

MISSION TESTING STANDARD

FOR

WOOD FUEL BOILERS

PRESENTED BY THE WASHINGTON-OREGON 1973 HOG FUEL BOILER STUDY

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NOVEMBER 28, 1973
D.O.E. SOURCE TEST METHOD 101

ACKNOWLEDGEMENT

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WOOD FUEL BOILER

1.0 INTRODUCTION

1.1 PURPOSE

This standard provides the referee method for the sampling of particulate air pollutant emissions from wood fuel (hog fuel) boilers.

Use of test method adaptations, adjustments and short cuts found acceptable to all parties in advance of testing is not precluded. The standard method shall be the basis for validating all alternate methods.

The inclusion of requirements for the visual determination of plume opacity is anticipated in areas where such a requirement exists and in these instances plume opacity measurements shall be accomplished in accordance with EPA Method 9 (Ref.). Requirements for measurement of additional pollutants are not excluded and may be made by local authority. Such measurements shall be made in the manner so required.

1.2 APPLICABILITY

This standard specifies in detail the test methods for the sampling and evaluation of wood fuel boiler particulate air pollutant emissions. The tested wood fuel boiler, a furnace and indirect heat exchanger, shall be operated at the maximum expected steam production rate, as established by the owner, and the furnace shall be burning the principle fuel during the emission test. Auxiliary fuels, if normally used, may be used during the test if found by advance agreement to be acceptable.

The results obtained by this sampling and analysis method are the acceptable measures of the maximum particulate emission from the furnace.

This standard applies to single boilers and to multiple boiler combinations, where short manifolded breechings do not permit individual boiler sampling.

2.0 GENERAL INSTRUCTIONS

2.1 OPERATIONS AND TESTING CONDITIONS REQUIRED

2.1.1 In recognition of the substantial variations in both the installation and operation of wood fuel fired boilers, the regulations pertaining to boiler operation during compliance testing and the standard test procedure used to determine if a boiler is operating in compliance are both subject to negotiation and modification. It is recommended that all _____ compliance with emission

standards be discussed in detail _____ regulatory agency prior to the actual test and must be agreed to in writing by the person responsible for the test and the regulatory agency.

- 2.1.2 Each test run shall be carried out with the boiler producing steam at a rate equal to the average normal maximum steam production rate of the boiler. Following successful completion of the test demonstrating that the boiler was operated within the emission limitations as established by _____, the boiler may be certified for operation at a steam production rate up to but not to exceed the steam production rate at which the test was carried out.
- 2.1.3. For those installations in which more than one boiler is ducted to a common exhaust stack, the owner/operator has the option of demonstrating compliance for each individual boiler, or demonstrating compliance for the combined exhaust gas flow through the stack subject to the following limitations:
 - 2.1.3.1 If the boilers ducted to a common stack are not subject to the same emission limitations, then each boiler must be shown to be in compliance with the regulations applicable to it.
 - 2.1.3.2 If the boilers ducted to a common stack are not subject to the same emission limitations, compliance with the emission regulations may be demonstrated if the test results of the combined exhaust gases are within the most restrictive limitation applied to any of the boilers.
 - 2.1.3.2 As noted above, certification for operation of each boiler ducted to a common exhaust stack will be based upon the steam production rate for each boiler at which the certification test was carried out. No boiler may operate in excess of that steam generation rate without recertification of the ability of the unit to operate within the applicable emission limitations.
- 2.1.4 Steam production rate shall be determined by:
 - 2.1.4.1 A steam flow meter connected to the primary steam header leaving each individual boiler being tested, or:
 - 2.1.4.2 A water meter connected to the boiler feed water input line to each boiler being tested, or:
 - 2.1.4.3 An equivalent system for determining steam production for each individual boiler tested. Equivalent steam flow metering systems are subject to approval by the regulatory agency.
- 2.1.5 If auxiliary fuel is used during normal maximum steam production from the

boiler, then it should be used in the same relative proportions to the wood fuel during compliance certification testing. The data sheets indicate the information which should be supplied regarding the auxiliary fuel constituents.

2.1.6 For each boiler compliance certification test, the data sheets entitled “Source Identification and related Basic Information” should be filled out completely.

2.1.7 “Source Testing shall not be conducted during grate cleaning or soot blowing unless these operations are performed on a continuous basis.”

2.2 _____ (missing text) Boiler Identification and Related Basic Information forms included under Section G of these guidelines.

3.0 STACK GAS MOISTURE, O₂, CO₂ AND CO MEASUREMENT

3.1 MOISTURE CONTENT

3.1.1 Sources not employing wet scrubbing

3.1.1.1 Referee Methods

a. EPA Method 5 (1) includes an accurate and acceptable means of measuring stack gas moisture content.

3.1.2 Alternate methods

When fuel and firing conditions can be shown to not vary significantly during the testing period, and with prior approval of the appropriate regulatory agency, the following alternate methods may be used. At least three independent determinations are required, preferably one immediately before and after and one half-way through the test run.

The use of any of these alternate methods will require supporting documentation which clearly details the justification for its use and the steps followed in arriving at the final answer.

a. Any methods of instruments capable of accurately determining wet bulb temperature and the dry bulb temperature may be used. The percent moisture may then be determined from the appropriate psychrometric charts or tables (3) or may be calculated using Carrier’s equation (5). Precautions to be used in measuring wet bulb temperatures or should be followed (4).

b. Moisture content may be calculated on the basis of ultimate analysis of the

fuel and a measurement of the moisture content of the air being supplied for combustion.

3.1.2.1 Sources employing wet scrubbing

In this case the moisture content shall be determined by assuming that the gas its saturation vapor pressure is available from tables (6), and is converted to % H₂O by volume as follows:

$$\% \text{ H}_2\text{O} = \frac{100 P_{sv}}{P_s}$$

P_{sv} = saturation vapor pressure at sampling point

P_s – absolute static pressure at same point.

The possibility of including entrained water precludes the use of any other method.

3.2 ANALYSIS FOR O₂, CO₂ AND CO

3.2.1 Sources not employing wet scrubbing

3.2.1.1 Referee method

a. Sample collection. This method requires the use of a plastic (Tedlar or Teflon) bag for collection of the sample at a constant rate during the test run. Two arrangements are possible. The sample may be drawn from the stack through a glass wool filter, desiccant, flowmeter and a flow control valve by means of a leak-proof, oil-free pump which discharges into the bag.

Alternatively, the pump may be connected so as to pull a vacuum in an air tight chamber containing the plastic bag. With the filter, desiccant, flowmeter and control valve arranged as before, the sample is drawn into the bag by means of the vacuum created by the pump.

The minimum sample size is one cubic foot and the rate must be adjusted so that sampling will occur at a constant rate during the test run.

b. Sample analysis. Analysis of the collected sample requires at least three determinations for CO₂, O₂ and CO, using either Fyrites or an Orsat analyzer. Variations in any one of the readings of more than 0.5% indicate problems with the analytical method.

Also, if the relationship: $19.1 \leq \% \text{CO}_2 + \text{O}_2 + 1/2\% \text{CO} \leq 21.5$ does not hold, then there was a leak in the sample collection system or a problem at the source, and the sample will be invalid.

3.2.2 Sources employing wet scrubbing at moisture saturation.

With prior approval of the appropriate regulatory agency, the following methods may be used. Evidence justifying their use and documentation detailing the procedure used to arrive at the final answers will be required.

- a. Grab sample method. This method requires the use of an Orsat analyzer to obtain at least six determinations of CO₂, O₂ and CO during the test run. They may be taken at convenient times, but should be as evenly spaced as possible throughout the test run. The results are averaged, and must all agree with the relationship

$$19.1 \leq \%CO_2 + O_2 + 1/2\%CO \leq 21.5$$

Fyrites are not acceptable because they do not analyze the same sample for all three components and therefore no check is available.

- b. Other methods. With prior approval and supporting documentation, any of a number of proven analytical instruments (7) designed to measure O₂ and/or CO₂ may be used. However, since most only measure one or the other, periodic verification of the data using Fyrites or an Orsat analyzer will be required.

3.2.3 Sources employing wet scrubbing

If analysis made downstream from the scrubber do not meet the requirement that

$$19.1 \leq \%CO_2 + O_2 + 1/2\%CO \leq 21.5$$

the problem may be due to absorption of CO₂ in the scrubber. If this is the case, analysis using one of the aforementioned methods must be made ahead of the scrubber.

References vs. example (7)

4.0 STACK GAS FLOW MEASUREMENT

4.1 LOCATION OF MEASUREMENT:

Velocity measurement should be made in a straight stack or duct, with 80% of the available straight duct system and 20% downstream of the point of measurement. Velocity measurements should not be taken with less than two and one-half (2-1/2) diameters of straight duct existing between the point of measurement and the last upstream disturbance.

4.2 NUMBER AND LOCATION OF VELOCITY TRAVERSE POINTS

4.2.1 Number of Velocity Traverse Points shall be determined from Figure 1.

4.2.2 In round ducts, velocity traverse points shall be located at points of equal

elemental areas per Table I or equivalent.

- 4.2.3 In rectangular ducts, the number of velocity traverse points shall be determined from Figure 1, and located at the centroid of equal elemental areas. The ratio of length to width of elemental areas are recommended to not exceed 2 to 1. An equivalent round diameter for a rectangular duct may be determined by:

$$\text{Equivalent diameter} = 2 (\text{length}) (\text{width}) / (\text{Length} + \text{width})$$

4.3 EQUIPMENT

“P” type of calibrated “S” type pitot tubes, or prior approval equal velocity measurement instrument shall be used for velocity measurement. Velocity instruments with an accuracy measurement with ± 0.01 ” H₂O are most desirable.

4.4 VELOCITY CALCULATION

- 4.4.1 Procedure: The following procedure or equivalent may be used to perform the calculations

$$v_s = K_p C_p (t_s \times \Delta p) \text{ avg} / p_s M_s)^{1/2}$$

v_s = Stack gas velocity, feet/sec.

$$K_p = 85.48 (\text{ft/sec.}) (\text{Lb/lb mole} - ^\circ\text{R})^{1/2}$$

C_p = Pitot tube coefficient, dimensionless

T_s = Absolute stack gas temperature, °R

Δp = Velocity head of stack gas, in. water column

P_s = Absolute Stack Gas Pressure, in. Mercury column

M_s = Molecular weight of stack gas, lb/lb mole

- 4.4.2 Average Velocity:

Calculate average stack gas velocity by summing the square roots of the individual products ($T_s \times \Delta p$) and divide by the number of readings to determine $T_s \times \Delta p$ avg for use in the preceding equation.

4.5 STACK GAS FLOW CALCULATION:

Stack gas flow equals the product of the average velocity x the cross sectional area of the stack or duct in the traverse plane.

5.0 PARTICULATE SAMPLING POINTS – NUMBER REQUIRED AND LOCATION

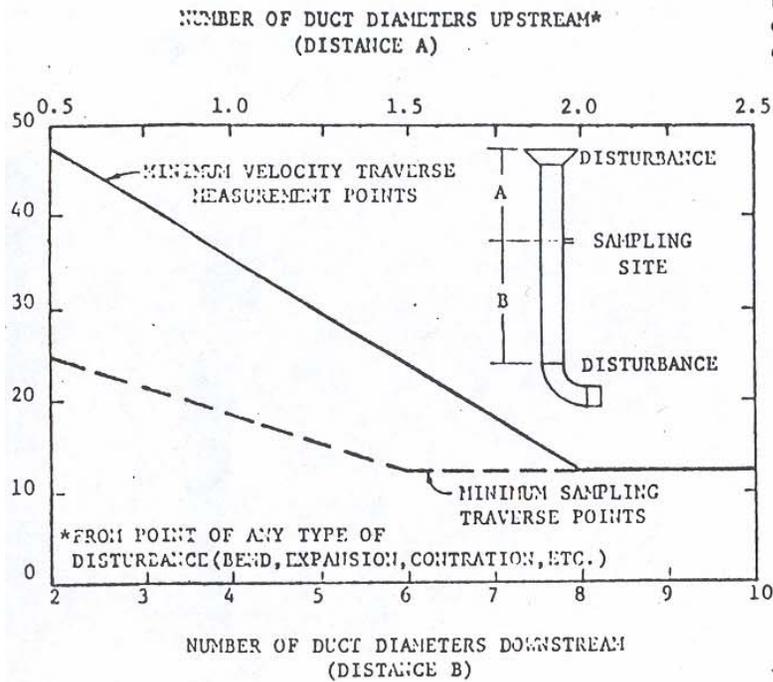
5.1 NUMBER OF POINTS

- 5.1.1 Particulate sampling may be conducted at, and simultaneously to, the velocity traverse measurements (i.e., according to minimum traverse measurements points per Figure 1.)

- 5.1.2 Particulate sampling may be conducted at the minimum number of sampling traverse points as specified in Figure 1. (Not less than 12.)
- 5.2 SAMPLING PORTS: Ports should be adequately sealed to prevent velocity fluctuations near port openings.
- 5.3 TEST RUN: A test run consists of collecting one sample at all elemental areas as specified in 11, A, Number of Points.
- 5.4 WALL CLEARANCE: Sampling nozzle shall not be placed within 1" of inside wall of stack to prevent sample contamination.
- 5.5 NUMBER OF TESTS RUN: Two (2) test runs shall be the minimum number to establish comparative compliance data.
- 5.6 TERMINOLOGY
 - 5.6.1 TRAVERSE: A traverse consists of collective velocity data and/or samples at all specified points (equal elemental areas) at a cross section of a duct. The number of points is specified by the cognizant procedure.
 - 5.6.2 TEST RUN: A test run consists of a sample collected at all specified points (equal elemental areas) at a cross-section of a duct. The number of points is specified by the cognizant procedure.

TABLE I.

Location of traverse points in circular stacks
(Percent of stack diameter from inside wall to traverse point)



Traverse point number on a diameter	Number of traverse points on a diameter*									
	6	8	10	12	14	16	18	20	22	24
1	4.4	3.3	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	14.7	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	29.5	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	44.3	29.1	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5	59.0	38.8	30.2	23.5	20.1	16.9	14.6	12.9	11.6	10.5
6	73.7	48.5	38.8	30.2	26.9	22.0	18.8	16.5	14.6	13.2
7	88.4	58.2	47.9	36.6	33.3	28.3	23.6	20.4	18.0	16.1
8	103.1	67.9	57.6	45.3	40.1	35.5	29.6	25.0	21.9	19.4
9	117.8	77.6	67.3	52.7	47.5	42.9	36.2	30.6	26.1	23.0
10	132.5	87.3	77.0	60.1	54.9	50.7	38.8	31.8	27.2	24.2
11	147.2	97.0	86.7	67.5	62.3	58.1	41.2	33.3	28.7	25.7
12	161.9	106.7	96.4	75.0	69.9	65.5	43.7	34.8	29.2	26.2
13	176.6	116.4	106.1	82.5	77.7	72.9	46.2	36.3	30.7	27.7
14	191.3	126.1	115.8	90.0	85.5	80.1	48.7	37.8	31.2	28.2
15	206.0	135.8	125.5	97.5	93.3	87.3	51.2	39.3	32.7	29.7
16	220.7	145.5	135.2	105.0	101.1	94.5	53.7	40.8	33.2	30.2
17	235.4	155.2	144.9	112.5	108.9	101.7	56.2	42.3	34.7	31.7
18	250.1	164.9	154.6	120.0	116.7	108.9	58.7	43.8	35.2	32.2
19	264.8	174.6	164.3	127.5	124.5	116.1	61.2	45.3	36.7	33.7
20	279.5	184.3	174.0	135.0	132.3	123.3	63.7	46.8	37.2	34.2
21	294.2	194.0	183.7	142.5	140.1	130.5	66.2	48.3	38.7	35.7
22	308.9	203.7	193.4	150.0	147.9	137.7	68.7	50.8	40.2	37.2
23	323.6	213.4	203.1	157.5	155.7	144.9	71.2	52.3	41.7	38.7
24	338.3	223.1	212.8	165.0	163.5	152.1	73.7	53.8	43.2	40.2

*Use one-half (1/2) number of traverse point specified by Figure 1 on each of two diameters.

FIGURE I. Minimum number of traverse points.

- 6.0 PARTICULATE SAMPLING AND ANALYSIS
- 6.1 Principal: Method 5, contained in the Federal Register, Vol. 36, No. 247 (December 23, 1971), with the following additions is the recommended particulate emission collection method for wood fired boilers:
- a. A complete test shall consist of a minimum of two one-hour runs. A complete plane-traverse shall be conducted for each run.
 - b. A minimum of 20 cubic feet of sample gas shall be collected during each run.
 - c. The largest size nozzle practicable while still maintaining isokinetic condition, stated in Method 5, shall be utilized to insure collection of large particles.
 - d. A stainless steel probe and filter holder (316) may be substituted for glass probe and holder mentioned in Method 5.
 - e. Temperature of the filter holder shall be maintained as $250^{\circ}\text{F} \pm 25$ to prevent possible vaporization or combustion of collected material.
 - f. Use of a cyclone between the probe and filter holder is permissible to obtain a rough estimate of particle size distribution.

7.0 SOURCE TEST REPORT OUTLINE

The report must be made to include the information in by the following outline.

- 7.1 Introduction, purpose, summary of results and conclusions.
- 7.2 Description of source
- 7.2.1 Process material flow rates, fuel rates, etc.
 - 7.2.2 Source design, type, size, etc.
 - 7.2.3 Process material composition, fuel composition, etc.
 - 7.2.4 Special conditions occurring during the source test period.
 - 7.2.5 Yearly average process material flow rates, fuel rates, etc.
- 7.3 Sampling and analytical methods
- 7.3.1 Field equipment – dates of calibration
 - 7.3.2 File Procedures – describe deviation from standard methods, if any.
 - 7.3.3 Analytical methods – describe deviations from standard methods, if any.
 - 7.3.4 Special problems or considerations
- 7.4 Sampling point description.
- 7.5 Detailed results – may be in tabulated form.

- 7.5.1 Emissions in gr/scf, in gr/scf corrected to 12% CO₂ if a combustion source, and in lb/hr.
- 7.5.2 Gas volume, temperature, moisture content, and stack area.
- 7.5.3 Percent isokinetic sampling rate.
- 7.5.4 Other results, particle size analysis, chemical analysis, or other optional data that may have been obtained.
- 7.5.5 Duration of test.

8.0

BASIC SOURCE TEST

8.1

SOURCE IDENTIFICATION TEST

Name of Company (Owner): _____

Location of Boiler (Stack): _____
City State

Name of Company Contact: _____

Name of Persons Conducting Test:

Name of Regulatory Agent(s) Present to Observe Test:

Stack Identification (i.e., 1, 2, ... N., S.,): _____

How many boilers are ducted to the exhaust stack? _____

Identification of each boiler ducted to the stack:

1. _____ 3. _____ 5. _____

2. _____ 4. _____ 6. _____

Note: A separate boiler identification form must be filled out for each boiler connected to the stack.

Sample Point Description:

Is the sample point in a circular _____ or rectangular _____ duct?

If circular, what is the diameter? _____ (inches)

If rectangular, what is the height? _____ (inches)

What is the width? _____ (inches)

How far downstream from the sample point is the nearest bend or other flow obstruction? _____ (ft)

How far upstream from the sample point is the nearest bend or other flow obstruction? _____ (ft)

8.1.2

BOILER IDENTIFICATION AND DESCRIPTION

Boiler Identification No. (i.e., 1, w, ... N., S.,): _____

Boiler Manufacturer _____

Installation Date: _____ Major Revision Date: _____

Nameplate Capacity of Boiler: _____ (lbs/hr) @ _____ (psig)
or _____ (H.P.) Water Tube: _____ Fire Tube: _____

Other Nameplate Data: _____

Spreader Stoker: _____ Dutch Oven: _____ Other: _____

Indicate which of the following are installed on the boiler:

- | | |
|--|--|
| <input type="checkbox"/> F.D. Fan | <input type="checkbox"/> Wet Scrubber |
| <input type="checkbox"/> Automatic F.D. Fan Damper Control | <input type="checkbox"/> Bag House |
| <input type="checkbox"/> I.D. Fan | <input type="checkbox"/> Cinder Reinjection Sys. |
| <input type="checkbox"/> Automatic I.D. Fan Damper Control | <input type="checkbox"/> Sanderdust Burner Sys. |
| <input type="checkbox"/> Automatic Fuel Feed Controller | Other Control Equipment |
| <input type="checkbox"/> Continuous Recording Steam Flow Meter | _____ |
| <input type="checkbox"/> Continuous Recording Opacity Monitor | _____ |
| <input type="checkbox"/> Continuous Recording Oxygen Recorder | _____ |
| <input type="checkbox"/> Multiclone Ciner Collections | _____ |

8.1.3 STEAM GENERATION RATE DATA

The following data should be recorded for each test run:

Date: _____ Run. No.: _____ Steam Pressure (psig): _____

Average Boiler Steam Generation Rate During Test: _____ (lbs/hr)

Peak Boiler Steam Generation Rate During Test: _____ (lbs/hr)

Minimum Boiler Steam Generation Rate During Test: _____ (lbs/hr)

How was steam flow rate determined: _____

8.1.4 ANALYSIS OF WOOD FUEL USED DURING BOILER CERTIFICATION TEST

Describe the approximate percentage make-up of the hogged fuel used during the compliance certification test:

Fuel Description	Approximate Percent by Weight (Dry)
<u>Planer Shavings</u>	_____ %
<u>Sanderdust</u>	_____ %
<u>Sawdust</u>	_____ %
<u>Bark</u>	_____ %
<u>Hogged White Wood</u>	_____ %
<u>Other Wood Residues</u>	_____ %
<u>Total</u>	_____ %

What is the moisture content of the mixed wood fuel on a “wet” basis?

_____ %

If the boiler is equipped with a cinder reinjection system, were the cinders being injected during the test? _____

8.1.5

AUXILIARY FUEL CONSTITUENTS

What is the normally used percentage of heat input to the boiler from?

Aux. Fuel Description	Approximate Percent of total BTU Input
<u>Natural Gas</u>	_____ %
<u>Propane</u>	_____ %
<u>Coal</u>	_____ %
<u>Oil: Crude</u>	_____ %
_____ <u>Light</u>	_____ %
_____ <u>Other</u>	_____ %
<u>Clarifier Sludge</u>	_____ %
<u>Other</u>	_____ %
<u>Wood (Hogged) Fuel</u>	_____ %
<u>Total</u>	_____ %

Form 8.2 ORSAT ANALYSIS DATA SHEET

Source _____ Date _____

Sampling Point Location _____

RUN _____

	CO ₂	O ₂	CO	N ₂	Time _____
Analysis 1					Test Conditions _____
Analysis 2					_____
Analysis 3					_____
Average					_____

CO₂ Atomic Wt. (44) O₂ Atomic Wt. (32) CO Atomic Wt. (28) N₂ Atomic Wt. (28)

_____ + _____ + _____ + _____ + = Total Atomic Wt.

RUN _____

	CO ₂	O ₂	CO	N ₂	Time _____
Analysis 1					Test Conditions _____
Analysis 2					_____
Analysis 3					_____
Average					_____

CO₂ Atomic Wt. (44) O₂ Atomic Wt. (32) CO Atomic Wt. (28) N₂ Atomic Wt. (28)

_____ + _____ + _____ + _____ + = Total Atomic Wt.

Form 8.5 LABORATORY REPORT

Laboratory

Test Site: _____ Brought in by _____ Date _____
 Address: _____ Received by _____ Date _____
 Date _____ No. Runs _____ Analysis by _____
 Source type _____ Date Completed _____

Run No.	Impinger	#1	#2	#3	#4	Total Condensate
	Not Cond.					
	Not Cond.					

Run No.	Filter	Part 1 Probe	Part 2 Organic Ext.	Part 3 Water Ext.	Part 4 Imps. Acetone	Total Net Wt. in Grams

Microscopic Analysis				Microscopic Analysis			
Size		Filter #		Size		Filter #	
Microns (ave.)	No.	Cumulative No.	%	Microns (ave.)	No.	Cumulative No.	%

Date approved by _____
 Date _____

Form 8.6 PARTICULATE SAMPLING CALCULATIONS

Constant Parameters

Po = Barometric pressure - _____ in. hg Plant _____

As = Stack area - _____ in.² Sampling Location _____

Dn = Nozzle diameter - _____ in. Date of Test _____

Sym- bol	PARAMETERS TO BE CALCULATED		RESULTS			
	Definition, Units	Calculating Equation	Run __	Run __	Run __	Avg.
Ts	Stack temp., °R	Avg. Fr. Field Data Sheet				
Ps	Stack pressure in. Hg abs.	Avg. fr. Vel. Calc. sheet				
ΔH	Orifice pressure drop in H ₂ O	Avg. from Field Data Sheet				
ΔT	Total sampling time, min.	Tot. fr. Field Data Sheet				
Tm	Gas Meter temp., °F	Avg. fr. Field Data Sheet				
S	$\sqrt{\Delta P \times T_s}$	Avg. fr. Vel. Calc. Sheet				
Qm	Sample gas volume at meter conditions, ft. ³	Avg. from Field Data Sheet Qm – Qm – water vapor thru meter				
Qd	Dry gas sample vol. at std. cond., scf	$Q_d = \frac{17.7(Q_m (P_o + \frac{\Delta H}{13.6}))}{m + 460}$				
Vv	Tot. vol. of condensed water.	Total fr. Lab Data Sheet				
Qv	Tot. Vol. of Condensed water vapor @ std. cond. Scf.	Qv – 0.0474 Vv = Q'v Qv = water vapor thru meter				
mv	% moisture in stack gas	$M_v = \frac{100 Q_v}{Q_v + Q_d}$				
md	Mole fraction of dry gas	$M_d = \frac{Q_d}{Q_v + Q_d}$				
Md	Molecular Wt. of dry gas	Gas analysis				
Ms	Molecular Wt. of stack gas	Ms = mdMd = 18 (1-mi)				
Vs	Stack velocity at stack, Fpm	$V_s = 4350 S \left(\frac{1}{P_s M_s} \right) \frac{1}{2}$				
qs	Stack flowrate at st. conditions, scfm	$q_s = \frac{0.123(V_s)(A_s)(m_d)(P_s)}{T_s}$				
I	Percent Isokinetic	$I = \frac{1032 T_s Q_d}{(V_s)(P_s)(m_d)(D_n^2)(\Delta t)}$				
W	Wt. of particulate sample, gm	Total from Lab Data Sheet				
Cg	Total Particulate grain loading, gr/scf	$C_g = \frac{0.154W}{Q_d}$				
C'g	Grain loading at 12% CO ₂ gr/scf	$C_g' = C_g \times \frac{0.12}{(\% CO_2)}$				
Ct	Total particulate emission, lb/hr	Ct = .00857 (Cg) (qs)				

REFERENCES

1. Vol. 36, No. 247, Part 2 of the Federal Register dated Thursday, December 23, 1971
2. ASME Power Test Code #19.18 (1932) paragraphs 44-50
3. Zimmerman, O.T. and I. Lavine; Psychometric Tables and Charts, Industrial Research Service, Inc., Dover, New Hampshire
4. AICHE Source Sampling Training Manual, 1972 American Institute of Chemical Engineers 345 E. 47th Street, New York, N.Y. 10017
5. The Physics of Air, American Air Filter Company, Inc. 215 Central Avenue, Louisville, Kentucky (1968)
6. Bulletin WP-50, "Methods of determination of Velocity, Volume, dust, and Mist Content Gases," Western Precipitation Division, Joy Manufacturing Co., 1000 West 9th St., Los Angeles, CA 90015
7. ASME Performance Test Code #19.10 (1968)

10.0 APPENDIX

10.1 Carrier's Equation

$$\% \text{ H}_2\text{O} = \text{PSV} - \frac{(P_s - P_{sv})(t_d - t_w)}{2800 - 1.3t_w} \frac{100}{P_s}$$

tw = wet bulb temperature, °F

td = dry bulb temperature, °F

Psv = saturation vapor pressure at tw (available from tables (6), inches Hg.

Ps = absolute static pressure in stack, inches Hg.

10.2 Conversion of lbs. H₂O/lb. dry air to % H₂O by volume

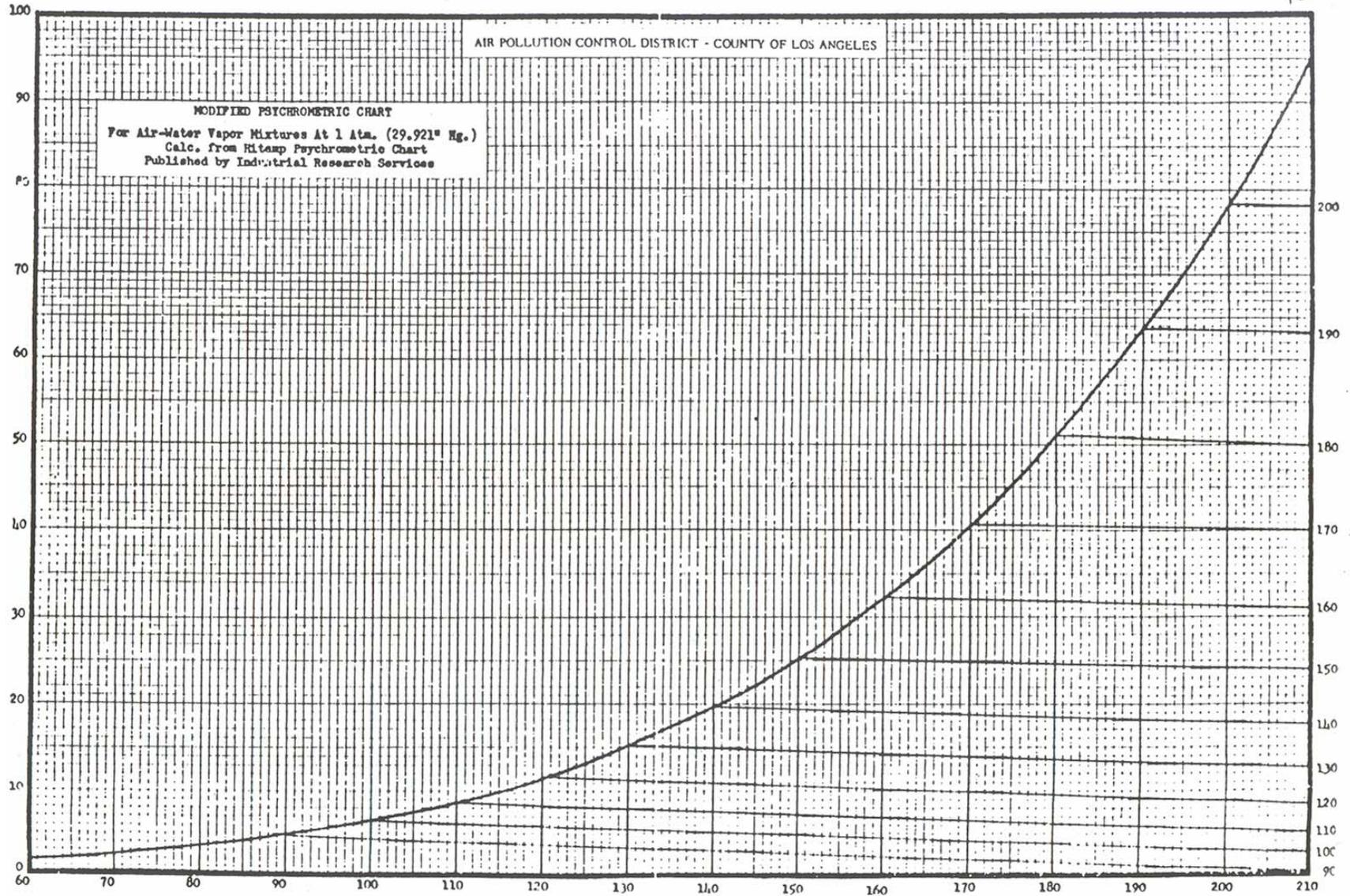
$$\% \text{ H}_2\text{O} = \frac{W (100)}{\frac{18}{29} + W}$$

W = lbs. H₂O/lb. dry air available from charts or tables.

10.3 NOMENCLATURE – SAMPLING CALCULATIONS

<u>VARIABLES</u>	<u>SUBSCRIPTS</u>
A = area, in ² or ft ²	d = dry gas
C = emission concentration or wt.	g = grain loading
D = diameter, ft. or in.	m = meter conditions
I = % Isokinetic sampling	n = nozzle
M = mole fraction or % by volume	o = atmospheric
P = pressure	v = Water vapor or liquid
q = gas volume flowrate, scfm	
Q – gas volume, ft ³ or scf	
$S = \sqrt{P \times T}$	
t = temperature, °F	
T = absolute temperature, °R	
u = velocity, fpm	
V = liquid volume, ml	
W = mass or weight, gm	
ΔH = orifice pressure drop, in. H ₂ O	
ΔP = pitot tube differential pressure, in. H ₂ O	

10.4



water is evaporated. Desiccate and dry to a constant weight. Report results to the nearest 0.1 mg.

10.4.5.2 Extract organic particulate from the impinger solution with three 25 ml. portions of chloroform. Complete the extraction with three 25 ml. portions of ethyl ether. Combine the ether and chloroform extracts, transfer to a tared beaker and evaporate at 70 degrees F. until no solvent remains. Desiccate 24 hours and dry to a constant weight and report the results to the nearest 0.1 mg. Determine impinger water non-extractables (inorganics) by evaporating extracted water solution at no more than 100 degrees C. (use of steam table is preferred). Desiccate 24 hours and dry to constant weight.

10.4.5.3 Evaporate blank samples of 100 ml. acetone (at ambient temperature and pressure; desiccate 24 hours and dry to a constant weight) and 25 ml chloroform and 25 ml. ether mixture. Evaporate blank samples of 100 ml. distilled and deionized water used for impinger solution and train cleanup (at no more than 100 degrees C., steam table preferred) desiccate 24 hours and dry to constant weight). Then weigh and record the residues after 24 hour desiccation.

10.4.6 Report

10.4..6.1 Report total weight of all collected particulate as well as the constituents separately as follows:

- a. Prefilter acetone wash.
- b. 1st filter weight gain
- c. Extractables
- d. Impinger water residue
- e. Impinger train acetone wash.

19.46.2.2 Report physical characteristics of collected particle specimen's as follows:

- a. Particle size (visually determined extent of particles over approximately 50 microns in diameter effecting local fallout.
- b. Presence of unburned constituents.

c. Other significant aspects.

SUPPORT DOCUMENT

for the Air Operating Permit issued to

**Kimberly-Clark Tissue Company
(KCTC)
2600 Federal Ave.
Everett, Washington**

State of Washington
DEPARTMENT OF ECOLOGY
300 Desmond Drive
P.O. Box 47600
Olympia, Washington 98504-7600

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INTRODUCTION

This Operating Permit Support Document fulfills the operating permit rule "Statement of Basis" requirement and explains particular portions of the air operating permit for Kimberly-Clark Tissue Company (KCTC). This document is not part of the operating permit for KCTC. Nothing in this document is enforceable against the permittee, unless otherwise made enforceable by permit or order.

Mill Description

KCTC is located in Everett, Washington, and is an integrated pulp and paper manufacturing facility. The site produces a wide range of tissue products including paper towels, toilet paper, napkins. The facility operates continuously with three shifts per day.

The pulp mill is currently producing bleached sulfite pulp. Most of this pulp is used by the paper mill along with purchased kraft pulp, semi-mechanical pulp, and recycled fiber to manufacture tissue products for both the commercial and consumer markets.

In general, wood chips are cooked with acid in digesters to make a pulp slurry. This slurry is then separated into pulp and liquor fractions. The liquor is concentrated and burned as fuel in the plant's recovery boiler. The pulp, is bleached. The bleached pulp either is immediately used in the paper mill or is dried, pressed, and baled for storage. An ammonia absorption tower recovers sulfur dioxide. The mill's unit processes are described further below.

Pulping Process

Wood chips from whole logs and sawmill residuals arrive at the plant by truck, barge, and rail car. The chips are stockpiled onsite in piles and silos. The chips are screened and conveyed by a covered belt to a batch digestion process to make pulp. Digestion occurs in an ammonium-based sulfite process that cooks the chips in large-batch digesters by using heat and chemicals. The cooking process separates the wood into its primary fractions: wood fibers and lignin, the binding material that holds the fibers together.

The chemicals used in the cooking acid are ammonium bisulfite and sulfurous acid. Raw materials used to create the cooking acid are anhydrous ammonia, molten sulfur, and water. Each process unit is hooded and vented to the acid plant ammonium-based absorption tower, which collects and recovers sulfur dioxide. The sulfur dioxide recovered from the flue gas is converted to ammonium bisulfite for use in the digestion process.

After cooking, the pulp is washed to remove the cooking liquor and organic solids. The spent sulfite liquor is concentrated in multiple-effect evaporators to form approximately 50 percent solids. This concentrated liquor is then sprayed into the plant's recovery boiler where the organic content in the liquor is burned, producing steam to operate the digesters and evaporators. The pulp is sent through screens and washers before going to the bleaching process.

Wastewater from the pulp mill is discharged to either an onsite primary treatment process for removal of solids, or an onsite secondary treatment process for removal of solids and oxidation of organic substances. The treatment process used depends on the source of the wastewater and its constituents.

Pulp Bleaching

The pulp is sent to the bleach plant to brighten the pulp. Chemicals alter and remove the lignin compounds in the pulp that remain after washing. After each bleaching stage, the mixture is washed. Wastewater from the bleach plant is sent to secondary wastewater treatment system.

Screening, Drying, and Baling

The bleached pulp is screened and centrifuged to remove dirt and contaminants from the finished pulp. Rejected material is sent to primary treatment. At this point, the cleaned pulp may be used immediately in the paper mill, or it may be dried on the pulp drying machines and stored for later use and/or sale. When needed, the dried pulp is wetted in a repulper to form a slush to be sent to the paper mill. Some of the dried sulfite pulp is also sold to other mills. Purchased dried pulp is also used daily as part of paper mill recipes.

Paper Mill

The paper mill receives pulp from the sulfite process as well as blends of secondary fiber and purchased pulp. Water is added to the pulp to make about a one-half of one percent solution. Wet and dry strengthening agents, and optional dyes may be added. The solution is conveyed to a Fourdrinier wire followed by a felt press. It is then dried and "creped" on Yankee dryers. For some products, optional after-dryers may be used after the Yankee dryers. For paper towels and toilet paper, the dried material is rolled, dyes and design imprints are added, and final embossing and texturing may be done. The product is rewound on rolls and perforation tears may be added. A rotating blade then cuts the long roll into smaller ones. For napkins, the product is cut and folded in the finishing process. The product is wrapped and conveyed to a distribution building for transport. Five paper machines are used to produce the paper products.

Paper machine and finishing waste is called broke, and is recycled to the mill. Wet and dry broke from the paper machines and finishing areas are placed in a beater. The broke is treated with hypochlorite to bleach the dyes and to aid defibering by breaking down chemicals in the paper. Hypochlorite is consumed by the reactions with the fiber, dyes, and additives. Excess chlorine is neutralized with sodium bisulfite. The slushed broke is pumped to a broke storage chest and reused in the process.

Utilities

Five boilers (No. 14, and 7 through 10) are available to supply steam for plant operations: one cogenerating wood-waste boiler, three dual-fuel boilers, and a recovery boiler. Boiler No. 14 is a woodwaste boiler (installed in 1995) produces about 435,000 pounds of steam per hour. Boilers Nos. 7 through 9 can burn either gas or oil and operate in swing capacity to provide extra steam as needed. Boiler No. 10 is the sulfite recovery boiler. The recovery boiler is used to burn spent sulfite liquor, and is capable of producing 330,000 pounds of steam per hour. Boiler No. 10 also burns gas as necessary.

The woodwaste boiler burns approximately 800.000 wet tons of fuel per year. The fuel is provided by local sawmills and wood products companies, and consists of sawdust, bark, and other wood waste. In addition, KCTC burns approximately 12,000 dry tons of dewatered sludge per year from the primary and secondary clarifiers of the wastewater treatment plant. This sludge contains about 60 percent woodwaste fiber. Minor amounts of other fuels are burned, including wood pallets and other waste paper products from onsite operations.

Emissions from boiler No. 14 are vented to a baghouse to remove particulate material. The boiler

is part of a cogeneration facility that meets plant steam needs, and also generates a total of about 325,000 megawatt-hours of electrical power per year. This is enough power to supply 21,000 residential customers.

Boiler No. 10 burns spent sulfite liquor, which is liquor that has been concentrated after the digestion process. Sulfur from the cooking mixture that is bound up in the spent sulfite liquor is liberated during combustion and converted to sulfur dioxide. An ammonia absorption tower captures the sulfur dioxide, which is reused in the mill. Brinks-type mist eliminators remove mist droplets. Particulate emissions are removed by a Dynawave reverse jet caustic scrubber located after the absorption tower. Sulfur dioxide emissions are further reduced by this scrubber.

STATEMENT OF BASIS

When the Department of Ecology issues a draft operating permit, it is required to provide a statement that sets forth the legal and factual basis for the draft permit conditions, including references to the applicable statutory or regulatory provisions. [WAC 173-401-700(8).]

1. Assuring Compliance With All Applicable Requirements

An operating permit must contain terms and conditions that assure compliance with all applicable requirements at the time of permit issuance, [WAC 173-401-600(1)]. The Department of Ecology has determined that the requirements listed in Appendix A to the permit do not apply to the facility, as of the date the permit is issued, for the reasons specified. [WAC 173-401-640(2)]. Not all of the inapplicable requirements are listed in Appendix A. Requirements that were considered obviously inapplicable were excluded from the list of inapplicable requirements. Appendix C of the permit contains the abbreviations used in the permit. The state Regulatory Orders that impose limitations and requirements on the permittee are listed in Appendix B of the permit. These limitations and requirements are on going. Also new sources are required to complete performance tests, notification and record keeping under 40 CFR 60.7 and 40 CFR 60.8. These new source requirements for the new hog fuel boiler (Boiler No. 14) were all completed by July 16, 1998.

Compliance with the conditions in the permit is deemed to constitute compliance with applicable requirements as contained in the permit on which the terms and/or conditions are based, as of the date that the permit is issued. [WAC 173-401-640(1)].

Alternate operating scenario

The permittee did not request any other alternate operating scenario; and therefore. WAC 173-401-650 becomes an inapplicable requirement.

MACT Standards

The permittee may be regulated by the 40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants for Source Categories when they become effective.

Application

Ecology received a complete application prior to April 20, 1998. Therefore, the Compliance Assurance Monitoring (CAM) rules will be applicable in the next permitting issuance period or if a significant permit modification is made prior to renewal affecting specific emission unit with

potential to emit greater than major source thresholds.

LA. Descriptions and Comments on Specific Permit Conditions

Process Description

Cogeneration Boiler (No. 14)

KCTC, in conjunction with Snohomish County PUD No. 1, built a cogeneration boiler that burns primarily wood waste. This wood-waste boiler can produce 435,000 pounds of steam per hour as well as producing 325,000 megawatt-hours of electrical power. The boiler uses fabric filter emission control system. This baghouse includes bags of a "goretex" filtering material that improves filtration efficiency. Boiler No. 14 has a single emission point, the wood-waste boiler exhaust stack. The stack dimensions are 165 feet in height and 14 feet in diameter.

Fuel to the new No. 14 boiler is primarily clean wood waste. Sludge from the mill's primary and secondary wastewater treatment dewatering filters, and mill wood and paper wastes disintegrated in the onsite shredder are also be burned. Additionally, up to 12 tons per day of contaminated wood waste may be used, under the terms of the No. 14 Boiler Fuel Plan submitted to Ecology June 29, 1994 (supplemented and revised July 27, 1994). The primary backup fuel for this boiler is natural gas. The secondary backup fuel is No. 2 distillate with a sulfur content below 0.05 percent by weight. Order Number DE OOAQIS-241 permits the burning of some wood containing creosote.

Steam is produced for electrical power production and internal mill uses. The distribution between users and actual usage rates for produced steam varies over time, depending on power grid and mill operational demands. During maintenance or emergency shutdown situations, the baghouse will have to be bypassed for 2 to 3 hours. This will occur during both startup, when the boiler is warming up, and shutdown, when the boiler is cooling. Bypassing is necessary because low temperatures will cause condensation in the bags and plugging. Visible emissions may exceed 10 percent during periods of bypass.

Permit Condition A.1

The limit for NO_x (180 lbs/hr) is continuously monitored to assure compliance. The limit from 40 CFR part 60 (1 84.8 lbs/hr) is also shown for completeness. It was calculated using formula from the CFR and assuming oil firing. This calculation provides the most restrictive limitation under this regulation. A continuous emission monitor (CEM) is used to pull a sample from the air emissions, and analyze the NO_x present. The computer part of the CEM uses the air flow data entered from a previous source test and the NO_x present to calculate and then log the NO_x concentration present. This information is used to calculate the pounds of NO_x per hour.

Permit Condition A.2

The limit for CO is continuously monitored to assure compliance.

Permit Condition A.3

The limit for SO₂ (79.2 lbs/hr) is continuously monitored to assure compliance. The limit from 40 CFR part 60 (492.8 lbs/hr) is also shown for completeness. It was calculated using formula from the CFR and assuming oil firing. This calculation provides the most restrictive limitation under this regulation.

Permit Condition A.4

Yearly tests for VOC indicate virtually no emission of this pollutant. This is due to the extremely

efficient design and firing control of this unit. Some source tests have indicated no detection for the pollutant. Yearly source test assure compliance for this parameter.

Permit Conditions A.5, A.6

The limit for PM (17.4 lbs/hr) is monitored annually to assure compliance. PM10 is largely a function of the total PM load. The limit from 40 CFR part 60 (61.6 lbs/hr) is also shown for completeness. It was calculated using formula from the CFR and assuming oil firing. This calculation provides the most restrictive limitation under this regulation. Also shown for completeness is the WAC 173-410 citation (0.1 gr/dscf). This is an order of magnitude less restrictive than the limit set by Ecology Order DE 98-AQIO28.

Baghouse conditions are suggested surrogate operating parameters for possible noncompliance with the particulate emission requirements. The baghouse condition will act as a trigger mechanism for taking corrective action. Exceedance of the trigger mechanisms is not by itself a violation of the permit. Failure to take corrective action is considered a violation of the permit.

Permit Condition A.7

The limit for Opacity (10%) is continuously monitored to assure compliance. The limit from 40 CFR part 60 (20%) is also shown for completeness. Opacity is also determined through visual observation once a week to assure compliance.

Permit Conditions A.1 thru A.7 limits that were arrived at through a Notice of Construction (NOC) Approval Order DE 98-AQIO28 per WAC 173-400-110, represent BACT for this emission unit.

Process Description
Pulping Operations

KCTC pulp mill operations have no direct emissions or emission points. All of the exhausts, tank vents, and relief gases are collected and sent into the "secondary system" following the recovery boiler, where the great majority of pollutants are absorbed prior to discharge from the recovery boiler stack. The following information is provided for completeness.

KCTC stores wood chips in piles and silos and then conveys them to the digester building, where they are stored in chip hoppers above each batch digester. There are currently 8 operational digesters. Chips and cooking acid are added to the digesters. The acid is made onsite by burning sulfur to produce SO₂, which is combined with ammonia and water to produce the ammonium bisulfite cooking acid. This acid is made in the secondary system. The acid cooking in the digesters dissolves the lignin, leaving relatively pure cellulose.

After cooking, the pressure in a digester is relieved by directing the gas through a series of accumulators and back to the secondary system. Spent sulfite liquor (SSL) is then used to facilitate dumping the digesters to the digester dump tanks. Emissions from these tanks also vent to the secondary collection system. Pulp is then pumped to the SSL washer system. The SO₂ and volatile gases released in the pulp washing operations also enter the secondary collection system. Pulp washed in the countercurrent washer operation leaves the process cooled and odor free. At that point, the pulp goes to the screen room and the bleach plant. The concentrated spent liquor from the washers is sent to the evaporators and then to the chemical recovery boiler.

Process Description

Recovery Boiler/Secondary System (No. 10)

The No. 10 recovery boiler is a Babcock & Wilcox unit that burns spent pulping liquor and is a part of the acid recovery process. The boiler is capable of burning approximately 1,375,000 pounds of spent liquor per day and producing approximately 330,000 pounds of steam per hour. The exhaust gas from the boiler itself passes through a cooling tower, an absorption tower, an emission-control scrubber, and a demister unit before exhausting to the atmosphere. Nox is controlled through post-combustion ammonia injection. Acid recovery is the function of this process, and the absorption tower is the primary collector of SO₂. The emission control scrubber (a reverse-jet Dynawave unit) provides the final emission control step with additional SO₂ and particulate matter control. All of the SO₂ emissions collected from the pulping operations are controlled by this system. Boiler No. 10 has a single emission point. The stack dimensions are 202 feet in height and 6 feet in diameter.

The recovery boiler operates much like a base-load boiler for the mill because the chemical recovery operation tracks directly with the pulp production processes. Even though the digesters are a batch operation, there are sufficient numbers to approach a steady-state operation for spent liquor burning. Operational scenario options do not really apply in this case because the boiler burns whatever liquor is available. KCTC does have the option to burn natural gas to supplement the operation at times but does not routinely do so during normal operations.

One option that occurs periodically is the washing of the No. 10 boiler booster fan. This fan, which provides the driving force for exhausting air from the stack, coats up with ammonium sulfate deposits every few months. These deposits must be washed off, and the washing is done during the run to avoid boiler shutdown. When washing occurs, the excessive water vapor that is produced clouds over the windows of the opacity monitor, making accurate opacity readings impossible. The monitor windows are cleaned immediately following the washing to enable continuous monitoring.

Permit Condition B.1

No specific NO_x limit for this unit exists. Its NO_x contribution is limited by the total NO_x limit set for both boilers. See Permit Condition C.1 below.

Permit Condition B.2

The limit for SO₂ (300 ppm) is continuously monitored to assure compliance.

Permit Condition B.3

The limit for particulate is monitored monthly to assure compliance.

Permit Condition B.4

The limit for Opacity is continuously monitored to assure compliance. Opacity is also determined through visual observation once per week to assure compliance.

Permit Condition B.5

The limit for ammonia is monitored annually to assure compliance.

Permit Conditions B.6 and B.7

These conditions require reporting of operational parameters.

Permit Condition C.1

The combined limit for Nox is continuously monitored at both No. 14 and No. 10 Boilers to assure compliance.

Process Description

Power Boilers(Nos. 7 Through 9)

The three power boilers at the Scott Paper Everett mill are capable of burning both natural gas and residual fuel oil. Boiler No. 7 was installed in 1953 and is a Riley F type, rated at 150,000 pounds of steam per hour. Boiler No. 8 is a Combustion Engineering model BU50-BPX and was installed in 1954. Boiler No. 9 is identical to No. 8 and was installed in 1955. Boilers Nos. 8 and 9 have a rating of 165,000 pounds of steam per hour. There are no emission controls on any of these boilers. Each boiler has its own stack, providing three separate emission points. The stack dimensions (for each stack) are 102 feet in height and 6 feet in diameter.

These three power boilers provide both peak steam demand service as well as backup to the recovery boiler (No. 10) and the wood-waste boiler (No. 14). The mill's operational steam needs dictate when these boilers are running.

Permit conditions D.1 and D.2

These conditions require reporting of operational parameters.

Process Description

Catalytic Oxidizer (EM5)

EM5 was installed in 1979. It is different from a conventional paper machine in that it uses a proprietary process to manufacture towel and wiper products. In this process, chemicals are added to the paper before it "cures" on a dryer. Some volatile organics are released during this curing process, so a catalytic converter was designed into the paper dryer exhaust stream when the machine was built.

EM5 (as with the other paper machines) contains only categorically exempt emission units except for the catalytic oxidizer exhaust. A NOC for New Source Review was required for the installation of this pollution control device. The existence of this NOC approval (DE 79-335) requires that the catalytic oxidizer exhaust be classified as a significant emission unit under WAC 173-401-530(2)(a). The exhaust gas flow from the paper dryer is initially heated to 600 to 700°F by a natural gas heater. The gas then flows through the catalyst section of the device. The bed is a honeycomb array that currently uses a platinum-based catalyst. The catalytic effect of the platinum effectively oxidizes the organic material at reduced temperatures. The treated gas discharges through a vent on the paper mill roof

Permit condition E.1

Limit for particulate is 50 lbs/day. Less than 5 lbs per day is emitted based on calculations using EPA AP 42 emission factors. Tracking gas usage is used to assure compliance.

Permit condition E.2

Limit for hydrocarbon is 100 lbs/day. Less than 5 lbs per day of VOC (hydrocarbon) is emitted using NCASI TB 646 factor for calculations. Annual source testing is performed to assure compliance.

I.B. Comments on Facility-Wide General Requirements

Permit Condition 10.

Permit condition 10 is the generic S02 limitation from WAC 173-410-040(1)(f) of 1000 ppm which addresses emissions from units other than a recovery system, a blow system or an acid plant. EPA raised the issue of compliance regarding this requirement given the discrete interval of testing for some units and the existence of units for which no monitoring is required. Ecology has imposed periodic discrete monitoring for those units deemed to warrant monitoring. Ecology has not imposed monitoring for units unlikely to have a reasonable potential of exceeding S02 emission limits.

Permit Condition 11.

Permit condition 11 consists of two parts. The first part is an inclusion of WAC 173-400-I05(5)(h) which allows that monitoring and reporting requirements may be temporarily lifted during periods of monitoring system malfunction provided the permittee adequately explains such periods.

The second part of condition 11 is based on what Ecology considers an unlikely but possible scenario where recorded monitoring data is simply lost. Ecology will allow a 90% recovery rate each month for monitoring data if the permittee provides an adequate explanation for the cause of the lost data. Ecology expects the permittee to make every reasonable effort to maintain the integrity of all monitoring results. An allowance is specified for missing monitoring results under certain conditions so that these defined conditions are defined as "not penalized," thus reducing the administrative burden on the source and the permitting authority.

II. Insignificant Emission Units

The facility-wide general requirements apply to the whole facility, including insignificant emission units and activities (IEUs), as required by the operating permit rule. The rule states, however, that IEUs are not subject to monitoring requirements unless the generally applicable requirements in the State Implementation Plan (SIP) impose them. [WAC 173-401-530(2)(c)]. The Washington SIP does not impose any specific monitoring-related requirements for the facility-wide requirements for IEUs at this source. The permit, therefore, does not require any testing, monitoring, reporting, or recordkeeping for insignificant emission units or activities.

III. Regulatory Orders

The permittee is subject to regulatory orders. Order DE 78-106 was issued to direct the sulfite pulp mill sources compliance with the new WAC regulation WAC 173-410. Two other orders are notices of construction: for pollution control equipment for a new paper machine (Order DE 79 - 335), and the new No.14 Cogeneration Boiler (Order DE 98AQIO28). A majority of the most stringent emission limits for the facility are contained in these orders.

These orders establish source-specific limitations, but also include default limitations established by state regulations. Orders are not intended to be separate legal sources for default limitations that are based in state regulations. Therefore, for limits derived directly from state regulations that were

included in Regulatory Orders for convenience purposes, Ecology considers the regulation and not the Order to be the "applicable requirement" for purposes of Title V.

An important issue regarding any Title V permit is the basis of authority for the applicable requirements. This is particularly true regarding monitoring and reporting requirements. The basis of authority is used to determine federal or state-only applicability. Many of the applicable requirements come from orders issued by Ecology. The period of time during which these various orders were issued may in some cases span decades. Orders issued years ago do not clearly set forth the basis of authority. Also order consolidation has gone on in the past, further confusing the original basis of authority. Ecology decided the effort, besides being difficult, was not necessary as WAC 173-401-615 offered a solution to this problem. In the case of KCTC, the issue of state-only or federal applicability was put aside, it relies entirely on WAC 173-401-615 as the basis of authority for the type and frequency of monitoring. WAC 173-401-615 requires monitoring and recordkeeping sufficient to assure compliance with the terms and conditions of the permit. Monitoring and recordkeeping requirements based on this regulation are federally enforceable.