is a very conservative assumption. The data

Table E-1. Summary of SO_2 Source Tests and SO_2 Removal Efficiencies, Florida Sugar Industry

Date	Mill/ Boiler	Steam Load (lb/hr)	Heat Input* (10^6 Btu/hr)	Bagasse Rate† (lb/hr, dry)	Sulfur Content** (%, dry)	Theoretical SO_2 (lb/hr)	Measured Scrubber Inlet SO_2 (lb/hr)	Measured Scrubber Outlet SO_2 (lb/hr)	Scrubber SO_2 Efficiency (%)	Overall SO_2 Efficiency (%)
U.S. Sugar Bryant										
12/17/79	2	142,000	337.6	42,200	0.15	126.6	—	<2.5	—	>98.0
12/18/79	2	151,000	359.8	44,975	0.15	134.9	—	<2.5	—	>98.0
12/18/79	2	144,000	342.8	42,850	0.15	128.6	—	<2.5	—	>98.0
Sugar Cane Growers Coop.										
2/4/83	8	246,429	415.1	51,888	0.1	103.8	45.0	1.7	96.2	98.4
2/4/83	8	243,250	405.3	50,663	0.1	101.3	36.7	1.9	94.8	98.1
2/4/83	8	254,211	427.5	53,438	0.1	106.9	35.4	2.5	92.9	97.7
Osceola Farms (Average of 3 Tests)										
12/22/82	6	135,000	280.0	35,000	0.1	70.0	—	0.07	—	99.9

* Based upon actual steam temperature and pressure measurements and assuming 55-percent boiler efficiency.
† Assumes typical bagasse heating value of 8,000 Btu/lb, dry basis.
** For U.S. Sugar, based upon average bagasse analysis available from Bryant mill (see Appendix A). For Sugar Cane Growers and Osceola mills, a conservatively low content of 0.1-percent sulfur was assumed.

Source: ESE, 1983.

from SCGC Boiler 8 show that assuming 0-percent SO_2 removal when burning small quantities of oil in conjunction with bagasse is also a very conservative assumption.

APPENDIX F

CALCULATION OF CLEWISTON MILL BOILER EXHAUST FLOW RATES

APPENDIX F

CALCULATION OF CLEWISTON MILL BOILER EXHAUST GAS FLOW RATES FOR USE IN SO_2 IMPACT ANALYSIS

I. BAGASSE COMBUSTION--BOILERS 1, 2, and 3

Take average of last 3 years of source test data for tests during which bagasse only was burned (see Appendix D for data compilation).

1. Boiler 1

   Total of nine tests burning bagasse only
   Total heat input from bagasse = 3,794.5 x 10^6 Btu/hr
   Total acfm = 1,263,099
   Average acfm/10^6 Btu/hr = 332.9

2. Boiler 2

   Total of six tests burning bagasse only
   Total heat input from bagasse = 2,393.7 x 10^6 Btu/hr
   Total acfm = 879,692
   Average acfm/10^6 Btu/hr = 367.5

3. Boiler 3

   Total of three tests burning bagasse only
   Total heat input from bagasse = 790 x 10^6 Btu/hr
   Total acfm = 302,043
   Average acfm/10^6 Btu/hr = 382.3

II. NO. 6 FUEL OIL COMBUSTION--ALL BOILERS

	Ultimate Analysis			Theoretical Air Required for Combustion			
	lb per 100 lb Fuel	Molecular Weight	Moles per 100 lb Fuel	Moles/Mole Fuel O_2	Moles/Mole Fuel Dry Air	Moles/100 lb Fuel O_2	Moles/100 lb Fuel Dry Air
C	85.6	12	7.13	1.0	4.76	7.13	33.94
H_2	9.7	2	4.85	0.5	2.38	2.43	11.54
O_2	2.0	32	0.06	--	--	--	--
N_2	0.0	--	0.0	--	--	--	--
S	2.4	32	0.08	1.0	4.76	0.08	0.38
H_2O	0.2	18	0.01	--	--	--	--
Ash	0.1	--	--	--	--	--	--
Total	100.0		12.13			9.64	45.86
			Less O_2 in fuel			-0.06	-0.29*
			Required Theoretical Air			9.58	45.57

	Air Required for Combustion at 20-Percent Excess Air O_2	Air Required for Combustion at 20-Percent Excess Air Dry Air
Total Air @ 20-Percent Excess Air (x 1.20)	11.50	54.68
Excess Air	--	9.11
Excess O2	1.92	--

Products of Combustion

Product	Moles of Combustion Air	Moles of Products/ Mole of Combustion Air	Moles of Products/ 100 lb Fuel
CO_2	7.13 (O_2)	1	7.13
H_2O	4.85 (H_2)	--	6.06†
SO_2	0.08	1	0.08
N_2	54.68	0.79	43.20
O_2	Excess		1.92
		--	58.39 wet moles per 100 lb fuel
			52.33 dry moles per 100 lb fuel

Exit Gas Calculation

Moles Dry Gas/100 lb Wet Fuel = 52.33
Mole H_2O (52.33 x 0.48)** = 25.12
Total Moles Gas/100 lb Wet Fuel = 77.45

Ideal Gas Law: PV = nRT

P = 14.7 psi = 2,116.8 lb/ft^2
n = 77.45 moles
R = 1,545.3 lb-ft/mole-°R
T = 160°F = 620° R

$$V = \frac{nRT}{P} = \frac{77.45 \times 1{,}545.3 \times 620}{2{,}116.8} = 35{,}055 \text{ ft}^3/100 \text{ lb fuel}$$

$$= 350.55 \text{ ft}^3/\text{lb fuel}$$

* Air equivalent to O_2 in fuel (0.06 x 4.76 = 0.29).
† (4.85 x 1) + (54.68 x 0.021) + 0.06
Assumes moisture content of air corresponding to 60-percent relative humidity and 80°F dry bulb temperature: 0.0132 lb H_2O/lb dry air or 0.021 lb mole/lb mole.
** Saturated conditions at 160°F (exhaust gas outlet temperature) = 0.48 lb mole H_2O/lb mole dry air.

III. BOILER 4 BURNING MAXIMUM AMOUNT OF FUEL OIL

225 x 10^6 Btu/hr oil
Steam = 150,000 lb/hr

No. 6 Fuel Oil: 1,499 gal/hr oil ⟶ 12,295 lb/hr oil
acfm: 350.55 acf/lb oil = 71,834 acfm
Bagasse: 100,000 lb/hr steam
Dry bagasse = 27,273
= 218.18 x 10^6 Btu/hr

From Table 1-5
For 545.5 x 10^6 Btu/hr, acfm = 205,180 or 376.13 acfm/10^6 Btu/hr
218.18 x 10^6 x 376.13/10^6 = 82,064 acfm

Total acfm = 71,834 + 82,064 = 153,898 acfm
Diameter = 7.25 ft
Area = 41.28
Therefore, velocity = 18.94 m/s.

Source: ESE, 1983.

APPENDIX G

PROPOSED BOILER 4
EMISSION ESTIMATES

APPENDIX G

PROPOSED BOILER 4
EMISSION ESTIMATES

I. FUEL USAGE CALCULATIONS

A. BOILER DATA

Maximum steam capacity = 250,000 lb/hr when firing bagasse,
= 150,000 lb/hr when firing oil
Btu value of water entering boiler = 250 Btu/lb
Btu value of water leaving boiler = 1,450 Btu/lb
Btu requirements per lb steam = 1,450-250 = 1,200 Btu/lb
Boiler efficiency = 55 percent when firing bagasse
= 80 percent when firing oil

B. FUEL ANALYSIS

Parameter	Bagasse (dry basis)	No. 6 Fuel Oil*
Btu/lb	8,000	18,300
lb/gal	--	8.2 (API gravity 11.8)
% Sulfur	0.1 (avg), 0.2 (max)	2.5 max
% Nitrogen	0.3	0
% Ash	0.5-0.3	0.1
% H_2O	0 (55% wet)	0.2

C. BAGASSE BURNING

250,000 lb/hr steam x 1,200 Btu/lb ÷ 0.55 = 545.5 x 10^6 Btu/hr
545.5 x 10^6 Btu/hr ÷ 8,000 Btu/lb = 68,182 lb/hr dry bagasse
= 151,528 lb/hr wet bagasse

D. OIL BURNING

150,000 lb/hr steam x 1,200 Btu/lb ÷ 0.80 = 225.0 x 10^6 Btu/hr
225.0 x 10^6 Btu/hr ÷ 18,300 Btu/lb = 12,295 lb/hr oil
= 1,499 gal/hr oil

* Typical specifications for No. 6 oil of 2.4-percent sulfur content, based upon conversation with Mr. Tom Rayburg, Area Manager for Belcher Oil Company (305/848-1495).

II. MAXIMUM AND POTENTIAL EMISSIONS

Potential emissions are based upon 24 hr/day, 182-day/crop season

A. BURNING BAGASSE

Particulate
Allowables = 545.5 x 10^6 Btu/hr x 0.2 lb particulate/10^6 Btu = 109.1 lb/hr.

Potential emissions: from "Compilation of Emission Factors," U.S. Environmental Protection Agency (EPA), AP-42, Table 1.8-1
16 lb/ton bagasse (wet) x 151,528 lb/hr bagasse (wet) ÷ 2,000 = 1,212 lb/hr = 2,647 tons/yr

Sulfur Dioxide (based on scrubber removal of 50%)
Maximum emissions = 68,182 lb/hr bagasse (dry) x 0.002 x 2 x 0.5 = 136.4 lb/hr

Potential emissions = 136.4 lb/hr ÷ 0.5 = 272.8 lb/hr = 596 tons/yr

Nitrogen Oxides
Maximum and potential emissions: from AP-42, Table 1.8-1
1.2 lb/ton bagasse (wet) x 151,528 ÷ 2,000 = 90.9 lb/hr
= 199 tons/yr

Carbon Monoxide
Maximum and potential emissions: Best emission factor available is from AP-42 for wood waste combustion (Table 1.6-1), lb/ton = 4 to 47. However, these values seem very high; therefore, Reference 30 listed in Table 1.6-1 was reviewed. This review showed that average CO emissions from similar sized boilers (B and D) were 0.26 and 0.24 lb/10^6 Btu, respectively. Using an average value of 0.25 lb/10^6 Btu, we have:

0.25 lb/10^6 Btu x 545.5 x 10^6 Btu/hr = 136.4 lb/hr = 298 tons/yr

Volatile Organic Compounds
Maximum and potential emissions: Best factor from AP-42, Table 1.6-1 for wood waste combustion:
lb/ton = 1.4 + 0.3 = 1.7
1.7 lb/ton x 151,528 ÷ 2,000 = 128.8 lb/hr
= 281 tons/yr

B. BURNING FUEL OIL AT 225 x 10^6 BTU/HR AND 500,000 GAL/YR

Particulate
Allowable and maximum emissions = 225 x 10^6 Btu/hr x 0.1 lb/10^6 Btu = 22.5 lb/hr

Potential emissions: from AP-42 Table 1.3-1, for utility boilers
$lb/10^3$ gal = 10(S) + 3 = 10(2.5) + 3 = 28
1,499 gal/hr x 28 $lb/10^3$ gal = 42.0 lb/hr
500,000 gal/yr x 28 $lb/10^3$ gal ÷ 2,000 = 7.0 tons/yr

<u>Sulfur Dioxide (based upon no removal in scrubber)</u>
Maximum and potential emissions: from AP-42 Table 1.3-1
$lb/10^3$ gal = 157 (S) = 157(2.5) = 392.5
1,499 x 392.5 = 588.4 lb/hr
500,000 x $392.5/10^3$ ÷ 2,000 = 98 tons/yr

<u>Nitrogen Oxides</u>
Maximum and potential emissions: from AP-42 Table 1.3-1, for utility boilers
67 $lb/10^3$ gal x 1,499 = 100.4 lb/hr
500,000 x $67/10^3$ ÷ 2,000 = 17 tons/yr

<u>Volatile Organic Compounds</u>
Maximum and potential emissions: from AP-42, Table 1.3-1
(0.76 + 0.28) $lb/10^3$ gal x 1,499 = 1.56 lb/hr
500,000 x $1.04/10^3$ ÷ 2,000 = 0.3 tons/yr

<u>Carbon Monoxide</u>
Maximum and potential emissions: from AP-42, Table 1.3-1
5 $lb/10^3$ x 1,499 = 7.50 lb/hr
500,000 x $5/10^3$ ÷ 2,000 = 1.3 tons/yr

<u>Mercury, Beryllium, Fluorides, and Sulfuric Acid Mist</u>
Based upon emission factors in "Health Impacts, Emissions, and Emission Factors for Noncriteria Pollutants Subject to <u>De Minimis</u> Guidelines and Emitted from Stationary Conventional Combustion Processes," EPA-450/2-80-074, June 1980. Typical trace element concentration of No. 6 fuel oil (C) in ppm also attached. Assume no removal of trace elements in wet scrubbers.

Mercury: Maximum and potential emissions
$lb/10^{12}$ Btu = 23 C x 2.33 = 23 (0.04) x 2.33 = 2.14
225 x 10^6 Btu/hr x 2.14 $lb/10^{12}$ Btu = 0.0005 lb/hr
500,000 gal/hr x 8.2 lb/gal x 18,300 Btu/lb x 2.14 $lb/10^{12}$ Btu ÷ 2,000 = 8.0 x 10^{-5} tons/yr

Beryllium: Maximum and potential emissions
$lb/10^{12}$ Btu = 24 C x 2.33 = 24 (0.08) x 2.33 = 4.47
225 x 10^6 x $4.47/10^{12}$ = 0.001 lb/hr
500,000 x 8.2 x 18,300 x $4.47/10^{12}$ ÷ 2,000 = 1.7 x 10^{-4} tons/yr

Fluorides: Maximum and potential emissions
$lb/10^{12}$ Btu = 23 C x 2.33 = 23 (0.12) x 2.33 = 6.43
225 x 10^6 x $6.43/10^{12}$ = 0.0014 lb/hr
500,000 x 8.2 x 18,300 x $6.43/10^{12}$ ÷ 2,000 = 2.4 x 10^{-4} tons/yr

Sulfuric Acid Mist: Maximum and potential emissions--Use factor for oil-fired utility boilers.

$16.9 \text{ S} \times 2,326 \text{ lb}/10^{12} \text{ Btu}$

S = 2.5%

$\text{lb}/10^{12} \text{ Btu} = 16.9\ (2.5) \times 2,326 = 98,274$

$225 \times 10^{6} \times 98,274/10^{12} = 22.1 \text{ lb/hr}$

$500,000 \times 8.2 \times 18,300 \times 98,274/10^{12} \div 2,000 = 3.7 \text{ tons/yr}$

Arsenic: Maximum and potential emissions--see attached reference for best factor available.

$18 \text{ pg/J} \times 2.33 = 41.9 \text{ lb}/10^{12} \text{ Btu}$

$225 \times 10^{6} \times 41.9/10^{12} = 0.009 \text{ lb/hr}$

$500,000 \times 8.2 \times 18,300 \times 41.9/10^{12} \div 2,000 = 0.0016 \text{ ton/yr}$

Lead: Maximum and potential emissions--see attached reference for best factor available.

$80 \text{ pg/J} \times 2.33 = 186.4 \text{ lb}/10^{12} \text{ Btu}$

$225 \times 10^{6} \times 186.4/10^{12} = 0.042 \text{ lb/hr}$

$500,000 \times 8.2 \times 18,300 \times 186.4/10^{12} \div 2,000 = 0.007 \text{ ton/yr}$

Other Regulated Pollutants

No emission factors for other regulated pollutants are known to exist for bagasse or oil burning, nor are emissions of other pollutants considered to be significant.

C. WORST-CASE EMISSIONS

Particulate

Burning bagasse = 109.1 lb/hr

Sulfur Dioxide

Burning fuel oil at 225×10^{6} Btu/hr, with remainder of steam capacity from bagasse

SO_2 due to oil = 588.4 lb/hr

Steam due to oil = 150,000 lb/hr

Remaining steam due to bagasse = 250,000-150,000 = 100,000 lb/hr

Dry bagasse required = 100,000 lb/hr x 1,200 Btu/lb ÷ 0.55 ÷ 8,000 Btu/lb = 27,273 lb/hr

SO_2 due to bagasse = 27,273 x 0.002 x 2 x 0.5 = 54.5 lb/hr

Total SO_2 = 588.4 + 54.5 = 642.9 lb/hr

Nitrogen Oxides

Fuel-oil burning produces maximum NO_x emissions. Therefore, maximum NO_x occurs when burning maximum fuel with the rest of the steam supplied by bagasse.

NO_x due to oil = 100.4 lb/hr

Steam due to oil = 150,000 lb/hr (see SO_2 above)

Steam due to bagasse = 100,000 lb/hr

Bagasse required = 27,273 lb/hr (dry) ÷ 0.45 = 60,607 lb/hr (wet)

NO_x due to bagasse = 60,607 x 1.2 ÷ 2,000 = 36.4 lb/hr

Total NO_x = 100.4 + 36.4 = 136.8 lb/hr

Carbon Monoxide
Burning bagasse = 136.4 lb/hr

Volatile Organic Compounds
Burning bagasse = 128.8 lb/hr

Mercury, Beryllium, Fluorides, Sulfuric Acid Mist, Arsenic, and Lead
Since all estimated emissions are from fuel oil burning, maximum emissions are the same as those calculated for fuel oil burning.
Mercury = 0.0005 lb/hr
Beryllium = 0.001 lb/hr
Fluorides = 0.0014 lb/hr
Sulfuric acid mist = 22.1 lb/hr
Arsenic = 0.009 lb/hr
Lead = 0.042 lb/hr

D. POTENTIAL EMISSIONS

Particulates
Maximum potential is due to burning bagasse
= 1,212 lb/hr = 2,647 tons/yr

Sulfur Dioxide
Maximum potential due to burning fuel oil at maximum rate, with remainder of steam capacity supplied from bagasse. No removal in scrubber.
Potential due to oil = 588.4 lb/hr
Potential due to bagasse = 54.5 lb/hr ÷ 0.5 = 109.0 lb/hr
Total potential SO_2 = 697.4 lb/hr
Annual potential due to oil = 98 tons/yr
Annual potential due to bagasse:
500,000 gal/yr oil ÷ 1,499 gal/hr oil = 333.6 hr/yr on oil at 150,000 lb/hr steam
Hours on bagasse at 100,000 lb/hr steam = 333.6
SO_2 = 333.6 x 54.5 ÷ 0.5 ÷ 2,000 = 18.2 tons/yr
Hours on bagasse at 250,000 lb/hr steam = (182 x 24) - 333.6 = 4,034.4 hr
SO_2 = 4,034.4 hr x 272.8 lb/hr ÷ 2,000 = 550.3 tons/yr
Total annual potential = 98 + 18.2 + 550.3 = 666.5 tons/yr

Nitrogen Oxides
Same reasoning as for SO_2.
Hourly potential = Worst-case emissions = 136.8 lb/hr
Annual potential due to oil = 17 tons/yr
Annual potential due to bagasse:
@ 100,000 lb/hr steam: 333.6 x 36.4 lb/hr ÷ 2,000 = 6.1 tons/yr
@ 250,000 lb/hr steam: 4,034.4 x 90.9 lb/hr ÷ 2,000 = 183.4 tons/yr
Total annual potential = 17 + 6.1 + 183.4 = 206 tons/yr

Carbon Monoxide
Maximum potential due to bagasse burning = 136.4 lb/hr
= 298 tons/yr

Volatile Organic Compounds
Maximum potential due to bagasse burning = 128.8 lb/hr
= 281 tons/yr

Mercury, Beryllium, Fluorides, Sulfuric Acid Mist, Arsenic, and Lead
All due to oil burning; same as potential emissions (see Section II.B).

III. ACTUAL EMISSIONS

Maximum actual emissions are based upon the worst-case fuel and 182 crop days/yr.

A. The following pollutants are maximized when burning bagasse:
Particulate: 109.1 lb/hr x 24 x 182 ÷ 2,000 = 238.3 tons/yr
Carbon Monoxide: 136.4 lb/hr, or 298 tons/yr
Volatile Organic Compounds: 128.8 lb/hr, or 281 tons/yr

B. The following pollutants are maximized when burning fuel oil; maximum actual emissions are based upon 500,000 gallons of oil burned per year, with remainder of steam capacity due to bagasse burning (see also Worst-Case Emissions section). Hours on oil = 333.6.

Sulfur Dioxide
Oil = 98.1 tons/yr (Section II.B)
Bagasse = 54.5 x 333.6 ÷ 2,000 = 9.1 tons/yr
136.4 x 4,034.4 hr/yr ÷ 2,000 = 275.1 tons/yr
Total = 98.1 + 9.1 + 275.1 = 382.3 tons/yr

Nitrogen Oxides
Same as potential emissions = 206 tons/yr

Mercury, Beryllium, Fluorides, Sulfuric Acid Mist, Arsenic, and Lead
Same as potential emissions (see Section II.B).

REFERENCES FOR SO_2, PARTICULATE, NITROGEN OXIDES, VOLATILE ORGANIC COMPOUNDS AND CARBON MONOXIDE FROM FUEL OIL COMBUSTION

1.3 FUEL OIL COMBUSTION

1.3.1 General[1,2,22]

Fuel oils are broadly classified into two major types, distillate and residual. Distillate oils (fuel oil grade Nos. 1 and 2) are used mainly in domestic and small commercial applications in which easy fuel burning is required. Distillates are more volatile and less viscous than residual oils, having negligible ash and nitrogen contents and usually containing less than 0.3 weight percent sulfur. Residual oils (grade Nos. 4, 5 and 6), on the other hand, are used mainly in utility, industrial and large commercial applications with sophisticated combustion equipment. No. 4 oil is sometimes classified as a distillate, and No. 6 is sometimes referred to as Bunker C. Being more viscous and less volatile than distillate oils, the heavier residual oils (Nos. 5 and 6) must be heated to facilitate handling and proper atomization. Because residual oils are produced from the residue left after lighter fractions (gasoline, kerosene and distillate oils) have been removed from the crude oil, they contain significant quantities of ash, nitrogen and sulfur. Properties of typical fuel oils are given in Appendix A.

1.3.2 Emissions

Emissions from fuel oil combustion are dependent on the grade and composition of the fuel, the type and size of the boiler, the firing and loading practices used, and the level of equipment maintenance. Table 1.3-1 presents emission factors for fuel oil combustion in units without control equipment. The emission factors for industrial and commercial boilers are divided into distillate and residual oil categories because the combustion of each produces significantly different emissions of particulates, SO_x and NO_x. The reader is urged to consult the references for a detailed discussion of the parameters that affect emissions from oil combustion.

Particulate Matter[3-7,12-13,24,26-27] - Particulate emissions are most dependent on the grade of fuel fired. The lighter distillate oils result in significantly lower particulate formation than do the heavier residual oils. Among residual oils, Nos. 4 and 5 usually result in less particulate than does the heavier No. 6.

In boilers firing No. 6, particulate emissions can be described, on the average, as a function of the sulfur content of the oil. As shown in Table 1.3-1 (Footnote g), particulate emissions can be reduced considerably when low-sulfur grade 6 oil is fired. This is because low sulfur No. 6, whether refined from naturally occurring low sulfur crude oil or desulfurized by one of several current processes, exhibits substantially lower viscosity and reduced asphaltene, ash and sulfur - all of which results in better atomization and cleaner combustion.

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TABLE 1.3-1. UNCONTROLLED EMISSION FACTORS FOR FUEL OIL COMBUSTION

EMISSION FACTOR RATING: A

Boiler Type[a]	Particulate Matter[b]		Sulfur Dioxide[c]		Sulfur Trioxide		Carbon Monoxide[d]		Nitrogen Oxide[e]		Volatile Organics[f] Nonmethane		Volatile Organics[f] Methane	
	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal	kg/10³l	lb/10³gal
Utility Boilers														
Residual Oil	g	g	19S	157S	0.34S[h]	2.9S[h]	0.6	5	8.0 (12.6)(5)[i]	67 (105)(42)[i]	0.09	0.76	0.03	0.28
Industrial Boilers														
Residual Oil	g	g	19S	157S	0.24S	2S	0.6	5	6.6[j]	55[j]	0.034	0.28	0.12	1.0
Distillate Oil	0.24	2	17S	142S	0.24S	2S	0.6	5	2.4	20	0.024	0.2	0.006	0.052
Commercial Boilers														
Residual Oil	g	g	19S	157S	0.24S	2S	0.6	5	6.6	55	0.14	1.13	0.057	0.475
Distillate Oil	0.24	2	17S	142S	0.24S	2S	0.6	5	2.4	20	0.04	0.34	0.026	0.216
Residential Furnaces														
Distillate Oil	0.3	2.5	17S	142S	0.24S	2S	0.6	5	2.2	18	0.085	0.713	0.214	1.78

[a] Boilers can be approximately classified according to their gross (higher) heat rate as shown below:
- Utility (power plant) boilers: >106 x 10^9 J/hr (>100 x 10^6 Btu/hr)
- Industrial boilers: 10.6 x 10^9 to 106 x 10^9 J/hr (10 x 10^6 to 100 x 10^6 Btu/hr)
- Commercial boilers: 0.5 x 10^9 to 10.6 x 10^9 J/hr (0.5 x 10^6 to 10 x 10^6 Btu/hr)
- Residential furnaces: <0.5 x 10^9 J/hr (<0.5 x 10^6 Btu/hr)

[b] References 3-7 and 24-25. Particulate matter is defined in this section as that material collected by EPA Method 5 (front half catch).

[c] References 1-5. S indicates that the weight % of sulfur in the oil should be multiplied by the value given.

[d] References 3-5 and 8-10. Carbon monoxide emissions may increase by factors of 10 to 100 if the unit is improperly operated or not well maintained.

[e] Expressed as NO_2. References 1-5, 8-11, 17 and 26. Test results indicate that at least 95% by weight of NO_x is NO for all boiler types except residential furnaces, where about 75% is NO.

[f] References 18-21. Volatile organic compound emissions are generally negligible unless boiler is improperly operated or not well maintained, in which case emissions may increase by several orders of magnitude.

[g] Particulate emission factors for residual oil combustion are, on average, a function of fuel oil grade and sulfur content:
- Grade 6 oil: 1.25(S) + 0.38 kg/10^3 liter [10(S) + 3 lb/10^3 gal] where S is the weight % of sulfur in the oil. This relationship is based on 81 individual tests and has a correlation coefficient of 0.65.
- Grade 5 oil: 1.25 kg/10^3 liter (10 lb/10^3 gal)
- Grade 4 oil: 0.88 kg/10^3 liter (7 lb/10^3 gal)

[h] Reference 25.

[i] Use 5 kg/10^3 liters (42 lb/10^3 gal) for tangentially fired boilers, 12.6 kg/10^3 liters (105 lb/10^3gal) for vertical fired boilers, and 8.0 kg/10^3 liters (67 lb/10^3 gal) for all others, at full load and normal (>15%) excess air. Several combustion modifications can be employed for NO_x reduction: (1) limited excess air can reduce NO_x emissions 5-20%, (2) staged combustion 20-40%, (3) using low NO_x burners 20-50%, and (4) ammonia injection can reduce NO_x emissions 40-70% but may increase emissions of ammonia. Combinations of these modifications have been employed for further reductions in certain boilers. See Reference 23 for a discussion of these and other NO_x reducing techniques and their operational and environmental impacts.

[j] Nitrogen oxides emissions from residual oil combustion in industrial and commercial boilers are strongly related to fuel nitrogen content, estimated more accurately by the empirical relationship:
kg NO_2/10^3 liters = 2.75 + 50$(N)^2$ [lb NO_2/10^3gal = 22 + 400$(N)^2$] where N is the weight % of nitrogen in the oil. For residual oils having high (>0.5 weight %) nitrogen content, use 15 kg NO_2/10^3 liter (120 lb NO_2/10^3gal) as an emission factor.

Boiler load can also affect particulate emissions in units firing No. 6 oil. At low load conditions, particulate emissions may be lowered by 30 to 40 percent from utility boilers and by as much as 60 percent from small industrial and commercial units. No significant particulate reductions have been noted at low loads from boilers firing any of the lighter grades, however. At too low a load condition, proper combustion conditions cannot be maintained, and particulate emissions may increase drastically. It should be noted, in this regard, that any condition that prevents proper boiler operation can result in excessive particulate formation.

Sulfur Oxides (SO_x)[1-5,25,27] - Total sulfur oxide emissions are almost entirely dependent on the sulfur content of the fuel and are not affected by boiler size burner design, or grade of fuel being fired. On the average, more than 95 percent of the fuel sulfur is emitted as SO_2, about 1 to 5 percent as SO_3 and about 1 to 3 percent as particulate sulfates. Sulfur trioxide readily reacts with water vapor (both in air and in flue gases) to form a sulfuric acid mist.

Nitrogen Oxides (NO_x)[1-11,14,17,23,27] - Two mechanisms form nitrogen oxides, oxidation of fuelbound nitrogen and thermal fixation of the nitrogen in combustion air. Fuel NO_x are primarily a function of the nitrogen content of the fuel and the available oxygen (on the average, about 45 percent of the fuel nitrogen is converted to NO_x, but this may vary from 20 to 70 percent). Thermal NO_x, on the other hand, are largely a function of peak flame temperature and available oxygen - factors which depend on boiler size, firing configuration and operating practices.

Fuel nitrogen conversion is the more important NO_x forming mechanism in residual oil boilers. Except in certain large units having unusually high peak flame temperatures, or in units firing a low nitrogen residual oil, fuel NO_x will generally account for over 50 percent of the total NO_x generated. Thermal fixation, on the other hand, is the dominant NO_x forming mechanism in units firing distillate oils, primarily because of the negligible nitrogen content in these lighter oils. Because distillate oil fired boilers usually have low heat release rates, however, the quantity of thermal NO_x formed in them is less than that of larger units.

A number of variables influence how much NO_x is formed by these two mechanisms. One important variable is firing configuration. Nitrogen oxide emissions from tangentially (corner) fired boilers are, on the average, less than those of horizontally opposed units. Also important are the firing practices employed during boiler operation. Limited excess air firing, flue gas recirculation, staged combustion, or some combination thereof may result in NO_x reductions from 5 to 60 percent. See Section 1.4 for a discussion of these techniques. Load reduction can likewise decrease NO_x production. Nitrogen oxides emissions may be reduced from 0.5 to 1 percent for each percentage reduction in load from full load operation. It should be noted that most of these variables, with the exception of excess air, influence the NO_x emissions only of large oil fired boilers. Limited excess air firing is possible in many small boilers, but the resulting NO_x reductions are not nearly as significant.

Other Pollutants[18-21] - As a rule, only minor amounts of volatile organic compounds (VOC) and carbon monoxide will be emitted from the combustion of fuel oil. The rate at which VOCs are emitted depends on combustion efficiency. Emissions of trace elements from oil fired boilers are relative to the trace element concentrations of the oil.

Organic compounds present in the flue gas streams of boilers include aliphatic and aromatic hydrocarbons, esters, ethers, alcohols, carbonyls, carboxylic acids and polycylic organic matter. The last includes all organic matter having two or more benzene rings.

Trace elements are also emitted from the combustion of fuel oil. The quantity of trace elements emitted depends on combustion temperature, fuel feed mechanism and the composition of the fuel. The temperature determines the degree of volatilization of specific compounds contained in the fuel. The fuel feed mechanism affects the separation of emissions into bottom ash and fly ash.

If a boiler unit is operated improperly or is poorly maintained, the concentrations of carbon monoxide and VOCs may increase by several orders of magnitude.

1.3.3 Controls

The various control devices and/or techniques employed on oil fired boilers depend on the type of boiler and the pollutant being controlled. All such controls may be classified into three categories, boiler modification, fuel substitution and flue gas cleaning.

Boiler Modification[1-4,8-9,13-14,23] - Boiler modification includes any physical change in the boiler apparatus itself or in its operation. Maintenance of the burner system, for example, is important to assure proper atomization and subsequent minimization of any unburned combustibles. Periodic tuning is important in small units for maximum operating efficiency and emission control, particularly of smoke and CO. Combustion modifications, such as limited excess air firing, flue gas recirculation, staged combustion and reduced load operation, result in lowered NO_x emissions in large facilities. See Table 1.3-1 for specific reductions possible through these combustion modifications.

Fuel Substitution[3,5,12,28] - Fuel substitution, the firing of "cleaner" fuel oils, can substantially reduce emissions of a number of pollutants. Lower sulfur oils, for instance, will reduce SO_x emissions in all boilers, regardless of size or type of unit or grade of oil fired. Particulates generally will be reduced when a lighter grade of oil is fired. Nitrogen oxide emissions will be reduced by switching to either a distillate oil or a residual oil with less nitrogen. The practice of fuel substitution, however, may be limited by the ability of a given operation to fire a better grade of oil and by the cost and availability thereof.

Flue Gas Cleaning[15-16,28] - Flue gas cleaning equipment generally is employed only on large oil fired boilers. Mechanical collectors, a prevalent type of control device, are primarily useful in controlling particulates generated during soot blowing, during upset conditions, or when a very dirty, heavy oil is fired. During these situations, high efficiency cyclonic collectors can effect up to 85 percent control of particulate. Under normal firing conditions or when a clean oil is combusted, cyclonic collectors will not be nearly as effective due to a high percentage of small particles (less than 3 microns diameter) being emitted.

Electrostatic precipitators are commonly used in oil fired power plants. Older precipitators which are also small precipitators generally remove 40 to 60 percent of the particulate matter emissions. Due to the low ash content of the oil, greater collection efficiency may not be required. Today, new or rebuilt electrostatic precipitators have collection efficiencies of up to 90 percent.

Scrubbing systems have been installed on oil-fired boilers, especially of late, to control both sulfur oxides and particulate. These systems can achieve SO_2 removal efficiencies of up to 90 to 95 percent and provide particulate control efficiencies on the order of 50 to 60 percent.

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REFERENCES FOR PARTICULATE, SO_2, AND NITROGEN OXIDES EMISSIONS FROM BAGASSE COMBUSTION

1.8 BAGASSE COMBUSTION IN SUGAR MILLS

by Tom Lahre

1.8.1 General[1]

Bagasse is the fibrous residue from sugar cane that has been processed in a sugar mill. (See Section 6.12 for a brief general description of sugar cane processing.) It is fired in boilers to eliminate a large solid waste disposal problem and to produce steam and electricity to meet the mill's power requirements. Bagasse represents about 30 percent of the weight of the raw sugar cane. Because of the high moisture content (usually at least 50 percent, by weight) a typical heating value of wet bagasse will range from 3000 to 4000 Btu/lb (1660 to 2220 kcal/kg). Fuel oil may be fired with bagasse when the mill's power requirements cannot be met by burning only bagasse or when bagasse is too wet to support combustion.

The United States sugar industry is located in Florida, Louisiana, Hawaii, Texas, and Puerto Rico. Except in Hawaii, where raw sugar production takes place year round, sugar mills operate seasonally, from 2 to 5 months per year.

Bagasse is commonly fired in boilers employing either a solid hearth or traveling grate. In the former, bagasse is gravity fed through chutes and forms a pile of burning fibers. The burning occurs on the surface of the pile with combustion air supplied through primary and secondary ports located in the furnace walls. This kind of boiler is common in older mills in the sugar cane industry. Newer boilers, on the other hand, may employ traveling-grate stokers. Underfire air is used to suspend the bagasse, and overfired air is supplied to complete combustion. This kind of boiler requires bagasse with a higher percentage of fines, a moisture content not over 50 percent, and more experienced operating personnel.

1.8.2 Emissions and Controls[1]

Particulate is the major pollutant of concern from bagasse boilers. Unless an auxiliary fuel is fired, few sulfur oxides will be emitted because of the low sulfur content (<0.1 percent, by weight) of bagasse. Some nitrogen oxides are emitted, although the quantities appear to be somewhat lower (on an equivalent heat input basis) than are emitted from conventional fossil fuel boilers.

Particulate emissions are reduced by the use of multi-cyclones and wet scrubbers. Multi-cyclones are reportedly 20 to 60 percent efficient on particulate from bagasse boilers, whereas scrubbers (either venturi or the spray impingement type) are usually 90 percent or more efficient. Other types of control equipment have been investigated but have not been found to be practical.

Emission factors for bagasse fired boilers are shown in Table 1.8-1.

Table 1.8-1. EMISSION FACTORS FOR UNCONTROLLED BAGASSE BOILERS
EMISSION FACTOR RATING: C

	Emission factors			
	lb/10^3 lb steam[a]	g/kg steam[a]	lb/ton bagasse[b]	kg/MT bagasse[b]
Particulate[c]	4	4	16	8
Sulfur oxides	d	d	d	d
Nitrogen oxides[e]	0.3	0.3	1.2	0.6

[a] Emission factors are expressed in terms of the amount of steam produced, as most mills do not monitor the amount of bagasse fired. These factors should be applied only to that fraction of steam resulting from bagasse combustion. If a significant amount (>25% of total Btu input) of fuel oil is fired with the bagasse, the appropriate emission factors from Table 1.3-1 should be used to estimate the emission contributions from the fuel oil.

[b] Emissions are expressed in terms of wet bagasse, containing approximately 50 percent moisture, by weight. As a rule of thumb, about 2 pounds (2 kg) of steam are produced from 1 pound (1kg) of wet bagasse.

[c] Multi-cyclones are reportedly 20 to 60 percent efficient on particulate from bagasse boilers. Wet scrubbers are capable of effecting 90 or more percent particulate control. Based on Reference 1.

[d] Sulfur oxide emissions from the firing of bagasse alone would be expected to be negligible as bagasse typically contains less than 0.1 percent sulfur, by weight. If fuel oil is fired with bagasse, the appropriate factors from Table 1.3-1 should be used to estimate sulfur oxide emissions.

[e] Based on Reference 1.

Reference for Section 1.8

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REFERENCES FOR VOLATILE ORGANIC COMPOUND AND CARBON MONOXIDE EMISSIONS FROM BAGASSE COMBUSTION

1.6 WOOD WASTE COMBUSTION IN BOILERS

1.6.1 General[1-3]

The burning of wood waste in boilers is mostly confined to those industries where it is available as a byproduct. It is burned both to obtain heat energy and to alleviate possible solid waste disposal problems. Wood waste may include large pieces like slabs, logs and bark strips as well as cuttings, shavings, pellets and sawdust, and heating values for this waste range from about 4,400 to 5,000 kilocalories per kilogram of fuel dry weight (7,940 to 9,131 Btu/lb). However, because of typical moisture contents of 40 to 75 percent, the heating values for many wood waste materials as fired range as low as 2,200 to 3,300 kilocalories per kilogram of fuel. Generally, bark is the major type of waste burned in pulp mills, and a varying mixture of wood and bark waste, or wood waste alone, are most frequently burned in the lumber, furniture and plywood industries.

1.6.2 Firing Practices[1-3]

A variety of boiler firing configurations is used for burning wood waste. One common type in smaller operations is the dutch oven, or extension type of furnace with a flat grate. This unit is widely used because it can burn fuels with a very high moisture content. Fuel is fed into the oven through apertures at the top of a firebox and is fired in a cone shaped pile on a flat grate. The burning is done in two stages, drying and gasification, and combustion of gaseous products. The first stage takes place in a cell separated from the boiler section by a bridge wall. The combustion stage takes place in the main boiler section. The dutch oven is not responsive to changes in steam load, and it provides poor combustion control.

In a fuel cell oven, the fuel is dropped onto suspended fixed grates and is fired in a pile. Unlike the dutch oven, the fuel cell also uses combustion air preheating and repositioning of the secondary and tertiary air injection ports to improve boiler efficiency.

In many large operations, more conventional boilers have been modified to burn wood waste. These units may include spreader stokers with traveling grates, vibrating grate stokers, etc., as well as tangentially fired or cyclone fired boilers. The most widely used of these configurations is the spreader stoker. Fuel is dropped in front of an air jet which casts the fuel out over a moving grate, spreading it in an even thin blanket. The burning is done in three stages in a single chamber, (1) drying, (2) distillation and burning of volatile matter and (3) burning of carbon. This type of operation has a fast response to load changes, has improved combustion control and can be operated with multiple fuels. Natural gas or oil are often fired in spreader stoker boilers as auxiliary fuel. This is done to maintain constant steam when the wood waste supply fluctuates and/or to provide more steam than is possible from the waste supply alone.

Sander dust is often burned in various boiler types at plywood, particle board and furniture plants. Sander dust contains fine wood particles with low moisture content (less than 20 weight percent). It is fired in a flaming horizontal torch, usually with natural gas as an ignition aid or supplementary fuel.

1.6.3 Emissions and Controls[4-28]

The major pollutant of concern from wood boilers is particulate matter, although other pollutants, particularly carbon monoxide, may be emitted in significant amounts under poor operating conditions. These emissions depend on a number of variables, including (1) the composition of the waste fuel burned, (2) the degree of flyash reinjection employed and (3) furnace design and operating conditions.

The composition of wood waste depends largely on the industry whence it originates. Pulping operations, for example, produce great quantities of bark that may contain more than 70 weight percent moisture and sand and other noncombustibles. Because of this, bark boilers in pulp mills may emit considerable amounts of particulate matter to the atmosphere unless they are well controlled. On the other hand, some operations such as furniture manufacture produce a clean dry (5 to 50 weight percent moisture) wood waste that results in relatively few particulate emissions when properly burned. Still other operations, such as sawmills, burn a variable mixture of bark and wood waste that results in particulate emissions somewhere between these two extremes.

Furnace design and operating conditions are particularly important when firing wood waste. For example, because of the high moisture content that can be present in this waste, a larger than usual area of refractory surface is often necessary to dry the fuel before combustion. In addition, sufficient secondary air must be supplied over the fuel bed to burn the volatiles that account for most of the combustible material in the waste. When proper drying conditions do not exist, or when secondary combustion is incomplete, the combustion temperature is lowered, and increased particulate, carbon monoxide and hydrocarbon emissions may result. Lowering of combustion temperature generally results in decreased nitrogen oxide emissions. Also, emissions can fluctuate in the short term due to significant variations in fuel moisture content over short periods of time.

Flyash reinjection, which is common in many larger boilers to improve fuel efficiency, has a considerable effect on particulate emissions. Because a fraction of the collected flyash is reinjected into the boiler, the dust loading from the furnace, and consequently from the collection device, increases significantly per unit of wood waste burned. It is reported that full reinjection can cause

TABLE 1.6-1. EMISSION FACTORS FOR WOOD AND BARK COMBUSTION IN BOILERS

Pollutant/Fuel Type	kg/Mg	lb/ton	Emission Factor Rating
Particulate[a,b]			
Bark[c]			
Multiclone, with flyash reinjection[d]	7	14	B
Multiclone, without flyash reinjection[d]	4.5	9	B
Uncontrolled	24	47	B
Wood/bark mixture[e]			
Multiclone, with flyash reinjection[d,f]	3	6	C
Multiclone, without flyash reinjection[d,f]	2.7	5.3	C
Uncontrolled[g]	3.6	7.2	C
Wood[h]			
Uncontrolled	4.4	8.8	C
Sulfur Dioxide[i]	0.075 (0.01 - 0.2)	0.15 (0.02 - 0.4)	B
Nitrogen Oxides (as NO_2)[j]			
50,000 - 400,000 lb steam/hr	1.4	2.8	B
<50,000 lb steam/hr	0.34	0.68	B
Carbon Monoxide[k]	2-24	4-47	C
VOC			
Nonmethane[l]	0.7	1.4	D
Methane[m]	0.15	0.3	E

[a]References 2,4,9,17-18. For boilers burning gas or oil as an auxiliary fuel, all particulates are assumed to result from only wood waste fuel.

[b]May include condensible hydrocarbons consisting of pitches and tars, mostly from back half catch of EPA Method 5. Tests reported in Reference 20 indicate that condensible hydrocarbons account for 4% of total particulate weight.

[c]Based on fuel moisture content of about 50%.

[d]After control equipment, assuming an average collection efficiency of 80%. Data from References 4, 7 and 8 indicate that 50% flyash reinjection increases the dust load at the cyclone inlet 1.2 to 1.5 times, while 100% flyash reinjection increases the load 1.5 to 2 times the load without reinjection.

[e]Based on fuel moisture content of 33%.

[f]Based on large dutch ovens and spreader stokers (averaging 23,430 kg steam/hr) with steam pressures from 20 - 75 kpa (140 - 530 PSI).

[g]Based on small dutch ovens and spreader stokers (usually operating <9075 kg steam/hr), with pressures from 5 - 30 kpa (35 - 230 PSI). Careful air adjustments and improved fuel separation and firing were used on some units, but the effects cannot be isolated.

[h]References 12-13, 19, 27. Wood waste includes cuttings, shavings, sawdust and chips, but not bark. Moisture content ranges from 3 - 50% by weight. Based on small units (<3000 kg steam/hr) in New York and North Carolina.

[i]Reference 23. Based on tests of fuel sulfur content and sulfur dioxide emissions at four mills burning bark. The lower limit of the range (in parentheses) should be used for wood, and higher values for bark. A heating value of 5000 kcal/kg (9000 BTU/lb) is assumed. The factors are based on the dry weight of fuel.

[j]References 7, 24-26. Several factors can influence emission rates, including combustion zone, temperatures, excess air, boiler operating conditions, fuel moisture and fuel nitrogen content.

[k]Reference 30.

[l]References 20, 30. Nonmethane VOC reportedly consists of compounds with a high vapor pressure such as alpha pinene.

[m]Reference 30. Based on an approximation of methane/nonmethane ratio, which is very variable. Methane, expressed as a percent of total volatile organic compounds, varied from 0 - 74 weight %.

a tenfold increase in the dust loadings of some systems, although increases of 1.2 to 2 times are more typical for boilers using 50 to 100 percent reinjection. A major factor affecting this dust loading increase is the extent to which the sand and other noncombustibles can successfully be separated from the flyash before reinjection to the furnace.

Although reinjection increases boiler efficiency from 1 to 4 percent and minimizes the emissions of uncombusted carbon, it also increases boiler maintenance requirements, decreases average flyash particle size and makes collection more difficult. Properly designed reinjection systems should separate sand and char from the exhaust gases, to reinject the larger carbon particles to the furnace and to divert the fine sand particles to the ash disposal system.

Several factors can influence emissions, such as boiler size and type, design features, age, load factors, wood species and operating procedures. In addition, wood is often cofired with other fuels. The effect of these factors on emissions is difficult to quantify. It is best to refer to the references for further information.

The use of multitube cyclone mechanical collectors provides the particulate control for many hogged boilers. Usually, two multicyclones are used in series, allowing the first collector to remove the bulk of the dust and the second collector to remove smaller particles. The collection efficiency for this arrangement is from 65 to 95 percent. Low pressure drop scrubbers and fabric filters have been used extensively for many years. On the West Coast, pulse jets have been used.

Emission factors for wood waste boilers are presented in Table 1.6-1.

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ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

A STUDY OF WOOD-RESIDUE FIRED POWER BOILER TOTAL GASEOUS NON-METHANE ORGANIC EMISSIONS IN THE PACIFIC NORTHWEST

ATMOSPHERIC QUALITY IMPROVEMENT
TECHNICAL BULLETIN No. 109

SEPTEMBER 1980

A. TGNMO Emissions from Boilers Sampled

TGNMO as methane, carbon monoxide, and other pertinent data for duplicated samples are shown in Table 6. The average uncorrected TGNMO's for each boiler was 0.12, 0.07, 0.09 and 0.05 lb as methane/10^6 Btu fired for boilers A through D respectively. Little or no ethane or ethylene were found in the samples.

During the early part of the work on wood-residue fired boilers, water collected in the burnout moisture removal trap was not measured. Calculation of an estimate of the CO_2 absorption interference for each piece of data could not be performed. Interference estimates were calculated for each source with the data that was available for that source. Wood-residue boilers C and D had complete information for estimating the CO_2 interference. Average corrections for the boilers were 0.016, 0.015, 0.014, and 0.015 lb/10^6 Btu representing a corrected TGNMO contribution of 0.10, 0.05, 0.07, and 0.04 lb/10^6 Btu for boilers A through D respectively.

The average 1 hour geometric mean of the carbon monoxide values were 0.90, 0.20, 2.52 and 0.22 lb/10^6 Btu were found to be log normal distributed. All analytical data generated is presented in Appendix B.

B. Precision

Two factors must be accounted for when considering the precision of this data. The hidden variation in the carbon dioxide interference correction factor and the variation found between the duplicate samples. It is difficult to predict the uncertainty contribution due to application of the interference factor because of the large variation in the data producing the correction factor. At best the correction factor variation is plus or minus the correction factor. The variation in the interference factor need not be considered when working with uncorrected data.

The precision of the data as indicated by duplicate samples is obtained from an analysis of variance. Results of analysis of variance on uncorrected lb/10^6 Btu data is shown in Table 7.

TABLE 7 ANALYSIS OF VARIANCE RESULTS

Boiler	n	S Sample	S Error	MSR	F	Significant?	95% Confidence About Average
A	12	0.066	0.019	28.9	2.8	yes	0.043
B	8	0.021	0.021	2.9	2.8	no	0.025
C	7	0.018	0.026	3.2	4.3	no	0.032
D	8	0.005	0.011	1.4	3.8	no	0.010

TABLE 6 WOOD RESIDUE FIRED BOILER TGNMO DATA

TGNMO as CH_4		CO as CO		Stack O_2	Stack Moisture	Average Steam Production
$lb/10^6$ Btu	ppm	$lb/10^6$ Btu	ppm	%	%	lb/hr
Boiler A						
0.06	100	3.25	3000	7.5	-	145,000
0.19	190	3.03	1750	11.2	-	75,000
0.22	310	-	3050	10.5	-	125,000
0.18	190	1.20	740	11.5	-	130,000
0.10	140	0.64	640	7.3	12.3	135,000
0.14	210	0.31	260	7.8	25.3	100,000
0.08	100	0.38	300	8.4	17.4	100,000
0.05	76	2.16	2230	8.0	11.7	130,000
0.21	316	1.45	5610	7.0	15.3	130,000
0.04	53	0.42	350	9.0	16.0	140,000
0.06	63	0.66	410	8.6	16.3	100,000
0.06	75	1.50	1010	11.5	12.6	105,000
Boiler B						
0.03	79	0.042	48	6.0	16.6	300,000
0.10	180	0.091	97	6.8	15.3	350,000
0.09	120	0.417	641	5.4	-	475,000
0.08	100	0	0	9.5	20.9	350,000
0.07	60	0.604	273	12.5	7.0	250,000
0.04	30	0.539	255	11.6	10.6	250,000
0.04	40	0.249	156	7.8	13.9	410,000
0.07	80	0.110	70	7.8	12.3	420,000
Boiler C						
0.06	61	1.44	900	11.0	9.7	100,000
0.14	116	4.00	1900	12.1	15.0	80,000
0.08	74	2.92	1570	11.6	15.5	90,000
0.08	84	2.99	1460	11.3	15.9	100,000
0.08	77	2.71	1640	12.0	12.0	110,000
0.08	84	2.29	1420	11.3	16.8	100,000
Boiler D						
0.03	41	0.117	87	8.9	13.9	300,000
0.05	70	0.151	116	8.9	13.3	300,000
0.05	78	0.224	217	7.4	17.7	340,000
0.04	71	0.144	148	7.2	18.7	350,000
0.06	99	0.242	230	6.6	13.9	350,000
0.06	84	0.291	252	8.8	13.3	340,000
0.04	61	0.243	212	9.3	19.4	300,000
0.05	71	0.537	410	10.2	11.9	275,000

REFERENCES FOR MERCURY, BERYLLIUM, FLUORIDES AND SULFURIC ACID MIST EMISSIONS FROM FUEL OIL COMBUSTION

CCEA SPECIAL REPORT

EPA-450/2-80-074

Health Impacts, Emissions, and Emission Factors for Noncriteria Pollutants Subject to De Minimis Guidelines and Emitted from Stationary Conventional Combustion Processes

by

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Contract No. 68-02-3138

EPA Project Officer: Wade Ponder 919-541-2818

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

June 1980

TABLE 4-3 TRACE ELEMENT EMISSION FACTORS FOR OIL-FIRED AND GAS-FIRED UTILITY AND INDUSTRIAL BOILERS

FURNACE TYPE	RESIDUAL OIL[a] pg/J			NATURAL GAS[b] pg/J		
	Hg	Be	F	Hg	Be	F
UNCONTROLLED[c]						
Tangential firing	23C	24C	23C	4.9	Nil	Nil
Wall firing	23C	24C	23C	4.9	Nil	Nil

(a) Emission factors for residual oil are calculated based on characterization of eleven residual oil samples and the assumption that all trace elements in the oil feed are emitted through the stack (Shih, et al, October 1979). C indicates the concentration of trace element in residual oil, in ppm.

(b) Based on stack test measurements for gas-fired utility boilers (1.).

(c) When boilers are equipped with wet scrubbers (used for flue gas desulfurization), the emission factor for Be may be assumed to be 0.01 times the uncontrolled factor given above, and emissions of Hg and F are .2 times the values given above (1.).

NOTE: To convert emission factor units to LB/10^{12}BTU, multiply factors by 2.33.

TABLE 4-6. EMISSION FACTORS FOR SULFURIC ACID MIST FROM COMBUSTION SOURCES

SOURCE	Percent of fuel Sulfur in H_2SO_4	Emission Factor[a] ng/J	Information Sources (Reference no.)
UNCONTROLLED [b]			
EXTERNAL COMBUSTION			
Bituminous coal-fired utility boilers	.74	8.8S	58,22,2,14,56
Oil-fired utility boilers	2.4	16.9S	59,58,56
INTERNAL COMBUSTION			
Distillate oil-fueled gas turbine	3.8	1.5	60,61
Distillate oil-fueled reciprocating engine	1.4	8.9S	62,57
Gas-fueled internal combustion	Nil	Nil	57

(a) Some emission factors are presented in terms of S, the percent sulfur in the fuel. The limited data base for distillate oil-fueled gas turbines did not permit the expression of emission rates in terms of fuel sulfur concentration.

(b) For controlled emission rates, multiply uncontrolled levels above by 0.50 when flue gas desulfurization units are used, 1.0 when cold side ESPs or mechanical precipitators are used, and 2.4 when hot side ESPs are used (63, 64, 65, 67, 68),

NOTE: To convert emission factor units to LB/10^{12}BTU, multiply factor by ~~2.33~~. 2.326 per calculation see pg. 55

PB81-145195

EPA-600/7-81-003a
November 1980

EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS: VOLUME III. EXTERNAL COMBUSTION SOURCES FOR ELECTRICITY GENERATION

November 1980

by:

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E.L. Moon, L.L. Scinto, and C. Yu

TRW Environmental Engineering Division
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EPA Contract No.: 68-02-2197
EPA Program Element No.: C9K N1C
Project Officer: Michael C. Osborne

Industrial Environmental Research Laboratory
Office of Environmental Engineering and Technology
Research Triangle Park, N.C. 27711

Prepared for:

U.S. Environmental Protection Agency
Office of Research and Development
Washington D.C. 20545

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TABLE 70. AVERAGE TRACE ELEMENT CONCENTRATIONS OF RESIDUAL OIL

Trace Element	Concentration, ppm	Trace Element	Concentration, ppm
Vanadium	160	Gallium	0.4
Nickel	42.2	Indium	0.3
Potassium	34	Silver	0.3
Sodium	31	Germanium	0.2
Iron	18	Thallium	0.2
Silicon	17.5	Zirconium	0.2
Calcium	14	Strontium	0.15
Magnesium	13	Bromine	0.13
Chlorine	12	→ Fluorine	0.12
Tin	6.2	Ruthenium	0.10
Aluminum	3.8	Tellurium	0.1
Lead	3.5	Cesium	0.09
Copper	2.8	→ Beryllium	0.08
Cadmium	2.27	Iodine	0.06
Cobalt	2.21	Lithium	0.06
Rubidium	2	→ Mercury	0.04
Titanium	1.8	Tantalum	0.04
Manganese	1.33	Rhodium	0.03
Chromium	1.3	Gold	0.02
Barium	1.26	Platinum	0.02
Zinc	1.26	Scandium	0.02
Phosphorus	1.1	Bismuth	0.01
Molybdenum	0.90	Cerium	0.006
Arsenic	0.8	Tungsten	0.004
Selenium	0.7	Hafnium	0.003
Uranium	0.7	Yttrium	0.002
Antimony	0.44	Niobium	0.001
Boron	0.41		

Source: Reference 108.

REFERENCES FOR ARSENIC AND LEAD EMISSIONS
FROM FUEL OIL BURNING

PB81-145195

EPA-600/7-81-003a
November 1980

EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS: VOLUME III. EXTERNAL COMBUSTION SOURCES FOR ELECTRICITY GENERATION

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Industrial Environmental Research Laboratory
Office of Environmental Engineering and Technology
Research Triangle Park, N.C. 27711

Prepared for:

U.S. Environmental Protection Agency
Office of Research and Development
Washington D.C. 20545

TABLE 71. EMISSION FACTORS AND MEAN SOURCE SEVERITIES OF TRACE ELEMENT EMISSIONS FROM OIL-FIRED UTILITY BOILERS

Trace Element	Concentration, ppm	Emission Factor, pg/J	Mean Severity Factor: Tangentially-fired Boilers	Mean Severity Factor: Wall-fired Boilers
Aluminum (Al)	3.8	87	0.0074	0.0027
Arsenic (As)	0.8	18	0.016	0.0059
Boron (B)	0.41	9.4	0.0013	0.0005
Barium (Ba)	1.26	28.8	0.025	0.0094
Beryllium (Be)	0.08	1.8	0.40	0.15
Bromine (Br)	0.13	3.0	0.0001	<0.0001
Calcium (Ca)	14	320	0.014	0.0052
Cadmium (Cd)	2.27	51.9	0.11	0.042
Chlorine (Cl)	12	274	0.018	0.0066
Cobalt (Co)	2.21	50.5	0.22	0.082
Chromium (Cr)	1.3	30	0.026	0.0098
Copper (Cu)	2.8	64	0.14	0.052
Fluorine (F)	0.12	2.7	0.0005	0.0002
Iron (Fe)	18	411	0.023	0.0086
Mercury (Hg)	0.04	0.9	0.0079	0.0029
Potassium (K)	34	777	0.0064	0.0024
Lithium (Li)	0.06	1.4	0.028	0.010
Magnesium (Mg)	13	297	0.022	0.0081
Manganese (Mn)	1.33	30.4	0.0027	0.0010
Molybdenum (Mo)	0.9	21	0.0018	0.0007
Sodium (Na)	31	708	0.0059	0.0022
Nickel (Ni)	42.2	964	4.2	1.6
Phosphorus (P)	1.1	25	0.11	0.041
Lead (Pb)	3.5	80	0.23	0.087
Antimony (Sb)	0.44	10	0.0088	0.0033
Selenium (Se)	0.7	16	0.035	0.013
Silicon (Si)	17.5	400	0.018	0.0065
Tin (Sn)	6.2	142	0.031	0.012
Strontium (Sr)	0.15	3.4	0.0005	0.0002
Thorium (Th)	<0.001	<0.02	<0.0001	<0.0001
Uranium (U)	0.7	16	0.035	0.013
Vanadium (V)	160	3656	3.2	1.2
Zinc (Zn)	1.26	28.8	0.0032	0.0012

APPENDIX H

ESTIMATION OF CURRENT CLEWISTON MILL EMISSIONS

APPENDIX H

ESTIMATION OF CURRENT CLEWISTON MILL EMISSIONS

I. BAGASSE

Total burned (average 1981-1982) = 375,711 tons (wet)

Assumed sulfur content = 0.002

Heating value = 8,000 Btu/lb (dry)

Moisture content = 52.2 percent

Dry bagasse burned = 375,711 x (1 - 0.522) = 179,590 tons

Total heat input = 179,590 x 2,000 x 8,000 = 2.873×10^{12} Btu

PM @ allowables = 0.3 lb/10^6 Btu x 2.873×10^{12} Btu ÷ 2,000 = 431.0 tons/yr

SO_2: Assumes 50-percent efficiency in scrubbers

179,590 tons x 0.002 x 2 x 0.5 = 359.2 tons/yr

NO_x: 375,711 tons (wet) x 1.2 lb/ton ÷ 2,000 = 225.4 tons/yr

CO: 0.25 lb/10^6 Btu x 2.873×10^{12} Btu ÷ 2,000 = 359.1 tons/yr

VOC: 375,711 x 1.7 lb/ton ÷ 2,000 = 319.4 tons/yr

II. FUEL OIL

Total burned (average 1981-1982) = 378,050 gallons

Sulfur content = 2.4 percent

Density = 8.2 lb/gal

Heating value = 18,300 Btu/lb

Total heat input = 378,050 x 8.2 x 18,300 = 5.673×10^{10} Btu

PM @ allowables = 0.1 lb/10^6 Btu x 5.673×10^{10} Btu ÷ 2,000 = 2.8 tons/yr

SO_2: 378,050 x 8.2 x 0.024 x 2 ÷ 2,000 = 74.4 tons/yr

NO_x: 378,050 x 67/10^3 ÷ 2,000 = 12.7 tons/yr

CO: 378,050 x 5/10^3 ÷ 2,000 = 0.9 tons/yr

VOC: 378,050 x 1.04/10^3 ÷ 2,000 = 0.2 tons/yr

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 81 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: UNITED STATES SUGAR CORPORATION - CLEWISTON SUGAR MILL
2. Permit Number: AO26-7065
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 1 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.1 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	320,390	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas
174.6 10^3 gallons No. 6 Oil, 2.4 %S
_____ 10^3 gallons Propane
_____ 10^3 gallons Kerosene
_____ tons Coal
_____ 10^6 lb Black Liquid Solids
_____ tons Carbonaceous
_____ tons Refuse

Other (Specify type and units) Bagasse 145,040 Tons/year (52.33% Moisture)

V EMISSION LEVEL (tons/yr):

A. 129.40 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur
_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride
_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President, Sugar Houses
TYPED NAME AND TITLE

A. R. Mayo

March 17, 1982
DATE

DER FORM 17-1.122(44) Page 1 of 1

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 81 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: UNITED STATES SUGAR CORPORATION - CLEWISTON SUGAR MILL
2. Permit Number: A026-7251
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 2 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.1 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	269,750.	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

______ 10^6 cubic feet Natural Gas   176.7 10^3 gallons No. 6 Oil, 2.4 %S

______ 10^3 gallons Propane   ______ 10^3 gallons Kerosene

______ tons Coal   ______ 10^6 lb Black Liquid Solids

______ tons Carbonaceous   ______ tons Refuse

Other (Specify type and units) Bagasse 122,115 Tons/Yr. (52.33 Moisture)

V EMISSION LEVEL (tons/yr):

A. 90.47 Particulates ______ Sulfur Dioxide ______ Total Reduced Sulfur

______ Nitrogen Oxide ______ Carbon Monoxide ______ Fluoride

______ Hydrocarbon Other (Specify type and units) ______

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President, Sugar Houses
TYPED NAME AND TITLE

March 17, 1982
DATE

A. R. Mayo (signature)

DER FORM 17-1.122(44) Page 1 of 1

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 81 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: UNITED STATES SUGAR CORPORATION - CLEWISTON SUGAR MILL
2. Permit Number: A026-7250
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 3 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.1 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	147,251.	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas 113.3 10^3 gallons No. 6 Oil, 2.4 %S

_____ 10^3 gallons Propane _____ 10^3 gallons Kerosene

_____ tons Coal _____ 10^6 lb Black Liquid Solids

_____ tons Carbonaceous _____ tons Refuse

Other (Specify type and units) Bagasse 66,660. Tons/Yr. (52.33% Moisture)

V EMISSION LEVEL (tons/yr):

A. 54.53 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur

_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride

_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President, Sugar Houses
TYPED NAME AND TITLE

A. R. Mayo (signature)

March 17, 1982
DATE

DER FORM 17-1.122(44) Page 1 of 1

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 81 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: UNITED STATES SUGAR CORPORATION - CLEWISTON SUGAR MILL
2. Permit Number: A026-5069
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 5

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.1 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	69,412.	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas _____ 10^3 gallons _____ Oil, _____ %S

_____ 10^3 gallons Propane _____ 10^3 gallons Kerosene

_____ tons Coal _____ 10^6 lb Black Liquid Solids

_____ tons Carbonaceous _____ tons Refuse

Other (Specify type and units) Bagasse 31,423. Tons/Yr. (52.33% Moisture)

V EMISSION LEVEL (tons/yr):

A. 44.99 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur

_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride

_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President, Sugar Houses
TYPED NAME AND TITLE

A. R. Mayo (signature)

March 17, 1982
DATE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 81 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: UNITED STATES SUGAR CORPORATION - CLEWISTON SUGAR MILL
2. Permit Number: A026-7626
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 6

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.1 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
~~Steam~~	70,646	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas _____ 10^3 gallons _____ Oil, _____ %S

_____ 10^3 gallons Propane _____ 10^3 gallons Kerosene

_____ tons Coal _____ 10^6 lb Black Liquid Solids

_____ tons Carbonaceous _____ tons Refuse

Other (Specify type and units) Bagasse 31,981 Tons/Yr. (52.33% Moisture)

V EMISSION LEVEL (tons/yr):

A. 48.55 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur

_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride

_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

[signature] A. R. Mayo, Vice President, Sugar Houses

SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE TYPED NAME AND TITLE

[signature]

March 17, 1982
DATE

Best Available Copy

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 82 ___ prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: United States Sugar Corporation - Clewiston Sugar Mill
2. Permit Number: A-026-7065
3. Source Address: P. O. Crawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 1 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.4 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	284,322	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

___ 10^6 cubic feet Natural Gas — 137.3 10^3 gallons No. 6 Oil, 2.4 %S

___ 10^3 gallons Propane — ___ 10^3 gallons Kerosene

___ tons Coal — ___ 10^6 lb Black Liquid Solids

___ tons Carbonaceous — ___ tons Refuse

Other (Specify type and units) Bagasse 129,508 Tons/Year (51.98% Moisture)

V EMISSION LEVEL (tons/yr):

A. 116.9 Particulates ___ Sulfur Dioxide ___ Total Reduced Sulfur

___ Nitrogen Oxide ___ Carbon Monoxide ___ Fluoride

___ Hydrocarbon Other (Specify type and units) ___

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President - Sugar Hou
TYPED NAME AND TITLE

January 28, 1983
DATE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 82 ____ prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: United States Sugar Corporation - Clewiston Sugar Mill
2. Permit Number: A-026-7251
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 2 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	257,659	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

____ 10^6 cubic feet Natural Gas   78.1 10^3 gallons No. 6 Oil, 2.4 %S

____ 10^3 gallons Propane   ____ 10^3 gallons Kerosene

____ tons Coal   ____ 10^6 lb Black Liquid Solids

____ tons Carbonaceous   ____ tons Refuse

Other (Specify type and units) Bagasse 117,477 Tons/Year (51.98% Moisture)

V EMISSION LEVEL (tons/yr):

A. 79.8 Particulates   ____ Sulfur Dioxide   ____ Total Reduced Sulfur

____ Nitrogen Oxide   ____ Carbon Monoxide   ____ Fluoride

____ Hydrocarbon   Other (Specify type and units) ____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President, Sugar House
TYPED NAME AND TITLE

January 28, 1983
DATE

Best Available Copy

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 1982 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: United States Sugar Corporation - Clewiston Sugar Mill
2. Permit Number: A-026-7250
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 3 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 17.3 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	143,465	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas — 76.1 10^3 gallons No. 6 Oil, 2.4 %S
_____ 10^3 gallons Propane — _____ 10^3 gallons Kerosene
_____ tons Coal — _____ 10^6 lb Black Liquid Solids
_____ tons Carbonaceous — _____ tons Refuse

Other (Specify type and units) Bagasse 65,462' Tons/Year (51.98% Moisture)

V EMISSION LEVEL (tons/yr):

A. 52.2 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur
_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride
_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo [signature]
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President - Sugar Hous
TYPED NAME AND TITLE

January 28, 1983
DATE

DER FORM 17-1.122(44) Page 1 of 1

Best Available Copy

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 82 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: United States Sugar Corporation - Clewiston Sugar Mill
2. Permit Number: A-026-5069
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 5 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 16.7 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	62,984	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

_____ 10^6 cubic feet Natural Gas _____ 10^3 gallons _____ Oil, _____ %S

_____ 10^3 gallons Propane _____ 10^3 gallons Kerosene

_____ tons Coal _____ 10^6 lb Black Liquid Solids

_____ tons Carbonaceous _____ tons Refuse

Other (Specify type and units) Bagasse 28,662 Tons/Year (51.98% Moisture)

V EMISSION LEVEL (tons/yr):

A. 26.4 Particulates _____ Sulfur Dioxide _____ Total Reduced Sulfur

_____ Nitrogen Oxide _____ Carbon Monoxide _____ Fluoride

_____ Hydrocarbon Other (Specify type and units) _____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President - Sugar Hous
TYPED NAME AND TITLE

January 28, 1983
DATE

DER FORM 17-1.122(44) Page 1 of 1

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

ANNUAL OPERATIONS REPORT FORM FOR AIR EMISSIONS SOURCES

For each permitted emission point, please submit a separate report for calendar year 19 82 prior to March 1st of the following year.

I GENERAL INFORMATION

1. Source Name: United States Sugar Corporation - Clewiston Sugar Mill
2. Permit Number: AO-26-7626
3. Source Address: P. O. Drawer 1207
   Clewiston, Florida 33440
4. Description of Source: Bagasse Fired Boiler No. 6 - Clewiston

II OPERATING SCHEDULE: 24 hrs/day 7 days/wk 8.7 wks/yr

III RAW MATERIAL INPUT PROCESS WEIGHT:

Raw Material	Input Process Weight	
Steam	28,749	tons/yr
		tons/yr
		tons/yr
		tons/yr
		tons/yr

IV TOTAL FUEL USAGE, including standby fuels. If fuel is oil, specify type and sulfur content (e.g., No. 6 oil with 1 % S).

____ 10^6 cubic feet Natural Gas ____ 10^3 gallons ____ Oil, ____ %S

____ 10^3 gallons Propane ____ 10^3 gallons Kerosene

____ tons Coal ____ 10^6 lb Black Liquid Solids

____ tons Carbonaceous ____ tons Refuse

Other (Specify type and units) Bagasse 13,092 Tons/Year (51.98% Moisture)

V EMISSION LEVEL (tons/yr):

A. 12.6 Particulates ____ Sulfur Dioxide ____ Total Reduced Sulfur

____ Nitrogen Oxide ____ Carbon Monoxide ____ Fluoride

____ Hydrocarbon Other (Specify type and units) ____

B. Method of calculating emission rates (e.g., use of fuel and materials balance, emission factors drawn from AP 42, etc.)

VI CERTIFICATION:

I hereby certify that the information given in this report is correct to the best of my knowledge.

A. R. Mayo (signature)
SIGNATURE OF OWNER OR AUTHORIZED REPRESENTATIVE

A. R. Mayo, Vice President - Sugar Hous
TYPED NAME AND TITLE

January 28, 1983
DATE

DER FORM 17-1.122(44) Page 1 of 1

APPENDIX I

EAST AND WEST PELLET PLANTS--CALCULATION OF EMISSION OFFSETS

APPENDIX I

EAST AND WEST PELLET PLANTS--CALCULATION OF EMISSION OFFSETS

PARTICULATES

East Pellet Plant--Based upon last two source tests on units

Source test of 2-13-80

Actual emissions = 10.8 lb/hr

Pellet production = 8,317 lb/hr = 4.1585 tons/hr

Emission factor = 2.60 lb/ton

Source test of 3-12-81

Actual emissions = 10.53 lb/hr

Pellet production = 6,765 lb/hr = 3.3825 tons/hr

Emission factor = 3.11 lb/ton

West Pellet Plant--

Source test of 1-16-79

Actual emissions = 8.65 lb/hr

Pellet production = 17,030 lb/hr = 8.515 tons/hr

Emission factor = 1.02 lb/ton

Source test of 2-18-80

Actual emissions = 15.58 lb/hr

Pellet production = 10,731 lb/hr = 5.3655 tons/hr

Emission factor = 2.90 lb/ton

Average of four stack tests = 2.41 lb/ton

Total pellet production (average 1980-1981) = (2,313 + 6,895) ÷ 2 = 4,604 tons

PM emissions = 4,604 x 2.41 ÷ 2,000 = 5.5 tons/yr

OTHER POLLUTANTS

Emissions due to fuel oil burning

Total burned (average 1980-1981) = (48,303 + 134,576) ÷ 2 = 91,440 gallons

Sulfur content = 2.4 percent

SO_2: 91,440 x 8.2 x 0.024 x 2 ÷ 2,000 = 18.0 tons/yr

NO_x: 91,440 x $67/10^3$ ÷ 2,000 = 3.1 tons/yr

CO: 91,440 x $5/10^3$ ÷ 2,000 = 0.2 tons/yr

VOC: 91,440 x $1.04/10^3$ ÷ 2,000 = 0.05 tons/yr

UNITED STATES SUGAR CORPORATION

P. O. Drawer 1207
CLEWISTON, FLORIDA 33440

November 18, 1983

Mr. David Buff
Environmental Science and Engineering
P. O. Box 13454
Gainesville, Fl. 32604

Dear Mr. Buff:

As per Mr. A. R. Mayo's request, attached please find copies of the stack test for Clewiston and Bryant boilers for the last five years showing average stack temperature.

The following is a list of the production and oil consumption for the last three years of operation of the pellet plant:

	1981	1980	1979
Pellet production maximum daily	248.5 tons	264.4 tons	118.2 tons
Total production	2,312.9 tons	6,894.7 tons	2,270.5 tons
Fuel oil consumption maximum daily	4,339 gals	4,799 gals	3,140 gals
Total fuel oil consumption	48,303 gals	134,576 gals	55,539 gals

If I can be of any further assistance or you need any other information, please do not hesitate to let me know.

Sincerely,

UNITED STATES SUGAR CORPORATION

Magin Perez
Magin Perez
Supervisor, Engineering Design

MP:jt
Enclosures

APPENDIX J

FLORIDA SUGAR CANE LEAGUE TSP MONITORING DATA

PM → JFO → DAB

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241

DEPARTMENT OF ENVIRONMENTAL REGULATION
STATE OF FLORIDA

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

RECEIVED
SEP 13 1982
FLORIDA SUGAR CANE LEAGUE

September 7, 1982

Mr. David A. Bare
Director of Environmental
Relations
Florida Sugar Cane League,
Inc.
P. O. Box 1148
Clewiston, Florida 33440

Dear Mr. Bare:

Reference: Florida Sugar Cane League; Quality Assurance Plan for Ambient Air Network, 6/82 as amended.

Review of the subject document has been completed by my staff. The document, as amended, meets the requirements for quality assurance activities needed to produce acceptable ambient air quality data in support of Prevention of Significant Deterioration (PSD) monitoring requirements.

Please post this letter with the referenced document as the final approval notice.

Please feel free to contact this office at any time if you have further questions or comments.

Sincerely,

David R. Barker, Ph. D.
Environmental Administrator
Quality Assurance Section
Bureau of Air Quality Management

DRB:RJA:ht

cc: R. J. Arbes
C. Holladay

HI-VOL STATION # 7

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
10-2-82	3.5001	3.5791	.0790	45.5	44.5	1816	44	
10-8-82	3.4601	3.5333	.0732	46	45	1836	40	
10-14-82	3.4984	3.6040	.1056	46.5	46	1877	56	
10-20-82	3.4788	3.5423	.0635	46.5	46	1877	34	
10-26-82	3.4451	3.5103	.0652	48.5	49	1999	33	
11-1-82	3.5471	3.6331	.0860	46.5	46	1877	46	
11-7-82	3.5144	3.5825	.0684 corrected .0681	47.5	47.5	1938	35	23.86 h
11-13-82	3.5600	3.6548	.0953 corrected .0948	47.5	47.5	1938	49	23.86 h
11-19-82	3.5151	3.5866	.0719 .0715	47	46.5	1897	38	23.88
11-25-82	3.5344	3.6332	.0992 .0988	47.5	47.5	1938	51	23.90
12-1-82	3.5555	3.6578	.1026 .1023	46.5	46	1877	55	23.92
* 12-7-82	3.4891	3.5938	.1051 .1047	47.5	44	1795	59	23.90
12-13-82	3.5116	3.6002	.0891 .0886	49.5	47.5	1938	46	23.87
12-19-82	3.5154	3.6040	.0886	50	48	1958	45	
12-25-82	3.4653							23.88
12-31-82	3.4127	3.5099	.0976 .0972	48	45	1836	53	23.90

* NEW CALIBRATION

BEST AVAILABLE COPY

HI-VOL STATION # 7

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
1-6-83	3.4653	3.5503	(.0854) .0850	50	48	1958	44	23.90
1-12-83	3.4115	3.5002	(.0892) .0887	50	48	1958	46	23.87
1-18-83	3.3845	3.4918	(.1077) .1073	50	48	1958	55	23.90
1-24-83	3.4197	3.5342	(.1151) .1145	50.5	49	1999	58	23.88
1-30-83	3.4037	3.5334	(.1304) .1297	50.5	49	1999	65	23.88
2-5-83	3.4090	3.5141	(.1055) .1051	50.5	49	1999	53	23.92
2-11-83	3.3827	3.5528	(.1710) .1701	50	48	1958	87	23.88
2-17-83	3.2685	3.3518	(.0837) .0833	51	49.5	2020	41	23.88
2-23-83	3.3962	3.5222	(.1266) .1260	48.5	46	1877	67	23.88
3-1-83	3.2923	3.3969	(.1051) .1046	50	48	1958	54	23.88
3-7-83	3.4472	3.5236	.0764	48	45	(1829) 1836	42	23.88
3-13-83	3.4189	3.5119	.0930	49.5	47.5	1938	48	23.88
* 3-19-83	3.5954	3.7455	.1501	48	42	(1705) 1714	88	23.88
3-25-83	3.5046	3.5931	.0935	50	45	(1898) 1836	51	23.90
3-31-83	3.6028	3.6903	.0875	48.5	43	1746	50	23.88

* use new calibration

BEST AVAILABLE COPY

HI-VOL STATION # 7

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

	DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
	4-6-83	3.5036	3.5929	.0893	48.5	43	1746	51	23.88
	4-12-83	3.4815	3.5861	.1046	50	45	1827	57	23.88
	4-18-83	3.5746	3.7035	.1289	49	43.5	1767	73	23.90
	4-24-83	3.5578	3.7579	.2001	49	43.5	1766	113	23.88
	4-30-83	3.5047	3.6235	.1188	49	43.5	1766	67	23.88
	5-6-83	3.4799	3.5644	.0845	49	43.5	1766	48	23.88
	5-12-83	3.6335	3.7679	.1344	48	42	1704	79	23.87
	5-18-83	3.6067	3.7154	.1087	48	42	1705	64	23.88
	5-24-83	3.6784	3.7870	.1086	48	42	1705	64	23.88
	5-30-83	3.5800	3.6201	.0401	48	42	1706	24	23.90
	6-5-83	3.5584	3.6064	.0480	48	42	1705	28	23.88
*	6-11-83	3.6011	3.6576	.0565	48.5	45	1828	31	23.90
	6-17-83	3.5530	3.6271	.0741	48	44.5	1809	41	23.88
	6-23-83	3.4700	3.5352	.0652	48.5	45	1829	36	23.88
	6-29-83	3.4973	3.5608	.0635	48	44.5	1806	35	23.87

*New calibration

HI-VOL STATION # 7 **BEST AVAILABLE COPY**

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
7-5-83	3.3535	3.4143	.0608	49.5	46.5	1885	32	23.85
7-11-83	3.2898	3.3897	.0999	49.5	46.5	1887	53	23.87
7-17-83	3.3353	3.5304	.1951	48.5	45	1827	107	23.88
7-23-83	3.4819	3.6338	.1519	48	44.5	1807	84	23.88
7-29-83	3.4626	3.5352	.0726	48.5	45	1831	40	23.93
8-4-83	3.6220	3.7015	.0795	47	43	1749	45	23.93
8-10-83	3.6014	3.6738	.0724	47	43	1749	41	23.93
8-16-83	3.6139	3.6784	.0645	47.5	44	1789	36	23.92
8-22-83	3.6252	3.7373	.1121	47.5	44	1791	63	23.95
8-28-83	3.3169	3.4087	.0918	50	47.5	1932	48	23.93
9-3-83	3.4472	3.5162	.0690	48.5	45	1830	38	23.92
9-9-83	3.3536	3.4558	.1022	48.5	45	1830	56	23.92
* 9-15-83	3.4260	3.4789	.0529	48	44.5	1808	29	23.90
9-21-83	3.3891	3.4443	.0552	48.5	45.5	1850	30	23.92
9-27-83	3.6272	3.6923	.0651	48	44.5	1813	36	23.97

0600-002-J-5

HI-VOL STATION # 7

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M^3	MG/M^3	
10-3-83	3.5505	3.6023	.0518	47.5	44	1793	29	23.97
10-9-83	3.5649	3.6128	.0479	48	44.5	1810	26	23.93
10-15-83	3.5374	3.5940	.0566	48	44.5	1813	31	23.9
10-21-83	3.5220	3.5881	.0661	48	44.5	1810	37	23.9
10-27-83	3.6157	3.7117	.0960	48.5	45.5	1853	52	23.93
11-2-83	3.5732	3.6328	.0596	48	44.5	1810	33	23.93
11-8-83	3.5737	3.6221	.0484	48	44.5	1810	27	23.93
11-14-83	3.6241	3.7304	.1063	48.5	45.5	1851	57	23.93
11-20-83	3.5299	3.6402	.1103	48.5	45.5	1854	59	23.97
11-26-83	3.4106	3.4391	.0735	48.5	[illegible]	1851	42	23.93
* 12-2-83	3.3596	3.4492	.0896	47.5	45	1828	49	23.9
12-8-83	3.3862	3.4512	.0650	48.5	46.5	1891	34	23.9
12-14-83								
12-20-83								
12-26-83								

HI-VOL STATION # 19

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
10-2-82								
10-8-82								
10-14-82								
10-20-82								
10-26-82								
11-1-82	3.5214							PCN NO[cut off] RIN[cut off] WEL[cut off]
11-7-82	3.4919	3.5482	.0570 corrected .0563	41	45	1836	31	23.72 [cut off]
11-13-82	3.5194	3.5868	.0682 corrected .0674	41	45	1836	37	23.72
11-19-82	3.5111	3.5607	.0502 .0496	39.5	43.5	1775	28	23.73
11-25-82	3.5264	3.6109	.0855 .0845	41	45	1836	47	23.73
12-1-82	3.5377	3.6436	.1072 .1059	38.5	42	1714	63	23.72
12-7-82	3.5511	3.6807	.1311 .1296	39	43	1754	75	23.72
12-13-82	3.5312	3.6360	.1068 .1048	41.5	45.5	1856	58	23.00[cut off]
12-19-82	3.5250	3.6629	.1512 .1379	41.5	45.5	1856	81	21.5[cut off]
12-25-82	3.4273							23.72
12-31-82	3.3805	3.4913	.1121 .1108	40.5	44.5	1816	62	23.73

HI-VOL STATION # 19

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
1-6-83	3.4207	3.5177	(.1036) .0970	41.5	45.5	1856	57	22.05
1-12-83	3.4085	3.7718	(.3676) .3633	42	46.5	1897	194	23.72
1-18-83	3.3866	3.5650	(.1818) .1784	44	48.5	1979	92	23.55
1-24-83	3.3810	3.4428	(.0626) .0618	43.5	48	1958	32	23.70
1-30-83	3.3843	3.4433	(.0591) .0590	44	48.5	1979	30	23.70
2-5-83	3.4130	3.5156	(.1039) .1026	43.5	48	1958	53	23.70
2-11-83	3.3797	3.4431	(.0641) .0634	43	47.5	1938	33	23.72
2-17-83	3.4571	3.4991	(.0425) .0420	41	45	1836	23	23.72
2-23-83	3.4274	3.5047	(.0783) .0773	41.5	45.5	1856	42	23.70
3-1-83	3.4498	3.5253	([illegible]) .0755	41.5	45.5	1856	41	23.72
3-7-83	3.4174	3.4893	.0719	41.5	45.5	(1834) 1856	39	23.72
3-13-83	3.5972	3.7860	.1888	43	47.5	1915	99	23.72
* 3-19-83	3.5246	3.9280	.4034	41	46.5	(1855) 1897	214	23.55
3-25-83	3.4845	3.6201	.1356	43	48.5	(1956) 1979	69	23.72
3-31-83	3.5486	3.6014	.0528	41.5	47	1895	28	23.72

* see MVD explanation

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HI-VOL STATION # 19

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

	DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
	4-6-83	3.5201	3.6428	.1227	41.5	47	1895	65	23.72
	4-12-83	3.5965	3.6728	.0763	41	46.5	1873	41	23.70
	4-18-83	3.5844	3.6777	.0933	41.5	47	1894	49	23.70
	4-24-83	3.5479	3.6737	.1258	41	46.5	1873	67	23.70
	4-30-83	3.5174	3.6301	.1127	41	46.5	1875	60	23.72
	5-6-83	3.4885	3.5535	.0650	41	46.5	1873	35	23.70
	5-12-83	3.6130	3.7383	.1253	38.5	43.5	1753	71	23.70
	5-18-83	3.5820	3.6991	.1171	39.5	45	1813	65	23.70
	5-24-83	3.6054	3.6995	.0941	39	44	1773	53	23.70
	5-~~24~~30-83	3.5342	3.5735	.0393	40.5	46	1852	21	23.68
*	6-5-83	3.5877	3.6353	.0476	41	46.5	1887	25	23.87
	6-11-83	3.5665	3.5939	.0274	39	44.5	1793	15	23.70
	6-17-83	3.5856	—	—	—	—	—	—	23.70
	6-23-83	3.5441	3.5800	.0359	39.5	45	1812	20	23.68
	6-29-83	3.4775	3.5325	.0550	39.5	45	1812	30	23.68

* NEW CALIBRATION

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HI-VOL STATION # 19

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
7-5-83	3.2580							
7-11-83	3.2775	3.3385	.0610	41	46.5	1872	33	23.68
7-17-83	3.5145	3.6706	.1561	40	45.5	1832	85	23.68
7-23-83	3.4923	3.6168	.1245	39.5	45	1812	69	23.68
7-29-83	3.6291	3.6778	.0487	39	44.5	1791	27	23.68
8-4-83	3.6508	3.6955	.0447	39	44.5	1791	25	23.68
8-10-83	3.3339							
8-16-83	3.6068	3.6393	.0325	39.5	45	1813	18	23.70
8-22-83	3.3539	3.4195	.0656	41	46.5	1872	35	23.68
8-28-83	3.4682	3.5289	.0607	40	45.5	1833	33	23.70
* 9-3-83	3.4021	3.4549	.0528	40.5	46.5	1873	28	23.70
9-9-83	3.4125							
9-15-83	3.4023	3.4354	.0331	41	47	1892	17	23.68
9-21-83	3.3562	3.3911	.0349	40.5	46.5	1872	19	23.68
9-27-83	3.5872	3.6261	.0389	39.5	45.5	1832	21	23.68

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HI-VOL STATION # 19

FLORIDA SUGAR CANE LEAGUE, INC.

HI-VOL DATA SHEET

DATE	TARE WT.	FINAL WT.	SAMPLE WT.	OBSERVED FLOW	TRUE FLOW	TOTAL VOL. M3	MG/M3	
10-3-83	3.5457	3.5791	.0334	39	45	1812	18	23.68
10-9-83	3.5889	3.6333	.0444	39.5	45.5	1832	24	23.6
10-15-83	3.5075	3.5370	.0295	40	46	1852	16	23.68
10-21-83	3.5813	3.6084	.0271	39.5	45.5	1833	15	23.7
10-27-83	3.6081	3.6672	.0591	39	45	1813	33	23.7
11-2-83	3.5057	3.6001	.0944	40	46	1852	51	23.68
11-8-83	3.5804	3.6333	.0529	40	46	1853	29	23.70
11-14-83	3.5153	3.6014	.0856	40.5	46.5	1873	46	23.70
11-20-83	3.3999	3.4346	.0847	38.5	44.5	1791	47	23.63
11-26-83	3.3968	3.4668	.0700	40	46	1853	38	23.70
* 12-2-83	3.4598	3.7139	.2541	38.5	44	1786	142	23.33
12-8-83	3.3841	3.4350	.0509	41	46.5	1872	27	23.63
12-14-83								
12-20-83								
12-26-83								

APPENDIX K

SUPPORTIVE COMPUTER MODEL PRINTOUTS

(BOUND SEPARATELY)