AMTEST

AmTest-Air Quality, LLC
[illegible]
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Office (206) 222-7746
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December 4, 1996

Mr. Thor Sorenson
James River Corporation
Wauna Mill
Clatskanie, Oregon 97016

Dear Thor:

Please find enclosed three (3) copies of Am Test-Air Quality, LLC's final report for the residence time study performed as for the new wood-waste and cogeneration boiler at James River Corporation's Wauna Mill in Clatskanie, Oregon.

The gas temperature within the vapor space of the fluidized bed boiler (FBB) was measured at two locations; 10 feet above the overfire air ports (T1), and 25 feet above the overfire air ports (T2). Temperature measurements were taken in three (3) ports at each location using a high velocity thermocouple (HVT). Residence time was determined from the top of the overfire air ports to the point where the calculated gas temperature dropped to 1800° F. It was assumed that the temperature drop in between these points was linear.

Oxygen (O_2) concentration in percent (%) was measured at the boiler outlet using an in-situ analyzer, and at the baghouse outlet using an extractive analyzer. Possible air leakage and dilution was determined by comparison of the two O_2 measurements. It was assumed that the mass flow rate of air exiting the baghouse is the same as the mass flow rate of air exiting the FBB vapor space when corrected for dilution downstream of the vapor space.

The mass flow rate of air exiting the baghouse was determined using the measured volumetric flow rate and the calculated gas density. The volumetric flow rate measured at the baghouse outlet was corrected to the temperature and pressure inside the boiler vapor space. If the O_2 measurement at the baghouse outlet was greater than

the measurement at the boiler outlet, the volumetric flow rate was corrected for dilution using a ratio of the O_2 measurements.

The velocity of the gas in the vapor space was calculated in two sections, the space between the overfire air ports and T1, and the space above T1. Because of the 4-inch refractory lining that extends from the overfire air ports to T1, the cross-sectional area of the boiler is different for each section. The distance from T1 to to the point where the calculated gas temperature dropped to 1800° F was calculated, and the residence time for each section was determined using the gas velocity and the length of each section. These times were added together to determine the total residence time.

Mr. Douglas M. Albertson of Am Test-Air Quality, LLC conducted the field sampling, data reduction, and residence time analysis. Mr. Kris A. Hansen, Ms. Angela F. Blaisdell, and Mr. Thomas I. Allen performed the report preparation.

Also enclosed are individual spreadsheets for each test performed, example calculations, field notes, graphic representations of the temperature profiles, and temperature profile data provided by Lynn Clark of James River.

Please don't hesitate to call our office if you have any questions or require additional information.

Sincerely,
Am Test-Air Quality, LLC

Kris A. Hansen

Kris A. Hansen, QEP
President

Enclosure

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James River Corporation
Wauna, OR
Calculation of B & W fluid bed boiler residence time at 1800 degrees F.

FLUID BED BAGHOUSE STACK

KNOWNS:

1. Barometric pressure (Pbar)
2. Stack static pressure in inches of water
3. Stack temperature in degrees F
4. Volume % Moisture
5. Duct ID in inches
6. ACFM

These data are collected during isokinetic test runs at the baghouse stack performed concurrently with High Velocity Thermocouple (HVT) traversing of the Fluid Bed Boiler vapor space at port locations T1 and T2.

FLUID BED FURNACE VAPOR SPACE

KNOWNS:

1. Barometric pressure (Pbar)
2. Static pressure in the vapor space
The vapor space static pressure is assumed to be negative 0.5 inches of water on an average.
3. Temperature in degrees F
Temperature data will be collected at level #3 (ports T1) and at level #4 (ports T2) by HVT traverse. These data will be averaged and corrected to Multiple Shield High Velocity Thermocouple (M HVT) data or true gas temperature utilizing correction calculations provided in ; MEASUREMENT OF GAS TEMPERATURE IN BOILER FURNACES by Babcock & Wilcox. This document has been provided to ODEQ.
4. O2 % (wet vol.)
The O2 measurement is made at the boiler outlet using an insitu analyzer. This analyzer isn't calibrated as frequently as the reference analyzers measuring flue gas at the baghouse outlet stack during the compliance testing and is expected to be accurate to plus or minus 0.3 % O2. In-leakage correction will be performed if the baghouse % O2 (dry vol.) measurement when corrected to wet volume % is greater than the measured boiler outlet wet vol. % O2 by 0.3 % O2.
5. Vapor space area
The dimensions of the Fluid Bed boiler vapor space from the Overfire Air Ports (OFA) to the T1 port level is 15 feet 5 inches by 17 feet 1 inch (263.368 ft^2) due to refractory cladding of the membrane walls. From T1 level to T2 level the bare wall dimensions are 15 feet 9 inches by 17 feet 5 inches (274.313 ft^2).
6. The calculation: (M HVT average temperature at T1+1800)/2 will be used to derive the temperature of the vapor space from which to calculate the velocities.

Assumptions:

1.The lbs/hr of flue gas exiting the baghouse stack is the same as the lbs/hr flue gas exiting the furnace vapor space when corrected for any in-leakage occuring downstream of the fluid bed vapor space.

2. Residence time will be measured from the top of the overfire air ports to the calculated point in the vapor space where the flue gas temperature drops to 1800 degrees F. This assumes all points in between are(T1 temperature + 1800)/2.

JAMES RIVER CORPORATION
Wauna, Oregon
B & W Fluid Bed Boiler
October 23, 1996
Run # 1, 1005-1213 hrs

	INPUT		OUTPUT
BAGHOUSE STACK CONDITIONS			
Pbar ("Hg)	30.05	Pabs("Hg)	30.06
Static ("H2O)	0.12		
Duct ID (")	69.25	AREA (Feet^2)	26.16
% O2 (DRY vol.)	4.7	% O2 (WET vol.)	3.183
% CO2 (DRY vol.)	15	Mol. Wt. DRY	30.59
% Moisture	32.28	Mol. Wt. WET	26.52
Temperature (deg. F)	337.3	DENSITY(lbs/CF)	0.045772
ACFM	89,407	LBS/HR	245,538
FLUID BED VAPOR SPACE			
Static ("H2O)	-0.5	Pabs("Hg)	30.01

Note: The boiler wet O2 sensor is an insitu device, calibrated infrequently.
Accuracy is expected to be +-0.3% O2.
Input calculated BH stack wet O2 as fluid bed O2 (no dillution) unless boiler O2 is +0.3% lower than BH stack wet O2.

% O2 (WET vol.)	3.183	% O2 (DRY vol.)	4.70
T1 Temperature (deg. F)	1919	% Moisture	32.28
T2 Temperature (deg. F)	1713		
Duct area (OFA to T1)ft^2	263.37	Calc. Vapor Temp.F	1859.5
Duct area (Above T1)ft^2	274.31	Inleakage multiplier	1.000013
Feet (OFA to T1)	10	ACFM	260,501
		Feet (T1 to 1800)	8.67
		Velocity (OFA to T1)	16.5
		Velocity (Above T1)	15.8
		Residence time (seconds)	1.15

JAMES RIVER CORPORATION
Wauna, Oregon
B & W Fluid Bed Boiler
October 23, 1996
Run # 2, 1300-1509 hrs

	INPUT		OUTPUT
BAGHOUSE STACK CONDITIONS			
Pbar ("Hg)	29.95	Pabs("Hg)	29.95
Static ("H2O)	0.005		
Duct ID (")	69.25	AREA (Feet^2)	26.16
% O2 (DRY vol.)	4.9	% O2 (WET vol.)	3.306
% CO2 (DRY vol.)	14.9	Mol. Wt. DRY	30.58
% Moisture	32.53	Mol. Wt. WET	26.49
Temperature (deg. F)	336.7	DENSITY(lbs/CF)	0.045577
ACFM	89,115	LBS/HR	243,697
FLUID BED VAPOR SPACE			
Static ("H2O)	-0.5	Pabs("Hg)	29.91

Note: The boiler wet O2 sensor is an insitu device, calibrated infrequently.
Accuracy is expected to be +-0.3% O2.
Input calculated BH stack wet O2 as fluid bed O2 (no dillution) unless boiler O2 is +0.3% lower than BH stack wet O2.

% O2 (WET vol.)	3.306	% O2 (DRY vol.)	4.90
T1 Temperature (deg. F)	1926	% Moisture	32.53
T2 Temperature (deg. F)	1722		
Duct area (OFA to T1)ft^2	263.37	Calc. Vapor Temp.F	1863
Duct area (Above T1)ft^2	274.31	Inleakage multiplier	0.999997
Feet (OFA to T1)	10	ACFM	260,161
		Feet (T1 to 1800)	9.26
	Velocity (OFA to T1)		16.5
	Velocity (Above T1)		15.8
	Residence time (seconds)		1.19

JAMES RIVER CORPORATION
Wauna, Oregon
B & W Fluid Bed Boiler
October 23, 1996
Run # 3, 1600-1730 hrs

	INPUT		OUTPUT
BAGHOUSE STACK CONDITIONS			
Pbar ("Hg)	29.9	Pabs("Hg)	29.91
Static ("H2O)	0.08		
Duct ID (")	69.25	AREA (Feet^2)	26.16
% O2 (DRY vol.)	4.8	% O2 (WET vol.)	3.335
% CO2 (DRY vol.)	14.9	Mol. Wt. DRY	30.58
% Moisture	30.53	Mol. Wt. WET	26.74
Temperature (deg. F)	332.5	DENSITY(lbs/CF)	0.046181
ACFM	85,938	LBS/HR	238,120
FLUID BED VAPOR SPACE			
Static ("H2O)	-0.5	Pabs("Hg)	29.86

Note: The boiler wet O2 sensor is an insitu device, calibrated infrequently.
Accuracy is expected to be +-0.3% O2.
Input calculated BH stack wet O2 as fluid bed O2 (no dillution) unless boiler O2 is +0.3% lower than BH stack wet O2.

% O2 (WET vol.)	3.335	% O2 (DRY vol.)	4.80
T1 Temperature (deg. F)	2026	% Moisture	30.53
T2 Temperature (deg. F)	1717		
Duct area (OFA to T1)ft^2	263.37	Calc. Vapor Temp.F	1913
Duct area (Above T1)ft^2	274.31	Inleakage multiplier	1.000036
Feet (OFA to T1)	10	ACFM	257,703
		Feet (T1 to 1800)	10.97
		Velocity (OFA to T1)	16.3
		Velocity (Above T1)	15.7
		Residence time (seconds)	1.31

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James River — Contact Rick Fisher, Ron King

Level #3 HVT

Rosemount Mod. 3044C Smart temp transmitter
Calibration Device - Hart Communicator model 275
~~69.4~~ 59.4 = 60°F Range 600 to 2500°F

Level #4 HVT

Rosemount Model 3044C Smart temp transmitter
Calibration Device - Hart Communicator Model 275
68.2°F = 68.2°F Range 600 to 2500°F

At level #3 an ~18' high velocity thermocouple (HVT) is used to probe 3 ports located on the fuel feed tube side of the boiler. Three points/port are sampled for temperature. The HVT probe is supplied by B&W; however the temperature measuring device is supplied by James River. The above mentioned Rosemount transmitter has a microprocessor which enables ranging ~~from~~ modifications to fit the expected temperatures. In this case the range was set to 600-2500°F. I watched Rick Fisher of James River check the calibration of both the transmitters (Level #3 & #4). I also checked the calibration readout of the HVT thermocouple against the AmTest Flute TE readout - Perfect correlation w/in 1 degree at low temperature - ambient at both sites. Checked at boiler temp w/ 1300°F w/ good correlation as well. At level #3 the temp control board reads fixed TE's at both levels and HVT's as well. There is built in dampening on the Rosemounts to even out the rapid temperature fluctuations

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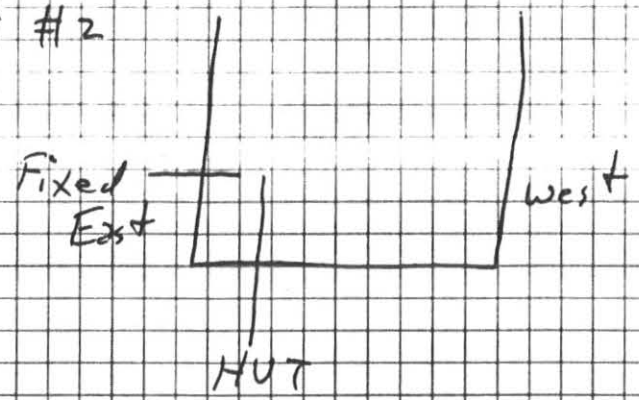
Bob

Level #3 HUT check

Point #2



	LE Fixed	HUT
Air off	1710 ~~1670~~	1460 ~~1530~~
4 SCFM	1690	1720
5 SCFM	1700	1740
6 "	1710	1730
7 "	1710	1740

Temp Readout Board

DMA HUT

7 SCFM	1700	1850
0 SCFM	1700	1700

Level #4

The temp probe is ~9½' long (HUT) as the distance across the boiler is reduced (bullnose to redirect flow than the screen section)

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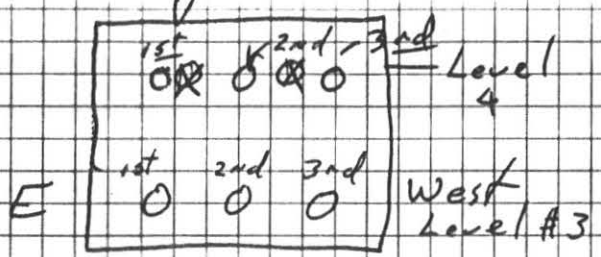
ΔP 0.63 338°F

Started 1st test at 10:00AM 10-23-96

7 SCFM thru HVT 12" Vac 80 psi Air East Port

Gas bag started as well

Started traverse on East side of Boiler - Moved to west side



For interest - 1st point middle port level #3 read 2020°F w/ air and dropped below 1600°F w/o air and still going down. H_2O jacket affects temp significant.

Lynn Clark took readings off-digital board - 2 sets of readings at each port - these are averaged.

6 SCFM thru HVT 14" Vac 80 psi Air at end of middle port on level #3

Pulled HVT and cleaned - ceramic shield completely plugged w/ ash.

West port 7 SCFM 11" Vac 80 psi Air

Took 1st reading at 1st point - checked SCFM - 6 - indicated pluggage - pulled probe - ceramic blinded w/ ash.

Finished at 11:01 hrs

Started 2nd test at 13:15 hrs in East Ports Point #1

7¼ SCFM 12" Vac 80 psi

Bag sample started simultaneously

Cleaned probe after 2 pt on mid port.
Check thermocouple end and found it wasn't sealed at pt. #1 west port. Taped end to prevent in leakage.
This is the reason my bag samples have been dilluted.
Took a small bag sample on west side ports after sealing TE leak.
14:15 Stop

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Started R#3 @ 1625 hrs E Side
Did 1st point then probe plugged.
Cleaned probe 4 times then traverse
1732 hrs Stop

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Run #1 Example Calcs

Baghouse Stack

$$P_{abs} = 30.05\text{"Hg} + \frac{0.12\text{"}H_2O}{13.6\text{"}H_2O/\text{"Hg}} = 30.06\text{"Hg}$$

From Stack velocity profile ACFM = 89,407 @ 32.28% (vol.) moisture, 337.3°F, 30.06"Hg, 30.59 dry molecular weight, (26.52 wet molecular weight)

Convert Baghouse Stack % O_2 (vol. dry) to wet vol. O_2 % to check for inleakage against the boiler wet O_2 (vol.) value

Stack moisture = 32.28% (vol.)
Stack O_2 = 4.7% (dry vol.)

$$\frac{100 - 32.28}{100} * 4.7 = 3.2\% \text{ (wet vol) at Baghouse Stack}$$

Fluid Bed Vapor Space O_2 = 3.24% (wet vol)
No Inleakage

Find moisture in Furnace Vapor Space if inleakage was found.

$$\text{Vapor Space \% Moisture} = \text{Baghouse Stack Moisture} * \frac{20.9\%\ O_2 \text{ in Air} - \text{Furnace Vapor Space \% wet } O_2 \text{ (vol.)}}{20.9 - \text{Baghouse Stack \% wet } O_2 \text{ (vol.)}}$$

Calculate Furnace Vapor Space dry O_2 % (vol.)

$$\text{Vapor Space wet vol. \% } O_2 * \frac{100}{100 - \text{\% Vapor Space Moisture}}$$

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Derive inleakage multiplier if necessary

$$\frac{20.9 - \text{Baghouse Stack \% } O_2 \text{ (dry vol.)}}{20.9 - \text{Vapor Space \% } O_2 \text{ (dry vol.)}}$$

Derive ACFM at Fluid Bed Vapor Space Conditions

$$\text{Inleakage multiplier} * \text{Baghouse Stack ACFM} * \frac{\left(\frac{T_1 + 1800}{2}\right) + 460}{\text{Avg Baghouse Stack °F} + 460}$$

This corrects ACFM to Vapor Space temperature

$$\text{ACFM @ Vapor Space temp.} * \frac{\text{Baghouse Stack Pabs}}{\text{Vapor Space Pabs}}$$

$$1 * 89{,}407 * \frac{1859.5 + 460}{337.3 + 460} * \frac{30.06}{30.01} = 260{,}501$$

$$\text{Velocity (feet/sec)} = \frac{\text{ACFM}}{\text{Area} \times 60}$$

Note: The area of the vapor space from the overfire air port level to T_1 (10' above the OFA ports) is 263.37 ft^2 due to refractory cladding of the membrane wall. Above T_1 the area is 274.31 ft^2 as the membrane wall is bare.

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From the Overfire air ports to T_1 level the velocity is:

$$\frac{260,501}{263.37 * 60} = 16.5 \text{ fps}$$

Above T_1 the velocity in the vapor space is:

$$\frac{260,501}{274.31 * 60} = 15.8 \text{ fps}$$

Calculate the distance up the vapor space from the OFA ports the flue gas temperature decreases to 1800°F.

The distance between T_1 and T_2 is 15 feet

The distance between the OFA ports and T_1 = 10 feet

$$\frac{T_1 - T_2}{15} = °F/ft$$

$$\frac{T_1 - 1800}{°F/ft} = \text{distance in feet from } T_1 \text{ to 1800°F level}$$

$$\frac{1919 - 1713}{15} = 13.73 \, °F/ft \qquad \frac{1919 - 1800}{13.73 \, °F/ft} = 8.67 \, ft$$

$$\text{Residence time} = \frac{10 \text{ ft from OFA to } T_1}{16.5} + \frac{8.67 \text{ ft from } T_1 \text{ to 1800°F level}}{15.8}$$

Residence time = 1.15 seconds

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Run #1 Baghouse Stack - Duct ID = 69.25"

1005 - 1213 hrs

Pbar = 30.05 "Hg

Static = 0.12 "H_2O

% O_2 (dry vol.) = 4.7

% CO_2 (dry vol.) = 15.0

% Moisture (vol.) = 32.28

Avg. Temp °F = 337.3

ACFM = 89,407

Area = 26.16 ft^2

Fluid Bed Vapor Space - Duct ID

1000 - 1101 hrs

a. T_1 = 15'5" x 17'1"

b. T_2 = 15'9" x 17'5"

Static Pressure = -0.5

Pabs = 30.01 "Hg

% O_2 (wet vol.) = 3.24

Avg MHVT @ T_1 = 1919 °F

$\frac{T_1 + 1800}{2}$ = 1859.5 °F

Avg MHVT @ T_2 = 1713 °F

Area @ T_1 = 263.37 ft^2

Area @ T_2 = 274.31 ft^2

Residence Time @ 1800+ °F = 1.15 sec

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Run #2 Baghouse Stack

Duct ID = 69.25"

1300 - 1509 hrs

Pbar = 29.95 "Hg

Static = 0.005 "H_2O

% O_2 (dry vol.) = 4.9

% CO_2 (dry vol.) = 14.9

% Moisture (vol.) = 32.53

Avg Temp. °F = 336.7

ACFM = 89,115

Area of Duct = 26.16 ft^2

Fluid Bed Vapor Space

Duct ID

T_1 = 15'5" x 17'1"

T_2 = 15'9" x 17'5"

Static pressure = -0.5 "H_2O

% O_2 (wet vol.) = 3.3

Avg MHVT @ T_1 = 1926 °F

Avg MHVT @ T_2 = 1722 °F

Area of T_1 Duct = 263.37 ft^2

Area of T_2 Duct = 274.31 ft^2

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Run #3 Baghouse Stack

1600 - 1730 hrs

Duct ID = 69.25"

Pbar = 29.90 "Hg

Static = 0.08 "H_2O

% O_2 (dry vol.) = 4.8

% CO_2 (dry vol.) = 14.9

% Moisture (vol.) = 30.5

Avg. Temp. °F = 332.5

ACFM = 85,938

Area of Duct = 26.16 ft^2

Fluid Bed Vapor Space

Duct ID

T_1 = 15'5" x 17'1"

T_2 = 15'9" x 17'5"

Static pressure = -0.5 "H_2O

% O_2 (wet vol.) = 3.3

Avg MHVT @ T_1 = 2026

Avg MHVT @ T_2 = 1717

Area of T_1 Duct = 263.37 ft^2

Area of T_2 Duct = 274.31 ft^2

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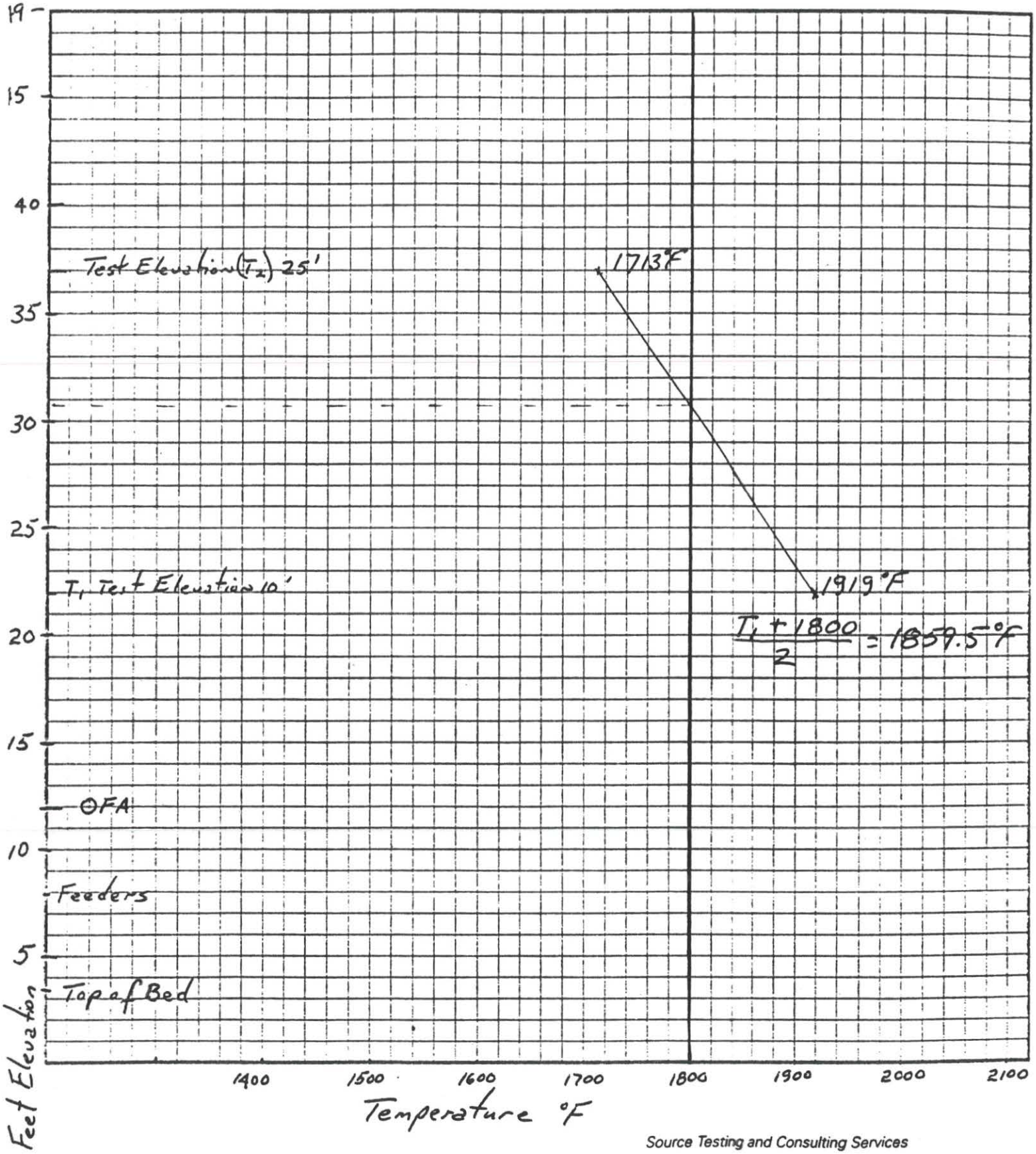
Run #1
10-23-96



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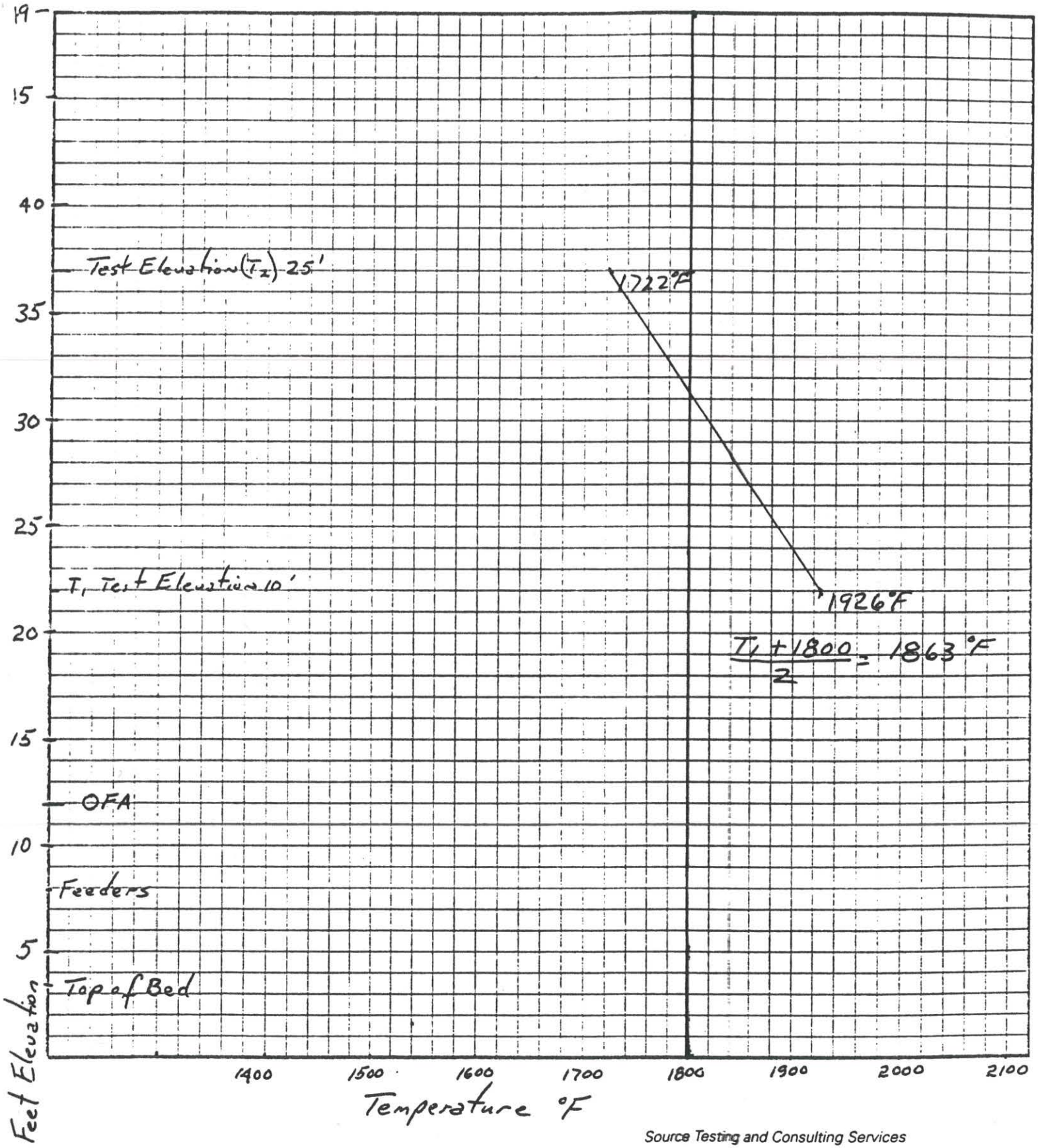
Run #2
10-23-96



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Run #3
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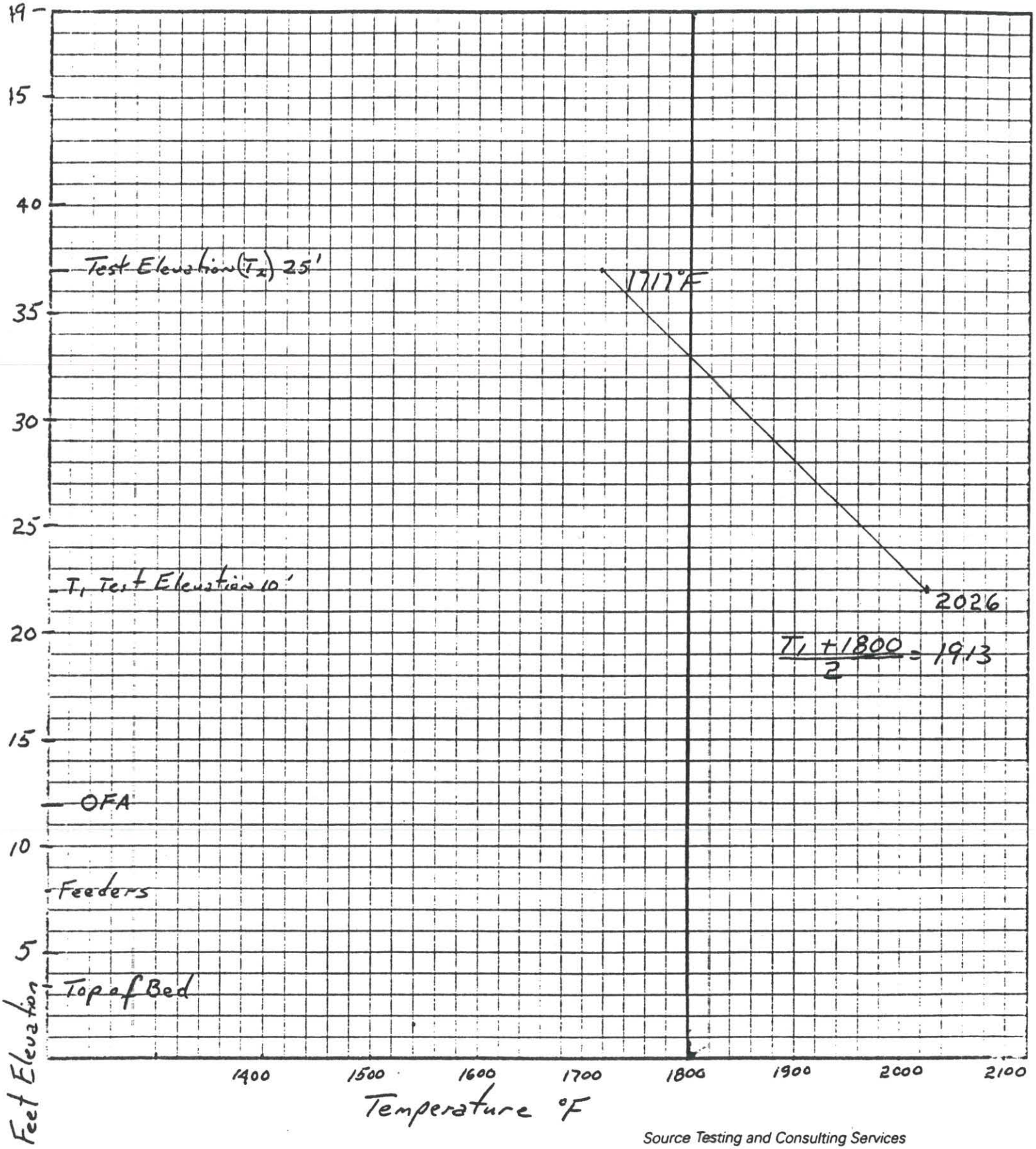
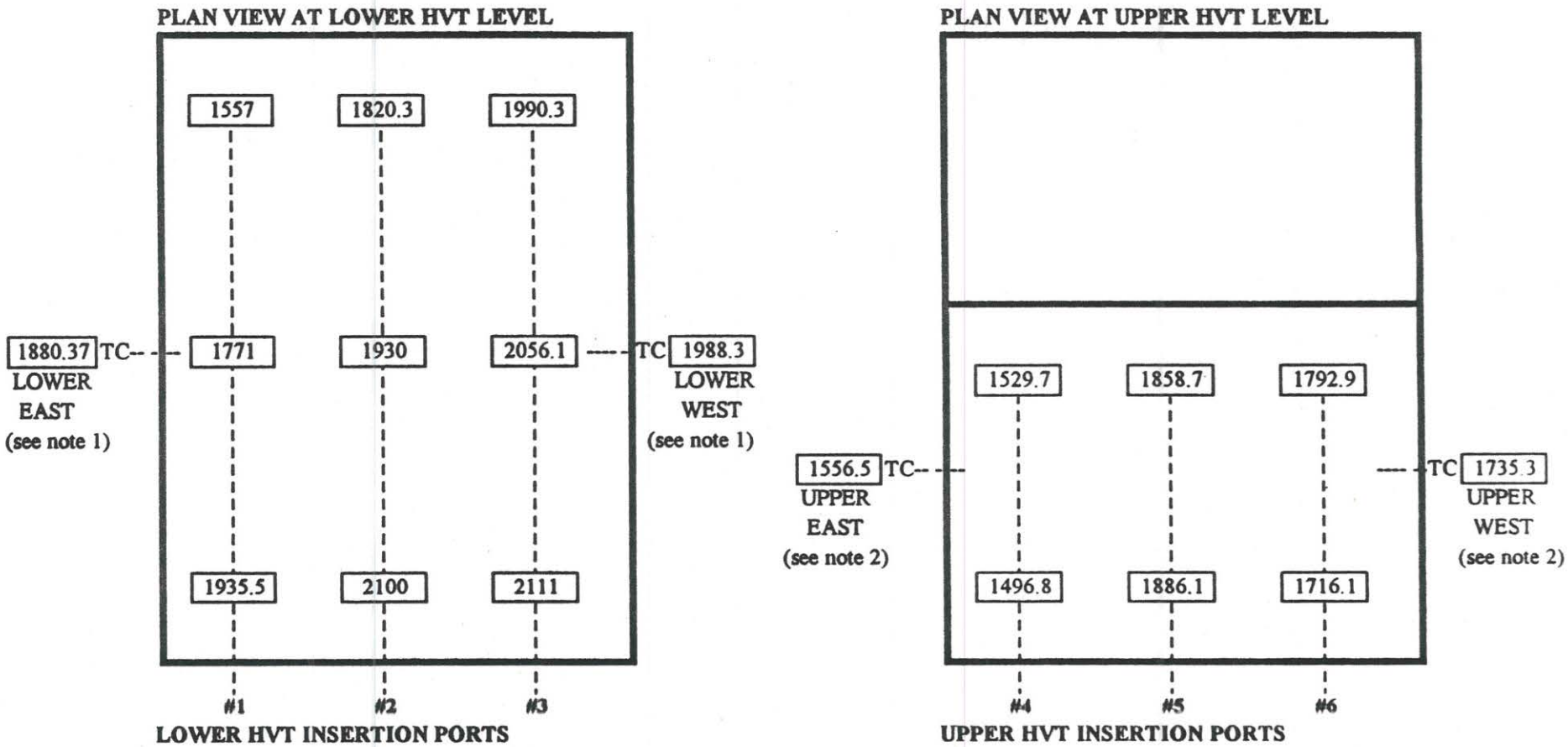


FLUID BED BOILER TEMPERATURE PROFILE

TRAVERSE NO. 10

FUEL: 55% SLUDGE, 40% BARK, 5% PAPER STEAM RATE: 108,000 PPH



ALL TEMPERATURES ON THIS PAGE ARE MHVT

NOTE 1: Average of lower TC readings during 9-point HVT traverse

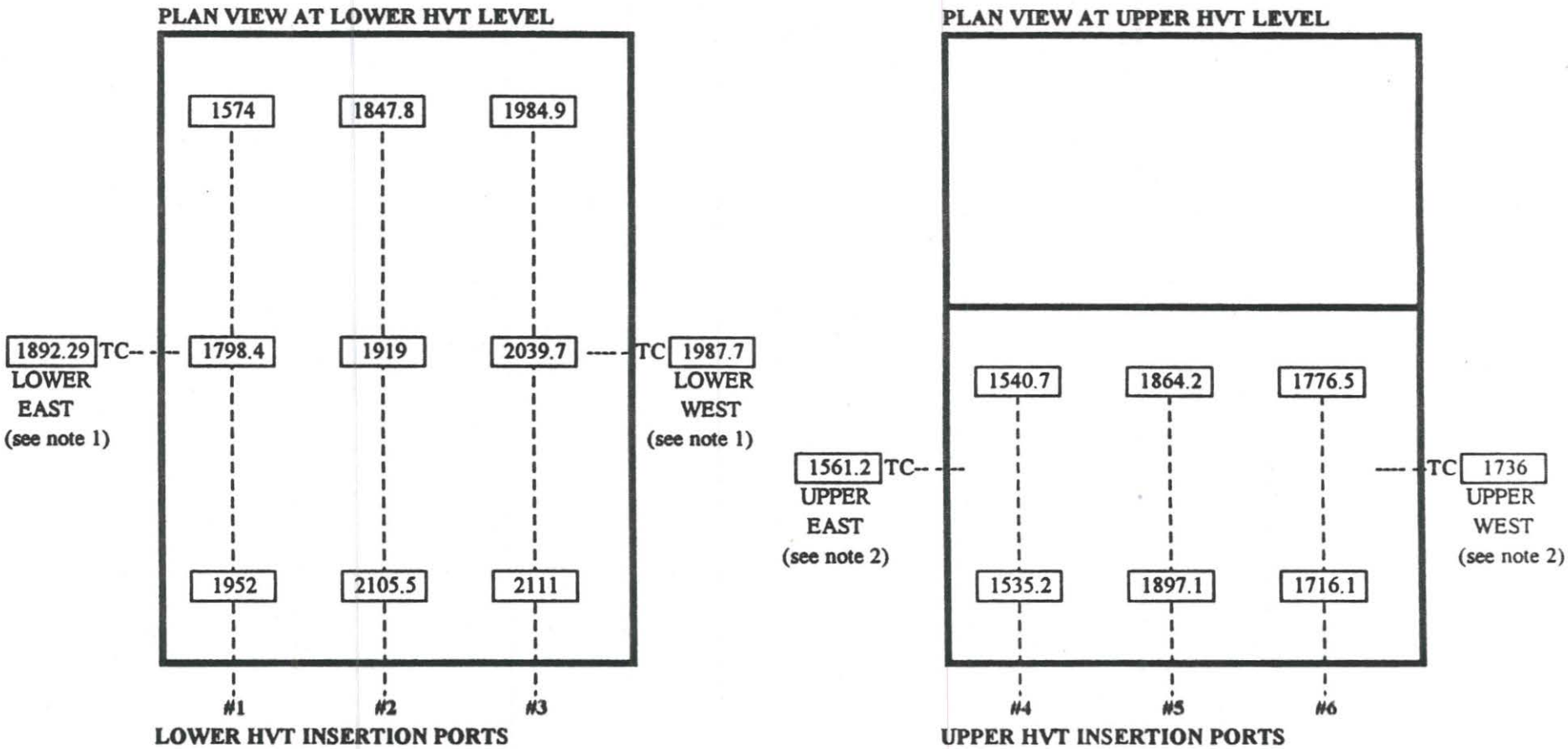
NOTE 2: Average of upper TC readings during 6-point HVT traverse

AVERAGE OF LOWER TC READINGS	**1934**
AVERAGE OF LOWER HVT READINGS	**1919**
AVERAGE OF UPPER TC READINGS	**1646**
AVERAGE OF UPPER HVT READINGS	**1713**

FLUID BED BOILER TEMPERATURE PROFILE

TRAVERSE NO. 11

FUEL: 55% SLUDGE, 40% BARK, 5% PAPER STEAM RATE: 108,000 PPH



ALL TEMPERATURES ON THIS PAGE ARE MHVT

NOTE 1: Average of lower TC readings during 9-point HVT traverse

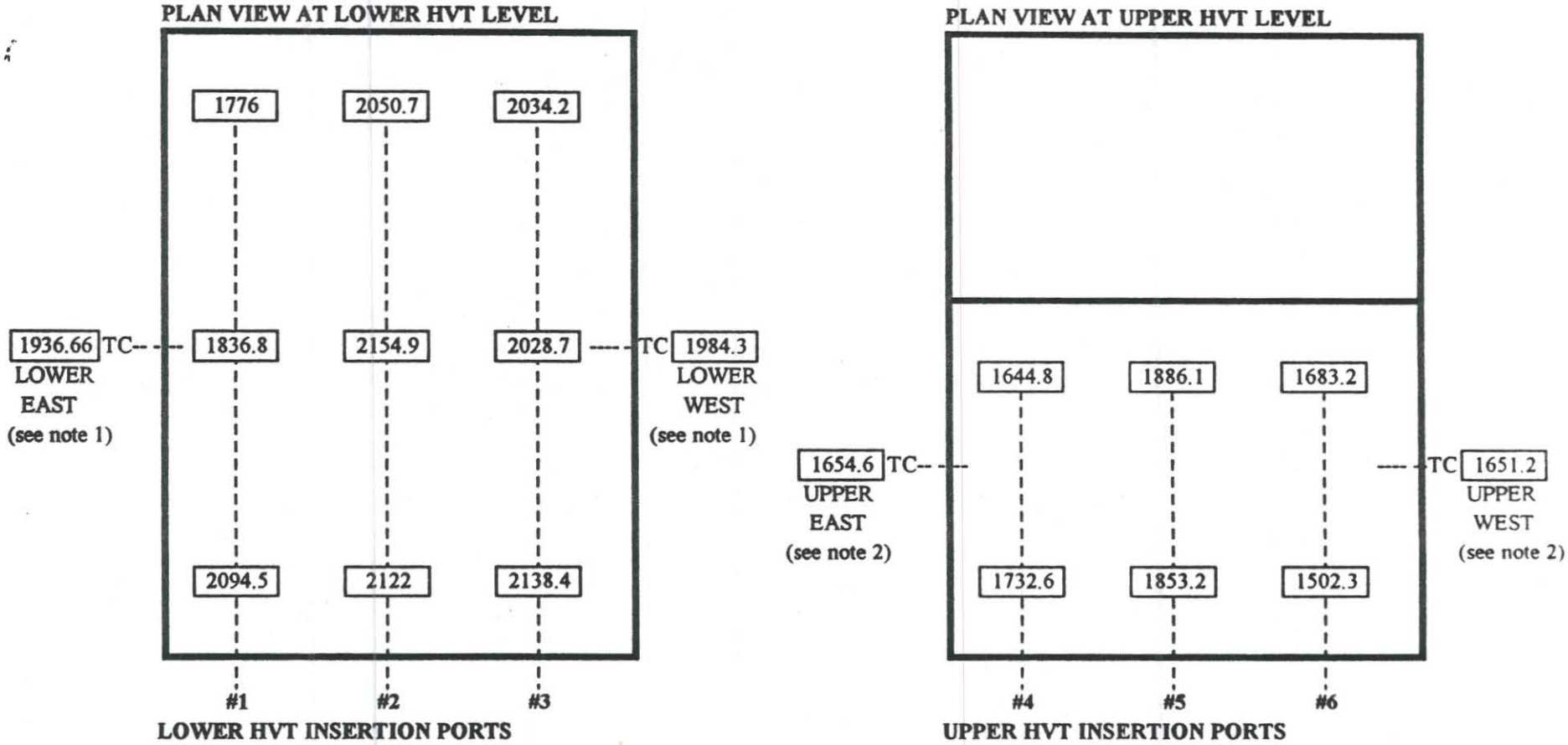
NOTE 2: Average of upper TC readings during 6-point HVT traverse

AVERAGE OF LOWER TC READINGS	**1940**
AVERAGE OF LOWER HVT READINGS	**1926**
AVERAGE OF UPPER TC READINGS	**1649**
AVERAGE OF UPPER HVT READINGS	**1722**

FLUID BED BOILER TEMPERATURE PROFILE

TRAVERSE NO. 12

FUEL: 55% SLUDGE, 40% BARK, 5% PAPER STEAM RATE: 108,000 PPH



ALL TEMPERATURES ON THIS PAGE ARE MHVT

NOTE 1: Average of lower TC readings during 9-point HVT traverse

NOTE 2: Average of upper TC readings during 6-point HVT traverse

AVERAGE OF LOWER TC READINGS	**1961**
AVERAGE OF LOWER HVT READINGS	**2026**
AVERAGE OF UPPER TC READINGS	**1653**
AVERAGE OF UPPER HVT READINGS	**1717**

HVT TRAVERSES OF A FLUID BED BOILER

LYNN CLARK

DATE 10/23
TRAVERSE NO. 12
PORT NOS. 1 &4
FIRING CONDITIONS 108,000 PPH, 55% SLUDGE,40% HOG FUEL, 5% PAPER

PROBE INSERTION	Upper 3', Lower 3'						Upper 6', Lower 7.5'						Upper (none), Lower 12'					
TIME	HVT		TC				HVT		TC				HVT		TC			
	Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West	
	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT
4:28	1690	1733	1560	1710	1470	1602												
	2030	2106	1820	2019	1750	1936												
4:30	1690	1733	1590	1745	1450	1578												
	2010	2084	1840	2043	1720	1900												
	AVG	**1733**		**1727**		**1590**												
		2095		**2031**		**1918**												
4:36							1610	1645	1510	1650	1540	1686						
							1810	1864	1740	1924	1820	2019						
4:40							1610	1645	1500	1638	1530	1674						
							1760	1809	1740	1924	1820	2019						
							AVG	**1645**		**1644**		**1680**						
								1837		**1924**		**2019**						
4:42													----	----	1500	1638	1550	1698
													1710	1755	1710	1888	1810	2008
4:44													----	----	1500	1638	1550	1698
													1750	1798	1710	1888	1810	2008
													AVG	----		**1638**		**1698**
														1776		**1888**		**2008**

HVT TRAVERSES OF A FLUID BED BOILER

LYNN CLARK

DATE 10/23
TRAVERSE NO. 12
PORT NOS. 2 &5
FIRING CONDITIONS 108,000 PPH, 55% SLUDGE,40% HOG FUEL, 5% PAPER

PROBE INSERTION	Upper 3', Lower 3'						Upper 6', Lower 7.5'						Upper (none), Lower 12'					
TIME	HVT		TC				HVT		TC				HVT		TC			
	Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West	
	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT
4:58	1810	1864	1490	1626	1520	1662												
	2050	2127	1730	1912	1780	1972												
5:00	1790	1842	1500	1638	1500	1638												
	2040	2116	1740	1924	1770	1960												
	AVG	**1853**		**1632**		**1650**												
		2122		**1918**		**1966**												
5:08							1830	1886	1510	1650	1500	1638						
							2070	2149	1750	1936	1780	1972						
5:10							1830	1886	1520	1662	1490	1626						
							2080	2160	1770	1960	1750	1936						
							AVG	**1886**		**1656**		**1632**						
								2155		**1948**		**1954**						
5:12													----	----	1520	1662	1500	1638
													1980	2051	1760	1948	1780	1972
5:14													----	----	1510	1650	1520	1662
													1980	2051	1750	1936	1800	1996
													AVG	----		**1656**		**1650**
														2051		**1942**		**1984**

HVT TRAVERSES OF A FLUID BED BOILER

LYNN CLARK

DATE 10/23
TRAVERSE NO. 12
PORT NOS. 3 &6
FIRING CONDITIONS 108,000 PPH, 55% SLUDGE,40% HOG FUEL, 5% PAPER

PROBE INSERTION	Upper 3', Lower 3'						Upper 6', Lower 7.5'						Upper (none), Lower 12'					
TIME	HVT		TC				HVT		TC				HVT		TC			
	Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West		Upper Lower		Upper East Lower East		Upper West Lower West	
	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT	Data	MHVT
5:18	1480	1502	1500	1638	1530	1674												
	2080	2160	1720	1900	1810	2008												
5:20	1480	1502	1500	1638	1530	1674												
	2040	2116	1730	1912	1820	2019												
	AVG	**1502**		**1638**		**1674**												
		2138		**1906**		**2013**												
5:24							1630	1667	1510	1650	1500	1638						
							1950	2018	1750	1936	1810	2008						
5:26							1660	1700	1510	1650	1500	1638						
							1970	2040	1760	1948	1810	2008						
							AVG	**1683**		**1650**		**1638**						
								2029		**1942**		**2008**						
5:30													----	----	1510	1650	1510	1650
													1950	2018	1750	1936	1790	1984
5:32													----	----	1510	1650	1510	1650
													1980	2051	1740	1924	1800	1996
													AVG	----		**1650**		**1650**
														2034		**1930**		**1990**