EVALUATOR CMC EVALUATION DATE 7/14/92

METHOD 5: SECONDARY EMISSIONS TEST REPORT EVALUATION

STATE: WY FACILITY: FMC-WYOMING CORP TEST DATE: 5/24-26/88

PROCESS(ES) TESTED: reagent plant gas fired calciner - wet scrubbers
NA-22

SAMPLING DURATION 3
must have at least 3 runs, each ≥ 1 hour duration, with sampling ≥ 2 minutes at each traverse point, and total sampling volume ≥ 30 dscf

PRODUCTION RATE 3
is process or production rate during testing representative of normal rates

CONTROL DEVICE(S) 2
are devices described, and their efficiencies given
no

METHOD 1 3
are calculations accurate, and is figure provided

METHODS 2,3 3 2
are data and calculations included for gas velocity, cyclonic flow, and molecular weight determination, and is source of barometric pressure noted
no

METHOD 4 3
are data and calculations included for moisture content determination, and is moisture content realistic [< saturation]

FIELD DATA is field data on standard forms, and does raw data correspond with printout 3

BOILER TESTS N/A
calculation of F_0 from Orsat accurate

SAMPLING TEMPERATURE 2
both probe and filter must be maintained at 248 ± 25°F or other temperature specified in NSPS
2

BACK-HALF 3
if any, what method was used to catch and recover condensible matter
WY - H_2O

EQUIPMENT were a borosilicate glass probe liner and a glass fiber filter used 2
no doc.

CALIBRATION were both pre- and post-test calibrations performed for
meter box 2
pitot tube 2
temperature sensor 2
nozzle (3 #) 2
no doc

LEAK CHECKS both pre- and post-test 3

BLANKS were filter and reagent blanks analyzed, and were any problems addressed 3

SAMPLE PREP 2
filter desiccation and tare weights documented
no doc.

ISOKINETICS within 100±10% for all runs 3

EVALUATOR CMC EVALUATION DATE 7/14/92

METHOD 5: SECONDARY EMISSIONS TEST REPORT EVALUATION

STATE: WY FACILITY: FMC Wyoming Corp. TEST DATE: 6/1,2/89

PROCESS(ES) TESTED: RA-23

sesqui plant - gas fired calciner w/ wet scrubbers

SAMPLING DURATION 3
must have at least 3 runs, each ≥ ~~3~~ 4 hour duration, with sampling ≥ 2 ~~4~~ minutes at each traverse point, and total sampling volume ≥ ~~30~~ dscf

PRODUCTION RATE 3
is process or production rate during testing representative of normal rates

CONTROL DEVICE(S) 2
are devices described, and their efficiencies given
no

METHOD 1 3
are calculations accurate, and is figure provided

METHODS 2,3 2
are data and calculations included for gas velocity, cyclonic flow, and molecular weight determination, and is source of barometric pressure noted
no

METHOD 4 3
are data and calculations included for moisture content determination, and is moisture content realistic (< saturation)

FIELD DATA is field data on standard forms, and does raw data correspond with printout 3

BOILER TESTS N/A
calculation of F_0 from Orsat accurate

SAMPLING TEMPERATURE 3
both probe and filter must be maintained at 248 ± 25°F or other temperature specified in NSPS

BACK-HALF 3
if any, what method was used to catch and recover condensible matter
W1

EQUIPMENT were a borosilicate glass probe liner and a glass fiber filter used 2
or dot.

CALIBRATION were both pre- and post-test calibrations performed for
meter box 2
pitot tube 2
temperature sensor 2
nozzle (3 ϕ) 2
ND ND

LEAK CHECKS both pre- and post-test 3

BLANKS were filter and reagent blanks analyzed, and were any problems addressed 3

SAMPLE PREP 3
filter desiccation and tare weights documented

ISOKINETICS within 100±10% for all runs 3

File Copy
Dan Y
File:

MEMORANDUM

TO: FMC Soda Ash Plant Compliance File

THROUGH: Chuck Collins, Air Quality Administrator
Bernie Dailey, Air Quality Supervisor

FROM: Lee Gribovicz, Division Air Quality Engineer

SUBJECT: Review of Sesqui Plant Gas Calciner Tests

DATE: November 1, 1988

By letter of January 4, 1988 the Division requested that FMC provide updated tests on RA-22 and RA-23 sources, which exhaust direct gas fired trona calciner kilns in the sesqui portion of the plant. These sources had very dated tests (6-10 years old) which showed emissions close to the allowable for these stacks. Because recent test results for another similar calciner (RA-24) had shown marginal results and because significant opacities had been noted in recent inspections of these two sources, it was felt that a confirmation of the current compliance status was appropriate. By letter of April 13, 1988 FMC scheduled this testing for the last part of May and the first part of June. The tests were conducted as planned, but because of other conflicts, the Division was unable to have an observer present during the test work.

The test reports for this test work were submitted separately, with the test report for RA-22 submitted under June 6, 1988 cover and the RA-23 report under June 15, 1988 cover. I have reviewed these test reports, and copies of my review worksheets are attached to this memo. I have had the opportunity to observe FMC's test crew numerous times and I am confident that proper procedure was followed. I can find no problems with the protocol evidenced in the test reports, therefore I must conclude that the reports are accurate (I did catch and correct a number of arithmetical errors). Test production rates were documented and reported, and I find that testing was conducted at representative conditions. As shown in the table below, both stacks tested well in compliance with their respective allowables. These tests should be accepted as confirmation of current compliance of the two stacks.

	RA-22	RA-23
Date of Testing	5/24-26/88	6/1-2/88
Measured Emission Rate (pph)	20.32	29.89
Allowable Emission Rate (pph)	32.0	35.0
Tested Production Rate (TPH)	26.6	30.5
Design Production Rate (TPH)	35	50

STACK EMISSION REVIEW

COMPANY FMC Trona Plant LOCATION Green River Wy

TESTING FIRM FMC Env. Dept TESTS CONDUCTED BY Ted Brown, Simon Lee, Ruth Norris

DATE TESTED 5/24-26/88

TEST OBSERVED BY Not Observed

TEST EVALUATED BY Lee Ledbetter

STACK DATA

Stack ht (ft) _____

Stack dia (ft) Twin stacks, each 3.5 ft dia

Process venting through stack RA-22A & RA-22B (R-9 Calciner Kiln)

TRAVERSE POINTS

Nozzle diameter: Test 1 0.18" Test 2 _____ Test 3 _____

Location of sampling ports 32.5 ft (9.3 dia) downstream; 5.7 ft (1.6 dia) upstream

Number of traverse points per test: Test 1 36 per stack, 72 per test Test 2 _____ Test 3 _____

Do sampling points follow EPA guidelines? Yes ✓ No _____

Comments:

EMISSIONS

	Test 1	Test 2	Test 3
Process wt rate (ton/hr)	26.8	27.6	25.5 → 26.6 avg / 35 design
Allowable emission (lb/hr)	32.0	32.0	32.0 section 25 limit
Measured emission (lb/hr)	22.43	18.61	19.92 → 20.32 avg
% Isokinetic	104%	105%	106%

Comments and recommendations:

Test was run @ ~76% of design production rate

Emissions are 64% of allowable ∴ accept test

LE 10/3/88

TSP
DATA SHEET

Total Test RA-77 A+B

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	23.99	24.06	24.00
P_s	= absolute stack gas pressure (in Hg)	23.99	24.06	24.00
T_s	= absolute average stack gas temp. (°R)	585.0	578.8	580.2
T_m	= absolute average dry gas meter temp. (°R)	553.9	548.1	553.4
V_{ic}	= total volume of water collected (ml)	133.4	123.2	140.9
V_m	= volume of gas through dry gas meter (ft^3)	56.480	50.447	50.467
ΔH	= average pressure drop across orifice (in H_2O)	0.401	0.334	0.328
C_p	= pitot tube coefficient	0.84 →		
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	0.638	0.568	0.566
A_s	= cross-sectional area of stack (ft^2)	19.2423 →		
M_n	= total amount of particulate collected with Back Half Included (g)	0.2327	0.1952	0.2115
~~θ~~	= total sampling time (min.)	144 →		
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4} →		

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	1.1	1.4	1.3
% O_2	15.1	12.6	15.1
% CO	—	—	—
% N_2	83.8	86.0	83.6

Stack Test RA-77 A & B

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

   $V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{ic}$

   $V_{w\ std} =$ 6.32, 5.84, 6.68 ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

   $$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

   $V_{m\ std} =$ 43.73, 39.13, 38.67 ft^3

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

   $$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

   $B_{wo} =$ 0.13, 0.13, 0.15

4. Molecular weight (lb/lb mole)

   $M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

   $M_d =$ 28.78, 28.73, 28.81 lb/lb mole

   $M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

   $M_s =$ 27.40, 27.33, 27.27 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

   $$V_s = 85.48\ Cp\ (\sqrt{\Delta p})ave \sqrt{\frac{T_s}{P_s\ M_s}}$$

   $V_s =$ 43.21, 38.76, 38.30 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

   $$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

   $Q_s =$ 31,498, 28,196, 27,525 ft^3 min

   Q_a 49,891 44,173 44,219 } 46,094 avg Two stacks

Total Test RA-22 A+B

PARTICULATE
CALCULATIONS (CONTINUED)

7. C_s = concentration (lb/ft^3)

$$C_s = 2.205 \times 10^{-3} \frac{M_n}{V_{m\_std}}$$

C_s = 1.19X10^{-5}, 1.10X10^{-5}, 1.21X10^{-5} lb/ft^3

grains/dscf
0.083 0.077 0.085

8. E = emission rate lb/hr

$$E = C_s \cdot Q_s \cdot 60$$

E = 22.43, 18.61, 19.92 lb/hr

9. % Isokinetic

$$I = \frac{1.667\ T_s \left(0.00267\ V_{ic} + \frac{V_m}{T_m} \left[P_{bar} + \frac{\Delta H}{13.6} \right] \right)}{\theta\ V_s\ P_s\ A_n}$$

I = 103.71, 104.85, 106.15 %

TSP
DATA SHEET

RA-22A Only

West Scrubber X-27

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	23.99	24.06	24.00
P_s	= absolute stack gas pressure (in Hg)	23.99	24.06	24.00
T_s	= absolute average stack gas temp. (°R)	583.6	578.4	579.9
T_m	= absolute average dry gas meter temp. (°R)	561.1	537.5	563.1
V_{ic}	= total volume of water collected (ml)	use moisture from both stacks ±		
V_m	= volume of gas through dry gas meter (ft^3)	25.436	22.658	20.509
ΔH	= average pressure drop across orifice (in H_2O)	0.311	0.271	0.213
C_p	= pitot tube coefficient	0.84 →		
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	0.569	0.507	0.449
A_s	= cross-sectional area of stack (ft^2)	9.6211 →		
M_n	= total amount of particulate collected (g)	volume calculation only		
Θ	= total sampling time (min.)	72 →		
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4} →		

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	1.1	1.4	1.3
% O_2	15.1	12.6	15.1
% CO	—	—	—
% N_2	83.8	86.0	83.6

RA-72A only

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

$V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{ic}$

$V_{w\ std} =$ not calculated ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

$$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

$V_{m\ std} =$ 19.21, 17.92, 15.44 ft^3

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

$$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

assume Two stack average is applicable

$B_{wo} =$ 0.13, 0.13, 0.15

4. Molecular weight (lb/lb mole)

$M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

$M_d =$ 28.78, 28.73, 28.81 lb/lb mole

$M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

$M_s =$ 27.40, 27.33, 27.27 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

$$V_s = 85.48\ Cp\ (\sqrt{\Delta p})_{ave} \sqrt{\frac{T_s}{P_s\ M_s}}$$

$V_s =$ 38.49, 34.14, 30.38 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

$$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

$Q_s =$ 14,063, 12,568, 10,920 ft^3 min

Q_a 22,271 19,708 17,535 } 19,871 avg (43% of total)

TSP
DATA SHEET

RA-72B Only

East Scrubber X-26

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	23.99	24.06	24.00
P_s	= absolute stack gas pressure (in Hg)	23.99	24.06	24.00
T_s	= absolute average stack gas temp. (°R)	586.4	578.1	580.5
T_m	= absolute average dry gas meter temp. (°R)	546.7	558.8	543.8
V_{ic}	= total volume of water collected (ml)	use moisture from both stacks		
V_m	= volume of gas through dry gas meter (ft^3)	31.043	27.788	29.958
ΔH	= average pressure drop across orifice (in H_2O)	0.492	0.398	0.443
C_p	= pitot tube coefficient	0.84 →		
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	0.707	0.629	0.682
A_s	= cross-sectional area of stack (ft^2)	9.6211 →		
M_n	= total amount of particulate collected (g)	volume calculation only		
θ	= total sampling time (min.)	72 →		
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4} →		

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	1.1	1.4	1.3
% O_2	15.1	12.6	15.1
% CO	—	—	—
% N_2	83.8	86.0	83.6

RA-22B Only

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

   $V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{ic}$

   $V_{w\ std} =$ not calculated ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

   $$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

   $V_{m\ std} =$ 24.00, 21.14, 23.38 ft^3

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

   $$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

   $B_{wo} =$ 0.13, 0.13, 0.15

   Assume Two stack average is applicable

4. Molecular weight (lb/lb mole)

   $M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

   $M_d =$ 28.78, 28.73, 28.81 lb/lb mole

   $M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

   $M_s =$ 27.40, 27.33, 27.22 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

   $$V_s = 85.48\ Cp\ (\sqrt{\Delta p})_{ave} \sqrt{\frac{T_s}{P_s\ M_s}}$$

   $V_s =$ 47.94, 42.38, 46.16 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

   $$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

   $Q_s =$ 17,431, 15,608, 16,579 ft^3 min

   $Q_a =$ 27,677 24,465 26,648 } 26,263 avg (57% of total)

STACK EMISSION REVIEW

COMPANY FMC Trona Plant LOCATION Green River, Wy

TESTING FIRM FMC Env. Dept. TESTS CONDUCTED BY Ted Brown
Simon Lee
Keith Norris

DATE TESTED 6/1-2/88

TEST OBSERVED BY Not Observed

TEST EVALUATED BY Lee Gribovicz

STACK DATA

Stack ht (ft) _____

Stack dia (ft) twin stacks, each 3.0 ft dia

Process venting through stack RA-23A & RA-23B

TRAVERSE POINTS

Nozzle diameter: Test 1 0.18" → Test 2 _____ Test 3 _____

Location of sampling ports 23 ft (7.6 dia) downstream; 8 ft (2.67 dia) upstream

Number of traverse points per test: Test 1 16 per test Test 2 _____ Test 3 _____
32 per test

Do sampling points follow EPA guidelines? Yes X No _____

Comments:

EMISSIONS

	Test 1	Test 2	Test 3
Process wt rate (ton/hr)	29.4	30.9	31.3 → 30.5 avg / 50 design
Allowable emission (lb/hr)	35	35	35 Section 25 allowable
Measured emission (lb/hr)	31.28	29.62	28.78 → 29.89 avg
% Isokinetic	104%	102%	105%

Comments and recommendations:

Test was run @ 61% of design production rate

Emissions are 85% of allowable tested is low enough below allowable to accept

ft 11/2/88

TSP
DATA SHEET

Total Coal
RA-73A+B

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	24.04 →		24.17
P_s	= absolute stack gas pressure (in Hg)	24.04 →		24.17
T_s	= absolute average stack gas temp. (°R)	607.4	605.4	598.8
T_m	= absolute average dry gas meter temp. (°R)	546.8	561.2	556.3
V_{ic}	= total volume of water collected (ml)	424.1	421.0	438.0
V_m	= volume of gas through dry gas meter (ft^3)	74865	76.450	76.431
ΔH	= average pressure drop across orifice (in H_2O)	0.847	0.855	0.847
C_p	= pitot tube coefficient	0.84 →		
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	1.127	1.136	1.128
A_s	= cross-sectional area of stack (ft^2)	14.1372 →		
M_n	= total amount of particulate collected (g)	0.3941	0.3676	0.3644
θ	= total sampling time (min.)	128 →		
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4} →		

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	3.6	3.5	4.6
% O_2	14.5	14.8	13.2
% CO	/	/	/
% N_2	81.9	81.7	82.2

Total Test RA-73A+B

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

   $V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{ic}$

   $V_{w\ std} =$ 20.10, 19.96, 20.76 ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

   $$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

   $V_{m\ std} =$ 58.74, 57.95, 58.76 ft^3

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

   $$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

   $B_{wo} =$ 0.26, 0.26, 0.26

4. Molecular weight (lb/lb mole)

   $M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

   $M_d =$ 29.16, 29.15, 29.26 lb/lb mole

   $M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

   $M_s =$ 26.79, 26.80, 26.87 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

   $$V_s = 85.48\ Cp\ (\sqrt{\Delta p})_{ave} \sqrt{\frac{T_s}{P_s\ M_s}}$$

   $V_s =$ 19.33, 19.88, 18.58 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

   $$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

   $Q_s =$ 34,937, 35,294, 35,081 ft^3 min

$Q_a =$ 67,286 67,709 66,650 Avg 67,215

Total Test
RA-237 A + B

PARTICULATE
CALCULATIONS (CONTINUED)

7. C_s = concentration (lb/ft^3)

$$C_s = 2.205 \times 10^{-3} \frac{M_n}{V_{m\ std}}$$

C_s = 1.49×10^{-5}, 1.40×10^{-5}, 1.37×10^{-5} lb/ft^3

grains/dscf
0.104 0.098 0.096

8. E = emission rate lb/hr

$$E = C_s \cdot Q_s \cdot 60$$

E = 31.28, 29.62, 28.78 lb/hr

9. % Isokinetic

$$I = \frac{1.667\ T_s \left(0.00267\ V_{ic} + \frac{V_m}{T_m} \left[P_{bar} + \frac{\Delta H}{13.6} \right] \right)}{\theta\ V_s\ P_s\ A_n}$$

I = 104.04, 102.48, 104.54 %

RA-73A West Scrubber only X-13

TSP
DATA SHEET

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	24.04 →		24.17
P_s	= absolute stack gas pressure (in Hg)	24.04 →		24.17
T_s	= absolute average stack gas temp. (°R)	607.7	606.4	598.4
T_m	= absolute average dry gas meter temp. (°R)	538.1	562.6	550.7
V_{ic}	= total volume of water collected (ml)	Use moisture from bubblers		
V_m	= volume of gas through dry gas meter (ft^3)	40.403	40.169	41.447
ΔH	= average pressure drop across orifice (in H_2O)	1.008	0.961	1.021
C_p	= pitot tube coefficient	0.84 →		
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	1.230	1.205	1.241
A_s	= cross-sectional area of stack (ft^2)	7.0686 →		
M_n	= total amount of particulate collected (g)	volume calculation only		
Θ	= total sampling time (min.)	64 →		
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4} →		

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	3.6	3.5	4.6
% O_2	14.5	14.8	13.2
% CO	/	/	/
% N_2	81.9	81.7	82.2

RA-23A only Wet Scrubber X-13

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

$V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{lc}$

$V_{w\ std}$ = not calculated ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

$$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

$V_{m\ std}$ = 31.96, 30.38, 32.21 ft^3

Assume stack average moisture

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

$$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

B_{wo} = 0.26, 0.26, 0.26

4. Molecular weight (lb/lb mole)

$M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

M_d = 29.16, 29.14, 29.26 lb/lb mole

$M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

M_s = 26.29, 26.30, 26.32 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

$$V_s = 85.48\ Cp\ (\sqrt{\Delta p})_{ave} \sqrt{\frac{T_s}{P_s\ M_s}}$$

V_s = 86.60, 84.74, 86.47 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

$$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

Q_s = 19,061, 18,764, 19,304 ft^3 min

Q_a = 36,727 36,411 36,657 } avg 36,440 (54% of total)

RA-23B only Cast Scrubber X-12

TSP
DATA SHEET

P_{std} = 29.92 in Hg

T_{std} = 528°R

		Test 1	Test 2	Test 3
P_{bar}	= barometric pressure at site (in Hg)	24.04	→	24.17
P_s	= absolute stack gas pressure (in Hg)	24.04	→	24.17
T_s	= absolute average stack gas temp. (°R)	607.1	604.5	599.1
T_m	= absolute average dry gas meter temp. (°R)	555.6	559.8	561.9
V_{ic}	= total volume of water collected (ml)	use moisture from both stacks		
V_m	= volume of gas through dry gas meter (ft^3)	34.462	36.281	34.984
ΔH	= average pressure drop across orifice (in H_2O)	0.688	0.749	0.673
C_p	= pitot tube coefficient	0.84	→	→
$(\sqrt{\Delta P})_{ave}$	= average velocity head of stack gas (in H_2O)	1.024	1.067	1.015
A_s	= cross-sectional area of stack (ft^2)	7.0686	→	→
M_n	= total amount of particulate collected (g)	volume calculation only		
~~θ~~	= total sampling time (min.)	64	→	→
A_n	= cross-sectional area of nozzle (ft^2)	1.767×10^{-4}	→	→

ORSAT ANALYSIS

	Test 1	Test 2	Test 3
% CO_2	3.6	3.5	4.6
% O_2	14.5	14.8	13.2
% CO	/	/	/
% N_2	81.9	81.7	82.2

RA-73B only East Scrubber X-12

CALCULATIONS

1. $V_{w\ std}$ = volume of water vapor in gas @ STP (ft^3)

$V_{w\ std} = 0.0474\ ft^3/ml \cdot V_{lc}$

$V_{w\ std}$ = not calculated ft^3

2. $V_{m\ std}$ = volume of gas sample through dry gas meter @ STP (ft^3)

$$V_{m\ std} = \left(17.65\ \frac{°R}{in\ Hg}\right) V_m \left(\frac{P_{bar} + \frac{H}{13.6}}{T_m}\right)$$

27.56

$V_{m\ std}$ = 26.37, [illegible], 26.61 ft^3

3. B_{wo} = proportion by volume of water vapor in gas stream (dimensionless)

Assume Tunstock average moisture

$$B_{wo} = \frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$$

B_{wo} = 0.26, 0.26, 0.26

4. Molecular weight (lb/lb mole)

$M_d = 0.44\ (\%\ CO_2) + .32\ (\%\ O_2) + .28\ (\%\ N_2 + \%\ CO)$

M_d = 29.16, 29.15, 29.26 lb/lb mole

$M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

M_s = 26.89, 26.30, 26.32 lb/lb mole

5. V_s = stack gas velocity (ft/sec)

$$V_s = 85.48\ Cp\ (\sqrt{\Delta p})_{ave} \sqrt{\frac{T_s}{P_s\ M_s}}$$

V_s = 12.06, 14.92, 10.72 ft/sec

6. Q_s = volumetric flow rate, dry basis, @ STP (ft^3/min)

$$Q_s = 60\ (1 - B_{wo})\ V_s \cdot A_s \left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

Q_s = 15,876, 16,588, 15,779 ft^3 min

Q_a = 30,561 31,775 29,994 Σ avg 30,777

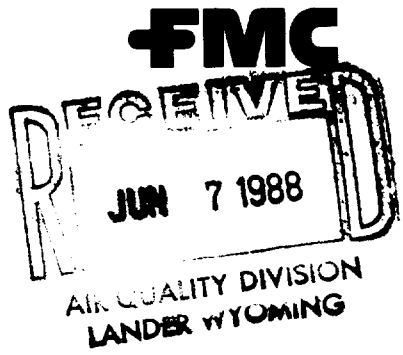
46% of total

Certified Mail No.: P 113 178 781

FMC Wyoming Corporation

Box 872
Green River Wyoming 82935
307 875 2580

June 6, 1988



Mr. Lee Gribovicz
District II Engineer
Air Quality Division
Department of Environmental Quality
210 Lincoln Street
Lander, Wyoming 82520

RE: Compliance Test Report
Emission Source: RA-22 A&B

Dear Mr. Gribovicz:

Per the Air Quality Division's request of January 4, 1988, compliance tests were run on emission source RA-22 A&B. These tests were run on May 24, 25, and 26, 1988. Enclosed you will find the compliance report for this testwork. Following the same format that we have used for other reports of this nature, this report contains the following information:

- Summary of the test results
- Sampling and Analysis procedures
- Appendix which includes field data, laboratory worksheets, and calculations for each test. Diagram showing locations of sample ports, and the location and number of points in each sample diameter are also included.

The section which contains the calculation of feedrate to the unit, has been separated from the main report and marked "Confidential" as provided for in § 35-11-1101 of the Wyoming Environmental Quality Act. Included in this separate packet are the control room logsheets of operating parameters monitored during the testwork. We consider this information to be trade secret and proprietary as it is not available to the public or to our competitors. We would appreciate you treating it as such.

If you have any questions concerning this report, or need any additional information, give me a call.

Yours very truly,

Carl R. Demshar, Jr.
Environmental Manager

jc

cc: Charles Collins, DEQ - Cheyenne
JW Coykendall*, JF Herink* - Green River

* Summary Table I included with cover letter.

COMPLIANCE TEST REPORT
EMISSION SOURCE RA-22 A&B
FMC WYOMING CORPORATION
GREEN RIVER, WYOMING

June 6, 1988

COMPLIANCE TEST REPORT

EMISSION SOURCE: RA-22 A&B

FMC WYOMING CORPORATION
GREEN RIVER, WYOMING

TEST DATE: MAY 24 - 26, 1988
REPORT DATE: JUNE 6, 1988

COMPLIANCE TEST REPORT
EMISSION SOURCE: RA-22 A&B

Section

Introduction

In an effort to verify compliance of source RA-22 A&B, compliance tests were conducted on May 24, 25, and 26, 1988. FMC Wyoming Corporation personnel taking part in the testwork were:

Ted Brown	Environmental Engineer
Simon Lee	Environmental Engineering Aide
Kieth Norris	Senior Laboratory Analyst

Summary of Results

This section summarizes the results of the compliance tests performed on emission source RA-22 A&B. Table I is a general summary showing the individual test results in relation to the maximum allowable emission for this source. Table II is a summary of the results obtained from each compliance tests. Details of the individual tests, including field data sheets, laboratoty data sheets, and calculation sheets can be found in the Appendix.

From Table I, it can be seen that the individual test results, as well as the three-test average, are well below the allowable emission rate for this particular unit.

TABLE I

Comparison of Compliance Test Results
With Allowable Emission Rates

Emission Source	Test Number	Emission Rate, lb/hr	
		Compliance Test	Allowable
RA-22 A&B	88-06-S-P	22.4	32.0
RA-22 A&B	88-07-S-P	18.6	32.0
RA-22 A&B	88-08-S-P	19.0	32.0
	Average:	20.0	32.0

TABLE II

SUMMARY OF STACK SAMPLING CALCULATIONS

Stack: RA-22 A & B

	TEST 1	TEST 2	TEST 3
Test Code Number	88-06-SP	88-07-SP	88-08-SP
Barometric Pressure at site, (in Hg)	23.99	24.06	24.00
Absolute stack gas pressure, (in Hg)	23.99	24.06	24.00
Absolute average stack gas temp. A, (R)	583.6	578.4	579.9
Absolute average stack gas temp. B, (R)	586.4	579.1	580.5
Absolute average dry gas meter temp., (R)	553.9	548.1	553.4
Total volume of water collected, (ml)	133.4	123.2	140.9
Volume of gas through dry gas meter, (ft3)	56.480	50.447	50.423
Average pressure drop across orifice, (in H2O)	0.401	0.334	0.328
Pitot tube coefficient	0.84	0.84	0.84
Average velocity head of stack gas A, (in H2O)	0.568	0.507	0.449
Average velocity head of stack gas B, (in H2O)	0.708	0.629	0.682
Cross sectional area of stack, (ft2)	9.621	9.621	9.621
Front half particulate collected, (gm)	0.2322	0.1878	0.2073
Back half particulate collected, (gm)	0.0005	0.0074	0.0042
Total particulate collected, (gm)	0.2327	0.1952	.2115 ~~0.2015~~
Total sampling time, (min)	144	144	144
Cross sectional area of nozzle, (ft2*10-4)	1.7672	1.7672	1.7672
Gas volume A, (acfm)	22180	19706	17533
Gas volume B, (acfm)	27713	24463	26646
Gas volume A, (scfm)	16151	14520	12854
Gas volume B, (scfm)	20083	18004	19514
Percent isokinetic	104.14	105.30	106.62
Emission rate, (lb/hr)	22.44	18.62	18.98

Sampling and Analysis Procedure

Compliance testing on emission source RA-22 A&B was conducted on May 24, 25, and 26 using EPA Method No. 5, "Determination of Particulate Emissions from Stationary Sources". This unit consists of two stacks, RA-22A and RA-22B. Each emission test consisted of traversing two sample diameters in each stack with 18 points being sampled on each diameter. Each point was sampled for two minutes resulting in a sample time of 72 minutes for each stack, with the total time for each emission sample being 144 minutes. One sample train was used for each emission test. Figure 1, located in Section A-2 of the Appendix, shows the location of the sample ports in relation to the nearest flow disturbance (an expansion, contraction, or bend in the stack). This diagram also shows the location of the sample points in each sample diameter.

Control room logsheets, containing operating data pertinent to the unit during the testwork, can be found in the Confidential Section of this report.

Calculation of Production Rate:

Emission Source: RA-22 A&B
Test Date: May 24, 25, and 26, 1988

Test No. 88-06-S-P	26.8 tons per hour
Test No. 88-07-S-P	27.6 tons per hour
Test No. 88-08-S-P	25.5 tons per hour

Details of these calculations, along with the control room logsheets which contain the data used in these calculations, can be found in the Confidential packet.

APPENDIX

Section A-1, Test Data

- Field Data Sheets
- Laboratory Data Sheets
- Test Calculations
- Preliminary Test Data

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy
Run No. 88-06-S-P
Sampling Location RA-22A+B
Date 5-24-88
Start Time 09:45
Finish Time 10:21
Filter No.

Assumed Moisture, % 0.10
Probe Tip Diameter, in. 0.18
Probe Length, ft. 5
Ambient Temperature, °F 5
Bar. Pressure, in. Hg. 25.99
Initial Leak Check, CFS
CFM 0.16 at 15 in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-22 B "East" X-26

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	464.719	0.29	0.538	0.26	0.26	68	65	1.0	233	76		124
2	2	465.3	0.28	0.529	0.25	0.25	70	66	1.0	237	76		125
3	4	466.0	0.29	0.538	0.26	0.26	73	67	1.2	241	76		126
4	6	466.6	0.28	0.529	0.25	0.25	74	68	1.2	242	76		126
5	8	467.3	0.27	0.520	0.24	0.24	76	69	1.0	244	76		126
6	10	467.9	0.26	0.510	0.23	0.23	78	70	1.0	236	77		126
7	12	468.5	0.25	0.500	0.22	0.22	79	71	0.9	242	77		126
8	14	469.1	0.20	0.447	0.17	0.17	79	73	0.8	243	77		127
9	16	469.6	0.17	0.412	0.15	0.15	80	74	0.6	244	77		126
10	18	470.1	0.31	0.557	0.27	0.27	83	74	1.8	244	76		126
11	20	470.8	0.70	0.837	0.61	0.61	89	76	2.5	248	75		127
12	22	471.8	0.94	0.969	0.81	0.81	91	76	3.0	244	75		125
13	24	472.9	1.0	1.000	0.86	0.86	93	77	3.0	248	74		128
14	26	474.0	0.9	0.985	0.84	0.84	94	79	3.0	247	73		128
15	28	475.2	0.98	0.990	0.85	0.85	95	80	3.0	244	73		127
16	30	476.3	0.94	0.969	0.81	0.81	96	81	3.0	222	73		127
17	32	477.4	0.97	0.985	0.84	0.84	97	82	3.0	229	73		125
18	34	478.5	0.97	0.985	0.84	0.84	97	82	3.0	236	73		125
	36	479.7					1841						124
Total	Vm	56.480	25.497		17.7		6242	86.7°F					456 / 126.4°
Average			TP 0.706		ΔH 0.492			546.7°F					586.4°

1.0389 × 54.365 = 29.881 × 1.0389 = 31.043

Orsat: 1.1 %CO₂ / 15.1 %O₂
Stk. Area 9.621
Water 33.4
Leach 0.2307

0.707 Avg. ΔH: 0.401 Avg. Tm: 553.9°R

STACK SAMPLING FIELD DATA

Company FMC Wy Corp
Plant Location Green River, Wy.
Run No. 88-06-S-P
Sampling Location RA-22 A+B
Date 5-24-88
Start Time 10:36 AM.
Finish Time 11:12 AM
Filter No. ____

Assumed Moisture, % 10
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F ____
Bar. Pressure, in. Hg. 23.99
Initial Leak Check, CFS ____ CFM ____ at [redacted] in. Hg.
Final Leak Check, CFS ____ CFM ____ at ____ in. Hg.

RA-22 B "East" X-26

Point No. (East port)	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot in. H_2O √P	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	479.7	0.28	0.529	0.25	0.25	91	86	1.9	236	82		123
2	2	480.5	0.31	0.557	0.27	0.27	92	87	1.9	241	81		124
3	4	481.1	0.32	0.566	0.28	0.28	94	88	1.9	239	80		124
4	6	481.8	0.30	0.548	0.26	0.26	94	88	1.9	240	80		125
5	8	482.4	0.29	0.538	0.26	0.26	95	89	1.9	244	81		126
6	10	483.0	0.25	0.500	0.22	0.22	96	89	1.8	239	80		126
7	12	483.7	0.19	0.436	0.16	0.16	96	90	1.0	244	80		126
8	14	484.2	0.11	0.332	0.10	0.10	95	90	0.5	245	81		126
9	16	484.6	0.06	0.245	0.07	0.07	94	91	0.3	248	82		128
10	18	484.9	0.22	0.469	0.19	0.19	95	91	1.0	243	81		127
11	20	485.5	0.50	0.707	0.43	0.43	99	91	2.1	240	81		127
12	22	486.3	0.88	0.938	0.76	0.76	100	91	3.0	240	80		126
13	24	487.3	1.10	1.049	0.95	0.95	103	92	3.5	243	80		126
14	26	488.5	1.10	1.049	0.95	0.95	104	92	3.5	237	79		126
15	28	489.7	1.10	1.049	0.95	0.95	105	93	3.6	239	79		126
16	30	491.0	1.10	1.049	0.95	0.95	106	93	3.7	240	79		127
17	32	492.2	1.10	1.049	0.95	0.95	106	94	3.8	246	80		127
18	34	493.4	1.10	1.049	0.95	0.95	107	94	3.8	246	80		126
	36	494.6					3404						2266
Total													
Average													

Σ√P = 25.461 / 36 = 0.707

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-06-S-P
Sampling Location RA-22 A+B
Date 5-24-88
Start Time 11:30 AM
Finish Time 10:06 PM
Filter No.

Assumed Moisture, % .10
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 23.99
Initial Leak Check, CFS
CFM at in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-22 A "West" V-27

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	494.6	0.22	0.469	0.19	0.19	99	96	1.9	243	82		121
2	2	495.3	0.22	0.469	0.19	0.19	100	97	1.9	248	82		122
3	4	495.9	0.23	0.479	0.20	0.20	101	97	2.0	243	81		120
4	6	496.4	0.26	0.510	0.23	0.23	101	98	2.0	246	78		125
5	8	497.1	0.25	0.500	0.22	0.22	100	99	2.0	248	77		123
6	10	497.7	0.21	0.458	0.17	0.17	99	98	1.1	253	76		122
7	12	498.1	0.08	0.283	0.07	0.07	100	98	2.0	252	76		124
8	14	498.5	0.08	0.283	0.07	0.07	98	98	0.8	249	78		124
9	16	498.9	0.08	0.283	0.07	0.07	98	97	0.6	254	78		125
10	18	499.2	0.20	0.447	0.17	0.17	100	97	2.0	253	79		124
11	20	499.7	0.47	0.686	0.41	0.41	102	97	2.6	252	79		126
12	22	500.5	0.59	0.768	0.51	0.51	104	97	2.9	252	79		125
13	24	501.4	0.60	0.774	0.52	0.52	105	97	3.0	250	78		125
14	26	502.4	0.58	0.761	0.50	0.50	105	97	3.0	251	77		127
15	28	503.3	0.59	0.761	0.50	0.50	105	97	3.0	247	77		124
16	30	504.2	0.56	0.748	0.49	0.49	106	97	3.0	246	77		126
17	32	505.1	0.56	0.748	0.49	0.49	106	98	3.0	247	76		125
18	34	505.9	0.56	0.748	0.47	0.47	106	98	3.0	247	78		127
	36	506.9					3587						7240
		24.484 Y	1.0389										
		25.436											
							7281 ✓					✓	4450
Total			20.465		11.2		101.1°F ✓						123.6
Average			P 0.569		ΔH 0.311 ✓		561.1°F ✓						583.6

0.569

STACK SAMPLING FIELD DATA

Company: FMC Wy Corp

Plant Location: Green River, Wy

Run No.: 88-06-S-P

Sampling Location: RA-22 A+B

Date: 05-24-88

Start Time: 12:20

Finish Time: 12:56

Filter No.:

Assumed Moisture, %: 10

Probe Tip Diameter, in.: .18

Probe Length, ft.: 5

Ambient Temperature, °F:

Bar. Pressure, in. Hg.: 23.99

Initial Leak Check, CFS
CFM ____ at ____ in. Hg.

Final Leak Check, CFS
CFM <.001 at 4.0 in. Hg.

RA-22 A "West" X-27

Point No. (S. East Port)	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot in. H_2O √P	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	506.9	0.27	0.520	0.24	0.24	101	98	2.1	240	91		+122
2	2	507.6	0.28	0.529	0.25	0.25	102	99	2.1	242	92		123
3	4	508.2	0.30	0.548	0.26	0.26	103	99	2.2	241	91		122
4	6	508.9	0.30	0.548	0.26	0.26	104	99	2.2	244	90		+123
5	8	509.5	0.29	0.538	0.25	0.25	104	99	2.1	244	89		124
6	10	510.1	0.22	0.469	0.19	0.19	104	99	2.0	242	88		123
7	12	510.7	0.04	0.200	0.03	0.03	101	100	0.03	244	88		123
8	14	510.9	0.04	0.200	0.03	0.03	100	100	0.03	246	88		+125
9	16	511.1	0.04	0.200	0.03	0.03	100	100	0.03	246	88		+124
→10	18	511.3	0.27	0.520	0.24	0.24	103	100	2.1	245	90		+122
11	20	511.9	0.50	0.707	0.43	0.43	107	100	2.9	242	90		+122
12	22	512.8	0.61	0.781	0.53	0.53	108	100	3.1	242	89		+123
13	24	513.7	0.62	0.787	0.54	0.54	109	100	3.1	243	89		+122
14	26	514.6	0.58	0.762	0.50	0.50	110	101	3.0	240	89		+122
15	28	515.5	0.57	0.755	0.49	0.49	110	101	3.0	244	89		123
16	30	516.4	0.55	0.742	0.48	0.48	110	101	3.0	239	87		+122
17	32	517.3	0.55	0.742	0.48	0.48	110	101	3.0	242	87		+122
18	34	518.2	0.55	0.742	0.48	0.48	110	101	3.1	241	86		+122
	36	519.084					30[illegible]						2210
				ΣV = 10.460									
				0.569									
Total													
Average													

TEST NO. 88-06-S-P DATE 05/24/88

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg

Vm=Volume (ft3) of gas at meter conditions

Tm=Average dry gas meter temperature (R)

Pbar=Barometric pressure (in. Hg)

deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 56.48*(23.99+0.401/13.6)/553.9 = 43.376 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor

Vlc=Total volume of water collected (ml)

Vwstd = .00474* 133.4 = 6.323 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 6.32*100/(6.32+ 43.38) = 12.723 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)

Mn=Total particulate collected (gm)

Cs' = 15.43*0.2327/(43.38+ 6.32) = 0.0722 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)

Ts=Stack absolute temperature (R)

deltaP=Average pitot reading (in. WG)

Mw=Molecular wt. of stack gas (lb/lb mole)

Kp=Pitot tube coefficient

Mw=0.18*12.72+0.44* 0.96+0.32*13.18+0.26*73.14 = 27.408 lb/mole

RA-22A V=0.84*85.48*0.556*SQR(583.6/(27.41*23.99)) = 38.423 ft/sec

RA-22B V=0.84*85.48*0.706*SQR(586.4/(27.41*23.99)) = 48.008 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions

A=Stack area (ft2)

SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-22A ACFM = 38.42* 9.621*60 = 22180 acfm

RA-22B ACFM = 48.01* 9.621*60 = 27713 acfm

RA-22A SCFM = 22180*530*23.99/(583.6*29.92) = 16151 scfm

RA-22B SCFM = 27713*530*23.99/(586.4*29.92) = 20083 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0722* 36234*60/7000 = 22.44 Lb/Hr

ISOKINETIC RATE

(1)

LABORATORY DATA

Company FMC WYO Run No.: 88-06-S-P

Sampling Location RA 22A-B Date: 5-24-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	661.8	
	Initial Weight/Volume	552.9	
	Increase	108.9	108.9
IMPINGER 2	Final Weight/Volume	555.7	
	Initial Weight/Volume	544.3	
	Increase	11.4	11.4
IMPINGER 3	Final Weight/Volume	440.7	
	Initial Weight/Volume	439.2	
	Increase	1.5	1.5
IMPINGER 4	Final Weight/Volume	655.1	
	Initial Weight/Volume	643.5	
	Increase	11.6	11.6
	TOTAL MOISTURE CATCH		133.4 ✓

1S
75.1200
75.0800
.0400

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

Filter & Particulates	0.7700
Filter Tare Weight	0.5778
Particulate	0.1922
Washings	0.0400
Particulate Catch	0.2322
Acetone Blank	- 0 -
TOTAL FRONT CATCH	0.2322

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

1BH

Extractable Weight	75.5480
Boil Down Weight	75.5475
Impinger Catch	0.0005
Water Blank	- 0 -
TOTAL BACK CATCH	0.0005
TOTAL TRAIN CATCH	0.2327 ✓

1B
74.9800
74.9800
- 0 -

STACK SAMPLING FIELD DATA

Company: FMC Wy Corp
Plant Location: Green River, Wy.
Run No.: 88-07-5-P
Sampling Location: R-9 RA-22A+B
Date: 05/25/88
Start Time: 09:53
Finish Time: 10:28
Filter No.:

Assumed Moisture, %: .10
Probe Tip Diameter, in.: .18
Probe Length, ft.: 5
Ambient Temperature, °F:
Bar. Pressure, in. Hg.: 24.06
Initial Leak Check, CFS / CFM .004 at 15 in. Hg.
Final Leak Check, CFS / CFM ___ at ___ in. Hg.

RA-22A West X-27

Point No. (east / port)	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot √P	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F (75°)	Stack Press. in. Hg	Stack Temp. °F
1	0	519.290	.12	0.346	0.11	0.11	58	53	1.8	231	69	—	119
2	2	519.7	.14	0.374	0.12	0.12	59	54	1.7	230	66	—	119
3	4	520.2	.16	0.400	0.14	0.14	61	55	1.7	238	64	—	116
4	6	520.7	.12	0.346	0.11	0.11	63	57	1.6	236	64	—	118
→5	8	521.1	.03	0.173	0.03	0.03	63	59	0	237	66	—	119
6	10	521.3	.03	0.173	0.03	0.03	63	59	0	243	66	—	118
7	12	521.4	.03	0.173	0.03	0.03	64	61	0	240	67	—	116
8	14	521.6	.03	0.173	0.03	0.03	65	61	0	238	67	—	118
9	16	521.8	.03	0.173	0.03	0.03	67	63	0	242	67	—	112
→10	18	522.0	.29	0.538	0.25	0.25	71	64	2.1	241	64	—	112
11	20	522.6	.47	0.685	0.41	0.41	76	65	2.8	243	60	—	119
12	22	523.4	.52	0.721	0.45	0.45	79	67	3.0	243	58	—	119
13	24	524.3	.52	0.721	0.45	0.45	81	68	3.0	246	56	—	118
14	26	525.1	.51	0.714	0.44	0.44	[illegible]	69	3.0	250	55	—	118
15	28	525.9	.48	0.693	0.41	0.41	83	70	2.9	248	54	—	118
16	30	526.8	.46	0.678	0.40	0.40	84	72	2.9	247	54	—	118
17	32	527.6	.46	0.678	0.40	0.40	85	73	2.9	249	54	—	118
18	34	528.4	.46	0.678	0.40	0.40	86	74	2.9	252	55	—	117
	36	529.2											
							5578						4264
Total	Vm	50.447		18.24		9.74	77.5°F						118.4°F
Average				√P 0.507		ΔH 0.271	537.5°R						578.4°R

1.0389 (48.558) = 50.447

21.810 × 1.0389 = 22.658

40.909 / 72 = 0.568

Orsat
%CO_2 = 1.4
%O_2 = 22.6
%CO = 0.0

Stack Area: 9.621
Water: 123.2
Catch = 0.1452 w/(BH)

118.8 / 578.8

Avg. ΔH = 0.334 Avg. Tm: 548.1°R

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-07-S-P
Sampling Location R-9 RA-22A-B
Date 05/25/88
Start Time 10:47
Finish Time
Filter No.

Assumed Moisture, % .10
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 24.06
Initial Leak Check, CFS
CFM at in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-22A West X-27

Point No. West Port	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O √P	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F 69°	Stack Press. in. Hg	Stac. Temp. °F
1	0	529.2	.20	0.447	0.17	0.17	83	79	2.0	260	61		116
2	2	529.9	.21	0.458	0.18	0.18	85	80	2.0	259	58		116
3	4	530.4	.24	0.490	0.22	0.22	87	90	2.1	263	57		118
4	6	531.0	.25	0.500	0.22	0.22	88	91	2.1	262	56		117
5	8	531.6	.25	0.500	0.22	0.22	86	82	2.1	260	56		119
6	10	532.2	.17	0.412	0.15	0.15	88	82	1.9	263	55		120
7	12	532.7	.04	0.200	0.03	0.03	85	83	0	265	56		120
8	14	533.0	.17	0.412	.15	0.15	88	84	2.0	268	57		117
9	16	533.2	.17	0.412	.15	0.15	89	84	2.0	264	57		119
10	18	534.0	.20	0.447	0.17	0.17	89	85	2.0	265	57		119
11	20	534.5	.47	0.685	0.41	0.41	92	85	3.0	263	56		119
12	22	535.3	.52	0.721	0.45	0.45	95	85	3.1	258	53		119
13	24	536.2	.50	0.707	0.43	0.43	96	85	3.1	261	53		118
14	26	537.0	.49	0.700	0.42	0.42	96	86	3.0	261	53		119
15	28	537.9	.46	0.678	0.40	0.40	96	86	3.0	261	53		119
16	30	538.7	.46	0.678	0.40	0.40	97	87	3.0	261	53		119
17	32	539.5	.46	0.678	0.40	0.40	97	87	3.0	254	52		120
18	34	540.3	.46	0.678	0.40	0.40	97	89	3.0	259	52		120
	36	541.1											
Total													
Average													

STACK SAMPLING FIELD DATA

Company: FMC Wy Corp.
Plant Location: Green River, Wy.
Run No.: 88-07-S-P
Sampling Location: R-9 RA-22A+B
Date: 05/25/88
Start Time: 11:37
Finish Time: 12:13
Filter No.:

Assumed Moisture, %: 10
Probe Tip Diameter, in.: .18
Probe Length, ft.: 5
Ambient Temperature, °F:
Bar. Pressure, in. Hg.: 24.06
Initial Leak Check, CFS / CFM ____ at ____ in. Hg.
Final Leak Check, CFS / CFM ____ at ____ in. Hg.

RA-22B EAST X-26

Point No. Port	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot in. H_2O √P	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	541.1	.23	0.480	0.20	0.20	92	89	2.0	252	67		117
2	2	541.8	.25	0.500	0.22	0.22	94	90	2.1	251	65		118
3	4	542.3	.21	0.458	0.18	0.18	95	91	2.0	249	63		119
4	6	542.9	.20	0.447	0.17	0.17	95	91	2.0	256	61		121
5	8	543.5	.21	0.458	0.18	0.18	96	91	2.0	256	66		119
[illegible]	10	544.0	.24	0.490	0.21	0.21	97	92	2.1	257	59		120
[illegible]	12	544.6	.21	0.458	0.18	0.18	96	92	2.0	258	.59		120
8	14	545.2	.18	0.424	0.15	0.15	97	92	2.0	259	60		119
9	16	545.7	.17	0.412	0.14	0.14	97	92	2.0	261	61		120
10	18	546.2	.35	0.592	0.30	0.30	99	93	2.8	253	59		120
11	20	546.9	.81	0.900	0.70	0.70	103	93	4.0	258	56		120
12	22	547.9	.89	0.943	0.77	0.77	104	93	4.0	262	55		120
13	24	549.0	.87	0.933	0.75	0.75	105	93	4.1	260	54		120
14	26	550.1	.85	0.922	0.73	0.73	106	94	4.1	253	53		120
15	28	551.2	.80	0.894	0.69	0.69	105	94	4.1	259	53		120
16	30	552.3	.78	0.883	0.67	0.67	106	94	4.1	259	53		119
17	32	553.3	.78	0.883	0.67	0.67	106	95	4.1	258	54		119
18	34	554.3	.78	0.883	0.67	0.67	107	95	4.1	256	54		120
	36	555.4											
							7112						4296
Total		22.659			14.32		98.8°F						119.1°F
Average		√ΔP 0.629			ΔH: 0.398		558.8°R						579.1°R

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.

Plant Location Green River, Wy.

Run No. 88-07-S-P

Sampling Location R-9 RA-22A+B

Date 05/25/88

Start Time 12:27

Finish Time 13:03

Filter No.

Assumed Moisture, % 10

Probe Tip Diameter, in. .18

Probe Length, ft. 5

Ambient Temperature, °F

Bar. Pressure, in. Hg. 24.06

Initial Leak Check, CFS

CFM at in. Hg.

Final Leak Check, CFS

CFM .00 / at 5.0 in. Hg.

RA-22B EAST X-26

Point No. (Test Port)	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot in. H_2O VP	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	555.4	.16	0.400	0.14	0.14	99	97	2.0	245	73		115
2	2	555.9	.16	0.400	0.14	0.14	100	97	2.0	249	74		117
3	4	556.4	.16	0.400	0.14	0.14	101	98	2.0	254	73		117
4	6	556.9	.14	0.374	0.12	0.12	101	98	1.9	252	73		117
5	8	557.3	.13	0.360	0.11	0.11	101	99	1.9	253	73		117
6	10	557.7	.12	0.346	0.10	0.10	101	99	1.9	250	74		118
7	12	558.1	.09	0.300	0.08	0.08	100	99	1.0	249	75		120
8	14	558.4	.06	0.245	0.05	0.05	100	99	0.03	255	77		114
9	16	558.7	.05	0.224	0.04	0.04	99	99	0.03	256	78		120
10	18	558.9	.21	0.458	0.18	0.18	101	99	2.2	245	76		119
11	20	559.5	.45	0.671	0.39	0.39	104	99	3.1	256	72		119
12	22	560.2	.71	0.843	0.61	0.61	106	99	4.0	252	69		120
13	24	561.2	.91	0.954	0.79	0.79	108	99	4.1	250	66		121
14	26	562.3	.94	0.969	0.81	0.81	109	99	4.1	252	64		121
15	28	563.4	.91	0.954	0.79	0.79	110	99	4.1	253	63		119
16	30	564.6	.87	0.933	0.75	0.75	110	99	4.1	251	63		119
17	32	565.6	.87	0.933	0.75	0.75	110	100	4.1	253	63		119
18	34	566.7	.87	0.933	0.75	0.75	111	100	4.1	249	63		115
	36	567.848											
Total													
Average													

1.148 × 1.0989

11.188

TEST NO. 88-07-S-P DATE 05/25/88

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg
Vm=Volume (ft3) of gas at meter conditions
Tm=Average dry gas meter temperature (R)
Pbar=Barometric pressure (in. Hg)
deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 50.45*(24.06+0.334/13.6)/548.1 = 39.259 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor
Vlc=Total volume of water collected (ml)

Vwstd = .00474* 123.2 = 5.840 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 5.84*100/(5.84+ 39.26) = 12.949 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)
Mn=Total particulate collected (gm)

Cs' = 15.43*0.1952/(39.26+ 5.84) = 0.0568 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)
Ts=Stack absolute temperature (R)
deltaP=Average pitot reading (in. WG)
Mw=Molecular wt. of stack gas (lb/lb mole)
Kp=Pitot tube coefficient

Mw=0.18*12.95+0.44* 1.22+0.32*10.97+0.28*74.86 = 27.339 lb/mole

RA-22A V=0.84*85.48*0.507*SQR(578.4/(27.34*24.06)) = 34.137 ft/sec
RA-22B V=0.84*85.48*0.629*SQR(579.1/(27.34*24.06)) = 42.377 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions
A=Stack area (ft2)
SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-22A ACFM = 34.14* 9.621*60 = 19706 acfm
RA-22B ACFM = 42.38* 9.621*60 = 24463 acfm
RA-22A SCFM = 19706*530*24.06/(578.4*29.92) = 14520 scfm
RA-22B SCFM = 24463*530*24.06/(579.1*29.92) = 18004 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0568* 32524*60/7000 = 18.62 Lb/Hr

ISOKINETIC RATE

I = 105.3018 %

(2)

LABORATORY DATA

Company ______________________ Run No. 88-07-5-P

Sampling Location R#22A-B Date 5-25-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	682.7	
	Initial Weight/Volume	579.1	
	Increase	103.6	103.6
IMPINGER 2	Final Weight/Volume	555.7	
	Initial Weight/Volume	546.4	
	Increase	9.3	9.3
IMPINGER 3	Final Weight/Volume	435.6	
	Initial Weight/Volume	434.2	
	Increase	1.4	1.4
IMPINGER 4	Final Weight/Volume	643.0	
	Initial Weight/Volume	634.1	
	Increase	8.9	8.9
	TOTAL MOISTURE CATCH		123.2

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

2S
74.3840
74.3486
.0354

Filter & Particulates	0.6890
Filter Tare Weight	0.5342
Particulate	0.1548
Washings	0.0354
Particulate Catch	0.1902
Acetone Blank	0.0024
TOTAL FRONT CATCH	0.1878

~~acetone blank one not modified~~

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

2B
74.7540
74.7516
.0024

2BH

Extractable Weight	75.4690
Boil Down Weight	75.4526
Impinger Catch	0.0074
Water Blank	X
TOTAL BACK CATCH	0.0074
TOTAL TRAIN CATCH	0.1952

Separate blank for each run out of dedicated wash bottle

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp. — Assumed Moisture, % 10

Plant Location Green River, Wy. — Probe Tip Diameter, in. .18

Run No. 88-08-S-P — Probe Length, ft. 5

Sampling Location RA-22 A+B R-9 — Ambient Temperature, °F

Date 5-26-88 — Bar. Pressure, in. Hg. 24.00

Start Time 10:03 — Initial Leak Check, CFS

CFM .00 at 15 in. Hg.

Finish Time 10:39 — Final Leak Check, CFS

Filter No. CFM ____ at ____ in. Hg.

RA-22 B "EAST" X-26

Point No. West Port	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F 74°F	Stack Press. in. Hg	Stack Temp. °F
					*		63	62					
1	0	568.864	0.29	0.538	0.25	0.25	66	61	2.6	227	73		121
2	2	569.5	0.31	0.557	0.27	0.27	67	62	2.7	236	72		120
3	4	570.1	0.25	0.500	0.22	0.22	70	63	2.2	235	71		120
4	6	570.7	0.21	0.458	0.18	0.18	71	64	2.0	243	70		121
5	8	571.2	0.24	0.490	0.21	0.21	73	66	2.2	256	69		122
6	10	571.8	0.25	0.500	0.22	0.22	75	67	2.2	240	68		121
7	12	572.4	0.21	0.458	0.18	0.18	76	68	2.1	239	69		121
8	14	573.0	0.15	0.387	0.13	0.13	77	69	2.0	243	68		121
9	16	573.4	0.14	0.374	0.12	0.12	78	70	2.0	235	69		123
10	18	573.9	0.39	0.624	0.33	0.33	82	72	3.0	243	67		121
11	20	574.6	0.80	0.894	0.69	0.69	87	73	4.2	246	64		121
12	22	575.6	0.90	0.949	0.78	0.78	89	74	4.7	249	62		121
13	24	576.7	0.90	0.949	0.78	0.78	90	76	4.9	256	61		121
14	26	577.8	0.89	0.943	0.77	0.77	92	77	4.9	256	60		121
15	28	578.9	0.82	0.905	0.71	0.71	92	78	4.6	257	60		120
16	30	580.0	0.83	0.911	0.71	0.71	93	79	4.6	249	61		120
17	32	581.0	0.83	0.911	0.71	0.71	94	80	4.6	248	61		120
18	34	582.1	0.83	0.911	0.71	0.71	95	81	4.6	253	62		121
	36	583.2			*								

50.467

1.0389 × 48.577 = 50.423

29.876 × 1.0389 = 29.958 − 29.529 = 50.467

Orsat
%CO₂ = 1.3
%O₂ = 15.1
%CO = 0.0

Stack Area = 9.621
Water = 140.9
Catch = 0.2015

6037 — 0.2115

Total	Vm	50.423	24.568		15.94		83.8°F						120.5°
Average		50.467	ΔP=0.682		ΔH=0.443		543.8°R						580.5°

Avg. ΔH = 0.328 — Avg. Tm = 553.4

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-08-S-P
Sampling Location RA-22 A+B
Date 5-26-88
Start Time 10:54
Finish Time 11:30
Filter No.

Assumed Moisture, % 10
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 24.00
Initial Leak Check, CFS
CFM at in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-22 B "EAST" X-26

Point No. East Port	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
					*								
1	0	583.2	0.21	0.458	0.18	0.18	99	85	2.3	250	84		119
2	2	583.7	0.42	0.646	0.36	0.36	92	86	3.1	239	79		116
3	4	584.5	0.42	0.648	0.36	0.36	94	86	3.2	243	75		119
4	6	585.2	0.40	0.632	0.34	0.34	95	87	3.0	252	72		120
5	8	586.0	0.37	0.608	0.32	0.32	96	88	3.0	240	72		120
6	10	586.8	0.34	0.583	0.29	0.29	96	88	3.0	250	71		121
7	12	587.5	0.24	0.490	0.21	0.21	96	89	2.9	251	71		121
8	14	588.1	0.14	0.374	0.12	0.12	95	89	2.1	254	73		121
9	16	588.5	0.08	0.283	0.07	0.07	93	89	0.4	251	74		121
10	18	588.9	0.20	0.447	0.17	0.17	95	90	2.6	259	74		121
11	20	589.4	0.44	0.663	0.38	0.38	99	90	3.3	250	71		121
12	22	590.2	0.71	0.843	0.61	0.61	102	91	4.3	253	68		121
13	24	591.1	0.86	0.927	0.74	0.74	104	92	5.0	252	65		120
14	26	592.2	0.90	0.949	0.78	0.78	105	93	5.1	243	65		120
15	28	593.3	0.88	0.938	0.76	0.76	105	93	5.1	249	65		120
16	30	594.4	0.88	0.938	0.76	0.76	105	93	5.2	245	65		120
17	32	595.6	0.88	0.938	0.76	0.76	106	94	5.2	253	66		120
18	34	596.6	0.86	0.928	0.71	0.76	106	94	5.3	253	67		120
	36	597.7			*								
Total													
Average													

STACK SAMPLING FIELD DATA

Company: FMC Wy. Corp.

Plant Location: Green River, Wy

Run No. 88-08-S-P

Sampling Location: RA-22 A+B R-9

Date: 05-26-88

Start Time: 11:50

Finish Time: 12:26

Filter No. ______

Assumed Moisture, %: 10

Probe Tip Diameter, in.: .18

Probe Length, ft.: 5

Ambient Temperature, °F: ______

Bar. Pressure, in. Hg.: 24.00

Initial Leak Check, CFS/CFM ______ at ______ in. Hg.

Final Leak Check, CFS/CFM ______ at ______ in. Hg.

RA-22 A "West" X-27

Point No. East Port	Time (min)	Dry Gas Meter FT³	Pitot in. H_2O P	Pitot √P	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	597.7	.12	0.346	.11	.11	98	96	2.1	243	91		117
2	2	598.4	.12	0.346	.11	.11	99	96	2.1	253	89		118
3	4	598.8	.12	0.346	.11	.11	99	97	2.1	254	88		119
4	6	599.3	.11	0.332	.10	.10	100	97	2.1	255	87		119
5	8	599.7	.08	0.283	.07	.07	99	97	1.0	248	85		117
6	10	600.0	.04	0.200	.03	.03	98	97	0.5	267	85		120
7	12	600.3	.02	0.141	.01	.01	98	97	0.6	251	85		120
8	14	600.5	.02	0.141	.01	.01	98	97	0.8	248	85		119
9	16	600.7	.02	0.141	.01	.01	98	98	0.8	255	85		119
10	18	601.0	.21	0.458	.18	.18	100	98	2.9	252	82		120
11	20	601.5	.45	0.671	0.39	0.39	105	98	3.8	249	76		121
12	22	602.4	.48	0.693	0.42	0.42	106	98	4.0	255	75		120
13	24	603.2	.47	0.686	0.41	0.41	107	99	4.0	261	75		120
14	26	604.0	.45	0.671	0.39	0.39	108	99	4.0	246	75		119
15	28	604.8	.42	0.648	0.36	0.36	108	99	3.8	246	76		119
16	30	605.6	.42	0.648	0.36	0.36	108	100	3.8	248	75		119
17	32	606.4	.42	0.648	0.36	0.36	109	100	3.8	245	75		118
18	34	607.2	.42	0.648	0.36	0.36	109	101	3.8	259	75		118
	36	608.0											
				5			7421						4317
Total				16.162		7.67	103.1°F						119.9°F
Average			√P: 0.449		ΔH: 0.213		563.1°R						579.9°R

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-08-SP
Sampling Location RA-22 A+B R-9
Date 5-26-88
Start Time 12:39
Finish Time 13:15
Filter No.

Assumed Moisture, % 10
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 24.00
Initial Leak Check, CFS
CFM at in. Hg.
Final Leak Check, CFS
CFM .004 at 5.5 in. Hg.

RA-22 A "West" X-27

Point No. (West Port)	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	609.0	.09	0.300	.09	.09	105	102	2.2	244			117
2	2	608.5	.09	0.300	.09	.08	105	103	2.2	253			117
3	4	609.2	.11	0.332	.10	.10	106	104	2.2	259			120
4	6	609.3	.11	0.332	.10	.10	106	104	2.1	257			120
5	8	609.7	.08	0.283	.07	.07	105	104	1.9	263			121
6	10	610.0	.03	0.173	.02	.02	104	104	0.4	250			120
7	12	610.1	.03	0.173	.02	.02	103	104	0.3	245			121
8	14	610.2	.03	0.173	.02	.02	103	104	0.3	249			120
9	16	610.4	.03	0.173	.02	.02	103	104	0.3	242			120
→10	18	610.5	.18	0.424	.15	.15	104	104	2.6	238			121
11	20	611.0	.47	0.685	.41	.41	110	104	3.9	243	76		121
12	22	611.8	.50	0.707	.43	.43	112	104	4.0	251	73		122
13	24	612.6	.50	0.707	.43	.43	112	104	4.0	264	71		123
14	26	613.5	.48	0.693	.42	.42	112	104	4.0	270	69		124
15	28	614.3	.45	0.671	.39	.39	112	104	3.9	259	67		123
16	30	615.	.44	0.663	.38	.38	112	104	3.9	264	65		121
17	32	615.9	.44	0.663	.38	0.38	112	105	3.9	275	65		123
18	34	616.7	.44	0.663	.38	0.38	113	105	3.9	262	65		120
	36	*617.441											
		↑ 617.441											
		19.741											
		×1.0369											
		20.509											
Total													
Average													

TEST NO. 88-08-S-P DATE 05-26-1988

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg
Vm=Volume (ft3) of gas at meter conditions
Tm=Average dry gas meter temperature (R)
Pbar=Barometric pressure (in. Hg)
deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 50.42*(24.00+0.328/13.6)/553.4 = 38.766 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor
Vlc=Total volume of water collected (ml)

Vwstd = .00474* 140.9 = 6.679 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 6.68*100/(6.68+ 38.77) = 14.696 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)
Mn=Total particulate collected (gm)

Cs' = 15.43*0.2015/(38.77+ 6.68) = 0.0684 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)
Ts=Stack absolute temperature (R)
deltaP=Average pitot reading (in. WG)
Mw=Molecular wt. of stack gas (lb/lb mole)
Kp=Pitot tube coefficient

Mw=0.18*14.70+0.44* 1.11+0.32*12.88+0.28*71.31 = 27.223 lb/mole

RA-22A V=0.84*85.48*0.449*SQR(579.9/(27.22*24.00)) = 30.373 ft/sec
RA-22B V=0.84*85.48*0.682*SQR(580.5/(27.22*24.00)) = 46.159 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions
A=Stack area (ft2)
SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-22A ACFM = 30.37* 9.621*60 = 17533 acfm
RA-22B ACFM = 46.16* 9.621*60 = 26646 acfm
RA-22A SCFM = 17533*530*24.00/(579.9*29.92) = 12854 scfm
RA-22B SCFM = 26646*530*24.00/(580.5*29.92) = 19514 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0684* 32368*60/7000 = 18.98 Lb/Hr

ISOKINETIC RATE

I = 106.619 %

(3)

LABORATORY DATA

Company: FMC Run No. 88-08-S-P

Sampling Location RA 29A-B Date 5-26-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	685.2	
	Initial Weight/Volume	565.4	
	Increase	119.8	119.5
IMPINGER 2	Final Weight/Volume	576.4	
	Initial Weight/Volume	565.9	
	Increase	10.5	10.5
IMPINGER 3	Final Weight/Volume	449.4	
	Initial Weight/Volume	448.3	
	Increase	1.1	1.1
IMPINGER 4	Final Weight/Volume	626.9	
	Initial Weight/Volume	617.1	
	Increase	9.8	9.8
	TOTAL MOISTURE CATCH		140.9

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

3S
75.6571
75,6250
.0321

Filter & Particulates	0.7072
Filter Tare Weight	0.5317
Particulate,	0.1755
Washings	0.0321
Particulate Catch	0.2076
Acetone Blank	0.0003
TOTAL FRONT CATCH	0.2073

3B
73.7849
73,7846
.0003

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

3BH

Extractable Weight	73.3101
Boil Down Weight	73.3059
Impinger Catch	0.0042
Water Blank	0.0000
TOTAL BACK CATCH	0.0042
	0.2115
TOTAL TRAIN CATCH	~~0.2015~~

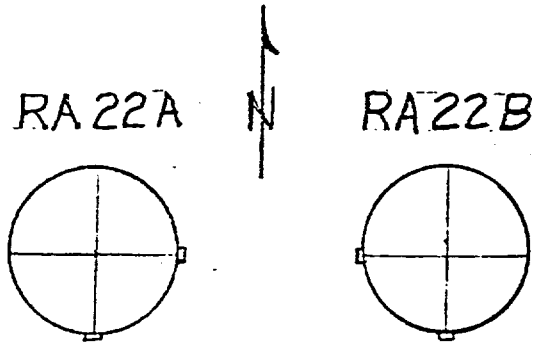
Section A-2, Information

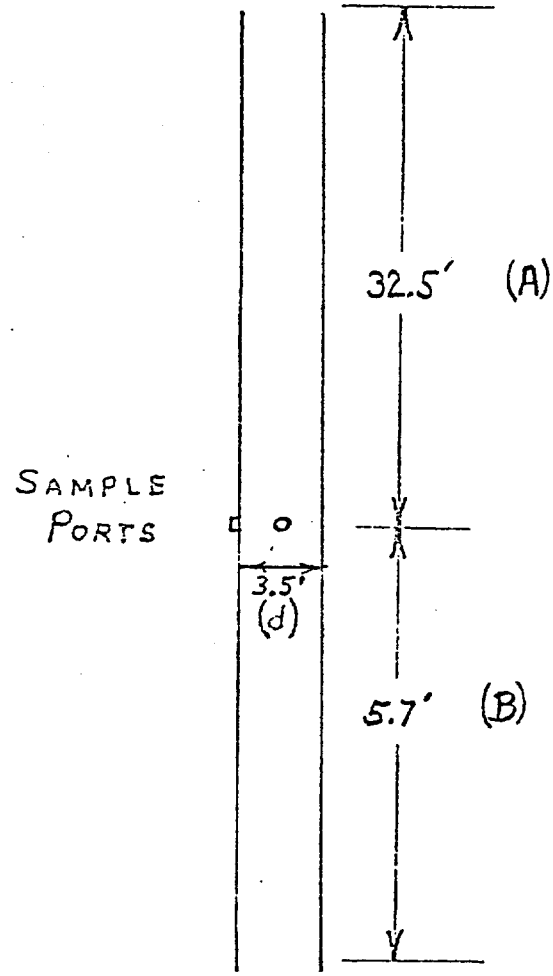
- Drawing showing location of sample ports and number of points per traverse

FMC Corporation

Industrial Chemical Division
Box 872
Green River Wyoming 82935
(307) 875 2580

RA 22 A & B





$\frac{B}{d} = 1.6$

NO. OF POINTS PER TRAVERSE = 36*
NO. OF POINTS PER DIAMETER = 18
NO. OF DIAMETERS PER RUN = 4 (2 EACH DUCT)
SAMPLE TIME PER POINT = 2 MINUTES

TRAVERSE POINTS ON EACH DIAMETER

	% OF DIAMETER	DISTANCE FROM INSIDE WALL (IN.)	DISTANCE FROM COUPLING (IN.)
1	1.4	1.00**	4.00**
2	4.4	1.84	4.84
3	7.5	3.15	6.15
4	10.9	4.58	7.58
5	14.6	6.13	9.13
6	18.8	7.90	10.90
7	23.6	9.91	12.91
8	29.6	12.43	15.43
9	38.2	16.04	19.04
10	61.8	25.96	28.96
11	70.4	29.57	32.57
12	76.4	32.09	35.09
13	81.2	34.10	37.10
14	85.4	35.87	38.87
15	89.1	37.42	40.42
16	92.5	38.85	41.85
17	95.6	40.15	43.15
18	98.6	41.00**	44.00**

* VERBAL FROM WOODY RUSSELL ON MARCH 1, 1977

** ADJUSTED TO MAINTAIN 1 INCH MINIMUM FROM WALL

Certified Mail No.: P 113 178 783

FMC Wyoming Corporation

Box 872
Green River Wyoming 82935
307 875 2580

June 15, 1988

FMC

Mr. Lee Gribovicz
District II Engineer
Air Quality Division
Department of Environmental Quality
210 Lincoln Street
Lander, Wyoming 82520

RE: Preliminary Compliance Test Results — Emission Source: RA-23 A&B

Dear Mr. Gribovicz:

Particulate emission tests were run on source RA-23 A&B to demonstrate this unit's compliance with its allowable emission. These tests were run on June 1 and 2, 1988. In a June 3, 1988, letter the Division was presented the preliminary results of these tests. Enclosed with this letter, you will find the final report of this testwork.

Included in this report is the following information:

- Summary of the test results
- Sampling and analysis procedures
- Appendix which includes:
  - o Field data
  - o Laboratory worksheet
  - o Calculations for each test

- Diagram showing
  - o Location of sample ports
  - o Location and number of sample points in each diameter

A CONFIDENTIAL Section is included with the report which contains the control room logsheets of operating parameters monitored during the testwork. As provided for in § 35-11-1101 of the Wyoming Environmental Quality Act, we consider this information to be trade secret and proprietary as it is not available to the public or our competitors. We would appreciate you treating it as such.

If you have any questions concerning this report, or need any additional information, give me a call.

Yours very truly,

Carl R. Demshar, Jr.
Environmental Manager

jc

cc: Charles Collins, DEQ - Cheyenne
JW Coykendall*, JF Herink* - Green River

* Summary Table I included with cover letter.

COMPLIANCE TEST REPORT
EMISSION SOURCE RA-23 A&B
FMC WYOMING CORPORATION
GREEN RIVER, WYOMING

June 15, 1988

COMPLIANCE TEST REPORT

EMISSION SOURCE: RA-23 A&B

FMC WYOMING CORPORATION
GREEN RIVER, WYOMING

TEST DATE: JUNE 1 and 2, 1988
REPORT DATE: JUNE 15, 1988

COMPLIANCE TEST REPORT
EMISSION SOURCE: RA-23 A&B

Section

Introduction

In an effort to demonstrate compliance of emission source RA-23 A&B, emission tests were run on June 1 and 2, 1988.

FMC Wyoming Corporation personnel taking part in the testwork were:

Ted Brown	Environmental Engineer
Simon Lee	Environmental Engineering Aide
Kieth Norris	Senior Laboratory Analyst

Summary of Results

This section summarizes the results of the compliance tests performed on emission source RA-23 A&B. Table I is a general summary showing the individual test results in relation to the maximum allowable emission for this source. Table II is a summary of the results obtained from each compliance test. Details of the individual tests, including field data sheets, laboratoty data sheets, and calculation sheets can be found in the Appendix.

From Table I, it can be seen that the individual test results, as well as the three-test average, are well below the allowable emission rate for this particular unit.

TABLE I

Comparison of Compliance Test Results
With Allowable Emission Rates

Emission Source	Test Number	Emission Rate, lb/hr	
		Compliance Test	Allowable
RA-23 A&B	88-09-S-P	31.3	35.0
RA-23 A&B	88-10-S-P	28.2	35.0
RA-23 A&B	88-11-S-P	28.8	35.0
	Average:	29.4	35.0

TABLE II

SUMMARY OF STACK SAMPLING CALCULATIONS

Stack: RA-23 A & B

	TEST 1	TEST 2	TEST 3
Test Code Number	88-09-SP	88-10-SP	88-11-SP
Barometric Pressure at site, (in Hg)	24.04	24.04	24.17
Absolute stack gas pressure, (in Hg)	24.04	24.04	24.17
Absolute average stack gas temp. A, (R)	607.7	606.4	598.4
Absolute average stack gas temp. B, (R)	607.1	604.5	599.1
Absolute average dry gas meter temp., (R)	546.8	561.2	556.3
Total volume of water collected, (ml)	423.8	421.0	438.0
Volume of gas through dry gas meter, (ft3)	74.865	76.449	76.431
Average pressure drop across orifice, (in H2O)	0.847	0.855	0.846
Pitot tube coefficient	0.84	0.84	0.84
Average velocity head of stack gas A, (in H2O)	1.230	1.205	1.240
Average velocity head of stack gas B, (in H2O)	1.023	1.067	1.014
Cross sectional area of stack, (ft2)	7.069	7.069	7.069
Front half particulate collected, (gm)	0.3934	0.3670	0.3646
Back half particulate collected, (gm)	0.0007	0.0006	0.0001
Total particulate collected, (gm)	0.3941	0.3676	0.3647
Total sampling time, (min)	128	128	128
Cross sectional area of nozzle, (ft2*10-4)	1.7672	1.7672	1.7672
Gas volume A, (acfm)	36723	36267	36619
Gas volume B, (acfm)	30528	32063	29962
Gas volume A, (scfm)	25733	25468	26200
Gas volume B, (scfm)	21413	22587	21412
Percent isokinetic	104.56	108.21	105.12
Emission rate, (lb/hr)	31.29	28.20	28.81

Sampling and Analysis Procedure

Compliance testing on emission source RA-23 A&B was conducted on June 1 and 2 using EPA Method No. 5, "Determination of Particulate Emissions from Stationary Sources". This unit consists of two stacks, RA-23A and RA-23B. Each emission test consisted of traversing two sample diameters in each stack with 16 points being sampled on each diameter. Each point was sampled for two minutes resulting in a sample time of 64 minutes for each stack, with the total time for each emission sample being 128 minutes. One sample train was used for each emission test. Figure 1, located in Section A-2 of the Appendix, shows the location of the sample ports in relation to the nearest flow disturbance (an expansion, contraction, or bend in the stack). This diagram also shows the location of the sample points in each sample diameter.

Control room logsheets, containing operating data pertinent to the unit during the testwork, can be found in the Confidential Section of this report.

Calculation of Production Rate:

Emission Source: RA-23 A&B
Test Date: June 1, and 2, 1988

Test No. 88-09-S-P	29.4 tons per hour
Test No. 88-10-S-P	30.9 tons per hour
Test No. 88-11-S-P	31.3 tons per hour

Details of these calculations, along with the control room logsheets which contain the data used in these calculations, can be found in the Confidential packet.

APPENDIX

Section A-1, Test Data

- Field Data Sheets
- Laboratory Data Sheets
- Test Calculations
- Preliminary Test Data

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-09-S-P
Sampling Location RA-23A+B
Date 6-1-88
Start Time 09:42 / 10:21
Finish Time 10:14 / 10:53
Filter No.

Assumed Moisture, % 20
Probe Tip Diameter, in. .19 (1.76715)
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 24.04
Initial Leak Check, CFS
CFM .012 at 15 in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-23A "West" X-13

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O √P	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F 51°F	Stack Press. in. Hg	Stack Temp. °F
South					0.52								
1	0	629.910	1.15	1.072	0.75	0.75	65	55	3.4	230	47		116
2	4	631.9	1.2	1.095	0.79	0.79	72	58	4.2	237	46		149
3	8	634.0	1.5	1.225	0.98	0.98	76	61	5.2	240	43		151
4	12	636.3	1.8	1.342	1.18	1.18	79	63	6.0	233	45		151
5	16	638.9	1.9	1.378	1.24	1.24	82	66	7.0	247	45		153
6	20	641.6	2.2	1.483	1.44	1.44	84	68	8.3	246	44		154
7	24	644.5	2.1	1.449	1.38	1.38	85	70	9.0	239	45		152
8	28	647.4	2.1	1.449	1.38	1.38	86	72	9.0	256	46		150
	32	650.3											
		38.990											
		Δ 11.0389											
		40.403											
Cross													
1	0	650.3	0.89	0.943	0.59	0.59	83	75	4.5	247	53		145
2	4	652.3	1.05	1.025	0.69	0.69	87	77	5.0	244	51		150
3	8	654.3	1.3	1.140	0.85	0.85	90	79	6.0	245	48		154
4	12	656.6	1.45	1.204	0.95	0.95	91	79	6.8	244	48		151
5	16	659.0	1.60	1.265	1.05	1.05	92	80	7.2	243	46		149
6	20	661.5	1.50	1.225	0.98	0.98	93	81	7.1	238	46		150
7	24	664.0	1.45	1.204	0.95	0.95	93	81	7.1	249	47		151
8	28	666.4	1.40	1.183	0.92	0.92	94	82	7.2	245	51		154
	32	668.8											
1.0389	X 72.062	74.865							Orsat				
									%CO₂ = 3.6				
									%O₂ = 14.5				
									%CO = 0.0				
									Stack Area: 7.069				
									Water: ~~485.8~~ 424.1				
							2478						2563
Total	Vm	74.865	19.68			16.12	78.1°F						147.7
Average			VP 1.230		ΔH 1.008		538.1°R						607.7

Avg. ΔH 0.847 Avg. Tm: 546.8°R

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy.
Run No. 88-09-S-P
Sampling Location RA-23 A+B R-13
Date 6-1-88
Start Time 11:04 / 11:45
Finish Time 11:36 / 12:17
Filter No.

Assumed Moisture, % 20
Probe Tip Diameter, in. .18
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg.
Initial Leak Check, CFS
CFM at in. Hg.
Final Leak Check, CFS
CFM .002 at 9.0 in. Hg.

RA-23-B "EAST" X-12

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	668.8	0.89	0.913	0.54	0.54	90	83	5.2	246	58		132
2	4	670.8	0.99	0.995	0.66	0.66	94	84	5.5	229	55		155
3	8	672.8	1.10	1.049	0.72	0.72	96	85	6.0	237	53		155
4	12	674.9	1.15	1.072	0.75	0.75	98	96	6.3	248	52		152
5	16	677.0	1.15	1.072	0.75	0.75	99	88	6.9	243	53		152
6	20	679.2	1.10	1.049	0.72	0.72	100	89	6.9	243	55		151
7	24	681.3	1.10	1.049	0.72	0.72	101	90	7.0	227	55		153
8	28	683.4	1.10	1.049	0.72	0.72	102	91	6.8	251	55		146
	32	685.5											
		33.1 x 1.049 = 34.7											
1	0	685.5	0.83	0.911	0.54	0.54	98	92	5.5	241	60		117
2	4	687.4	0.96	0.980	0.62	0.62	102	94	6.0	242	56		142
3	8	689.3	1.0	1.000	0.66	0.66	103	94	6.7	242	55		150
4	12	691.4	1.15	1.072	0.75	0.75	104	95	7.2	249	53		151
5	16	693.5	1.10	1.049	0.72	0.72	104	95	7.4	244	54		150
6	20	695.6	1.15	1.072	0.75	0.75	105	95	7.8	242	54		150
7	24	697.8	1.05	1.025	0.69	0.69	105	96	7.8	247	55		147
8	28	699.9	0.98	0.990	0.64	0.64	105	96	7.2	234	55		146
	32	701.972											
													2353
							3059 ✓						
Total			16.377		11.000		95.6°F ✓						147.1°F
Average			vp 1.023		ΔH 0.688 ✓		555.6°R						607.1°R
			1.024										

147.1 + 460 = 607.1

TEST NO. 88-09-S-P DATE 06/01/88

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg
Vm=Volume (ft3) of gas at meter conditions
Tm=Average dry gas meter temperature (R)
Pbar=Barometric pressure (in. Hg)
deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 74.87*(24.04+0.847/13.6)/546.8 = 58.442 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor
Vlc=Total volume of water collected (ml)

Vwstd = .00474* 423.8 = 20.088 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 20.09*100/(20.09+ 58.44) = 25.580 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)
Mn=Total particulate collected (gm)

Cs' = 15.43*0.3941/(58.44+ 20.09) = 0.0774 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)
Ts=Stack absolute temperature (R)
deltaP=Average pitot reading (in. WG)
Mw=Molecular wt. of stack gas (lb/lb mole)
Kp=Pitot tube coefficient

Mw=0.18*25.58+0.44* 2.68+0.32*10.79+0.28*60.95 = 26.302 lb/mole

RA-23A V=0.84*85.48*1.230*SQR(607.7/(26.30*24.04)) = 86.582 ft/sec
RA-23B V=0.84*85.48*1.023*SQR(607.1/(26.30*24.04)) = 71.976 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions
A=Stack area (ft2)
SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-23A ACFM = 86.58* 7.069*60 = 36723 acfm
RA-23B ACFM = 71.98* 7.069*60 = 30528 acfm
RA-23A SCFM = 36723*530*24.04/(607.7*29.92) = 25733 scfm
RA-23B SCFM = 30528*530*24.04/(607.1*29.92) = 21413 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0774* 47147*60/7000 = 31.29 Lb/Hr

ISOKINETIC RATE

I = 104.5606 %

(1)

LABORATORY DATA

Company FMC Run No.: 88-09-5-D

Sampling Location RA 23A & B Date: 6-1-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	820.5	
	Initial Weight/Volume	574.0	
	Increase	246.5	246.5
IMPINGER 2	Final Weight/Volume	717.8	
	Initial Weight/Volume	563.0	
	Increase	154.8	154.5 8
IMPINGER 3	Final Weight/Volume	459.6	
	Initial Weight/Volume	455.8	
	Increase	3.8	3.8
IMPINGER 4	Final Weight/Volume	633.2	
	Initial Weight/Volume	614.2	
	Increase	19.0	19.0
	TOTAL MOISTURE CATCH		~~423.0~~ 424.1

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

1S 75.1022 − 75.0830 = 0.0192

Filter & Particulates	0.9083
Filter Tare Weight	0.5338
Particulate	0.3745
Washings	0.0192
Particulate Catch	0.3937
Acetone Blank	0.0003
TOTAL FRONT CATCH	0.3934

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

1B 74.9746 − 74.9743 = 0.0003

Extractable Weight (1BH)	75.5495
Boil Down Weight	75.5488
Impinger Catch	0.0007
Water Blank	−0−
TOTAL BACK CATCH	~~0.0007~~
TOTAL TRAIN CATCH	0.3941

Acetone Blank & Washings

STACK SAMPLING FIELD DATA

Company: FMC Wy Corp.
Plant Location: Green River, Wy.
Run No. 88-10-S-P
Sampling Location: RA-23A+B
Date: 6-1-88
Start Time: 12:35 / 13:15
Finish Time: 13:07 / 13:47
Filter No.

Assumed Moisture, %: 20
Probe Tip Diameter, in.: .18 (1.76715)
Probe Length, ft.: 5
Ambient Temperature, °F:
Bar. Pressure, in. Hg.: 24.04
Initial Leak Check, CFS
CFM .002 at 15 in. Hg.
Final Leak Check, CFS
CFM ____ at ____ in. Hg.

RA-23-"A" "West"

Point No.	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot in. H_2O √P	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
South Port													
1	0	702.235	1.05	1.025	0.69	0.69	101	95	2.8	209	51		144
2	4	704.3	1.2	1.095	0.79	0.79	104	97	3.0	223	49		147
3	8	706.5	1.55	1.245	1.02	1.02	108	98	3.6	222	49		145
4	12	708.9	1.60	1.265	1.05	1.05	109	98	3.9	235	49		145
5	16	711.4	1.9	1.378	1.24	1.24	110	98	4.8	216	51		146
6	20	714.1	1.8	1.342	1.18	1.18	110	99	4.6	213	52		142
7	24	716.8	1.85	1.360	1.21	1.21	110	99	5.0	226	52		145
8	28 →	719.6	1.60	1.265	1.05	1.05	110	99	4.5	257	52		147
	32	722.1											
		38.665 × 1.0389 = 40.169											
East Port													
1	0	722.1	0.82	0.905	0.53	0.53	102	96	3.0	304	50		148
2	4	724.0	0.98	0.990	0.64	0.64	105	98	3.2	260	50		143
3	8	726.0	1.35	1.162	0.88	0.88	107	98	4.1	248	52		147
4	12	728.3	1.5	1.225	0.98	0.98	108	98	4.6	266	50		148
5	16	730.8	1.70	1.304	1.11	1.11	108	98	5.0	266	48		145
6	20	733.3	1.60	1.265	1.05	1.05	109	98	5.2	264	51		146
7	24	736.1	1.50	1.225	0.98	0.98	108	98	5.0	262	55		148
8	28	738.4	1.50	1.225	0.98	0.98	108	98	5.2	263	55		147
	32	740.4											
1.0389 × 73.587 = 76.449													
		76.449					3282				1454 / 1460 / 605.4		2342
Total	Vm	76.449		19.276		15.38	102.6°F						146.4°F
Average			√P 1.205		ΔH: 0.961		562.6°R						606.4°R

Orsat
% CO_2 = 3.5
% O_2 = 14.8
% CO: 0.0
Stack Area: 7.069
Water: 42.0

Avg ΔH: 0.855 / Avg Tm: 561.2°R

STACK SAMPLING FIELD DATA

Company: FMC Wy Corp.
Plant Location: Green River Wy.
Run No. 88-10-S-P
Sampling Location: RA-23A+B
Date: 6-1-88
Start Time: 13:54 / 14:40
Finish Time: 14:26 / 15:12 (35)
Filter No.

Assumed Moisture, %: 20
Probe Tip Diameter, in.: .18
Probe Length, ft.: 5
Ambient Temperature, °F:
Bar. Pressure, in. Hg.:
Initial Leak Check, CFS
CFM ____ at ____ in. Hg.
Final Leak Check, CFS
*** CFM .001 at 9 in. Hg.

RA-23-B "East"

Point No.	Time (min)	Dry Gas Meter FT^3	Pitot in. H_2O P	Pitot $\sqrt{P}$	Orifice ΔH in. H_2O Desired	Orifice ΔH Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
1	0	740.9	0.80	0.894	0.52	0.52	101	96	3.8	267	57		143
2	4	742.8	0.98	0.990	0.64	0.64	104	97	4.1	265	57		143
3	8	744.8	1.15	1.072	0.75	0.75	106	97	4.6	272	53		143
4	12	746.9	1.15	1.072	0.75	0.75	106	97	4.9	268	52		145
5	16	749.1	1.2	1.095	0.79	0.79	106	97	5.1	269	52		143
6	20	751.4	1.15	1.072	0.75	0.75	106	97	5.0	272	52		144
7	24	753.0	1.2	1.095	0.79	0.79	106	97	5.3	271	54		144
8	28	755.6	0.88	0.938	0.58	0.58	105	96	5.0	273	54		145
	32	757.8											
1	0	757.8	1.10	1.049	0.72	0.72	97	93	5.0	265	54		140
2	4	759.9	1.10	1.049	0.72	0.72	102	95	5.2	275	48		146
3	8	762.1	1.10	1.049	0.72	0.72	103	96	5.4	275	48		147
4	12	764.3	1.10	1.049	0.72	0.72	103	96	5.7	278	49		146
5	16	766.4	1.30	1.140	0.85	0.85	104	95	6.2	272	51		145
6	20	768.6	1.40	1.183	0.92	0.92	104	95	7.0	274	51		147
7	24	771.1	1.40	1.183	0.92	0.92	104	95	7.2	276	51		146
8	28	773.4	1.30	1.140	0.85	0.85	104	95	7.0	265	52		145
	32	*775.822											
							3195						2312
Total				17.07		11.99	99.8°F						144.5°
Average				$\sqrt{P}$ 1.067		ΔH = 0.749	559.8°R						604.5°R

.922
34.888
0
1
36 .7805

TEST NO. 88-10-S-P DATE 06/01/88

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg
Vm=Volume (ft3) of gas at meter conditions
Tm=Average dry gas meter temperature (R)
Pbar=Barometric pressure (in. Hg)
deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 76.45*(24.04+0.855/13.6)/561.2 = 58.149 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor
Vlc=Total volume of water collected (ml)

Vwstd = .00474* 521.0 = 24.695 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 24.70*100/(24.70+ 58.15) = 29.809 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)
Mn=Total particulate collected (gm)

Cs' = 15.43*0.3676/(58.15+ 24.70) = 0.0685 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)
Ts=Stack absolute temperature (R)
deltaP=Average pitot reading (in. WG)
Mw=Molecular wt. of stack gas (lb/lb mole)
Kp=Pitot tube coefficient

Mw=0.18*29.81+0.44* 2.46+0.32*10.39+0.28*57.35 = 25.828 lb/mole

RA-23A V=0.84*85.48*1.205*SQR(606.4/(25.83*24.04)) = 85.507 ft/sec
RA-23B V=0.84*85.48*1.067*SQR(604.5/(25.83*24.04)) = 75.596 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions
A=Stack area (ft2)
SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-23A ACFM = 85.51* 7.069*60 = 36267 acfm
RA-23B ACFM = 75.60* 7.069*60 = 32063 acfm
RA-23A SCFM = 36267*530*24.04/(606.4*29.92) = 25468 scfm
RA-23B SCFM = 32063*530*24.04/(604.5*29.92) = 22587 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0685* 48055*60/7000 = 28.20 Lb/Hr

ISOKINETIC RATE

I = 108.2138 %

(2)

LABORATORY DATA

Company FMC Run No.: 88-10-5-P

Sampling Location RR-23A&B Date: 6-1-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	807.3	
	Initial Weight/Volume	560.1	
	Increase	247.2	247.2
IMPINGER 2	Final Weight/Volume	694.7	
	Initial Weight/Volume	543.9	
	Increase	150.8	150.8
IMPINGER 3	Final Weight/Volume	426.2	
	Initial Weight/Volume	422.1	
	Increase	4.1	4.1
IMPINGER 4	Final Weight/Volume	646.9	
	Initial Weight/Volume	628.0	
	Increase	18.9	18.9
	TOTAL MOISTURE CATCH		421.0 ✓

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

Filter & Particulates	0.8994
Filter Tare Weight	0.5350
Particulate	0.3644
Washings	0.0029
Particulate Catch	0.3673
Acetone Blank	0.0003
TOTAL FRONT CATCH	0.3670

1S 74.9989
74.9960
0.0029

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

	1BH
Extractable Weight	75.4553
Boil Down Weight	75.4547
Impinger Catch	0.0006
Water Blank	-0-
TOTAL BACK CATCH	0.0006
TOTAL TRAIN CATCH	0.3676 ✓

2B 74.7538
74.7535
0.0003

STACK SAMPLING FIELD DATA

Company FMC Wy. Corp.
Plant Location Green River, Wy
Run No. 88-11-S-P
Sampling Location RA-23A+B
Date 6-2-88
Start Time 10:37 / 11:16
Finish Time 11:09 / 11:48
Filter No.

Assumed Moisture, % 20
Probe Tip Diameter, in. .18 (1.76715
Probe Length, ft. 5
Ambient Temperature, °F
Bar. Pressure, in. Hg. 24.17
Initial Leak Check, CFS
CFM .020 at 1.5 in. Hg.
Final Leak Check, CFS
CFM at in. Hg.

RA-23 "A" West X-12

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O √P	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
											68°F		
1	0	779.605	1.1	1.049	0.72	0.72	76	69	3.3	238	69		109
2	4	781.7	1.2	1.095	0.79	0.79	85	70	3.5	262	70		14
3	8	783.9	1.35	1.162	0.88	0.88	87	73	4.0	261	70		14
4	12	786.2	1.75	1.311	1.14	1.14	90	75	5.2	256	69		14
5	16	788.8	1.70	1.304	1.11	1.11	92	77	5.3	260	67		14L
6	20	791.4	2.1	1.449	1.37	1.37	95	79	6.5	270	66		142
7	24	794.3	2.3	1.516	1.50	1.50	97	97	7.1	263	65		143
8	28	797.3	2.1	1.449	1.37	1.37	99	84	7.3	248	67		14
	32	800.2											
1	0	800.2	0.82	0.905	0.53	0.53	95	87	3.2	243	69		109
2	4	802.2	1.1	1.049	0.72	0.72	100	89	4.0	256	65		139
3	8	804.3	1.4	1.183	0.91	0.91	103	90	5.0	265	68		143
4	12	806.6	1.6	1.265	1.04	1.04	104	91	5.8	254	70		143
5	16	809.1	1.75	1.311	1.14	1.14	105	92	6.1	257	69		14L
6	20	811.9	1.8	1.342	1.17	1.17	106	93	6.6	266	71		144
7	24	814.5	1.45	1.204	0.94	0.94	106	94	5.9	268	62		142
8	28	817.0	1.55	1.249	1.01	1.01	107	95	6.1	278	60		14
	32	819.5	.95										

.0389 X 73.569 = 76.431

Orsat
%CO₂ = 4.6
%O₂ = 13.2
%CO = 0.0
Stack Area: 7.069
Water: 13.80

Total	Vm	76.431	19.864		16.33	2904						331°	
Average			1.241		ΔH: 1.021	90.7°F V						138.5°	
					Avg. ΔH: 0.846	550.7°R						598.4°	
						Tm: 556.3							

STACK SAMPLING FIELD DATA

Company FMC Wy Corp. Assumed Moisture, % 20

Plant Location Green River, Wy. Probe Tip Diameter, in. .18

Run No. 88-11-S-P Probe Length, ft. 5

Sampling Location RA-23A+B Ambient Temperature, °F

Date 6-2-88 Bar. Pressure, in. Hg.

Start Time 11:52 / 12:30 Initial Leak Check, CFS

CFM at in. Hg.

Finish Time 12:24 / 13:02 Final Leak Check, CFS

Filter No. CFM .012 at 8.0 in. Hg.

RA-23 "B" East X-12

Point No.	Time (min)	Dry Gas Meter FT³	Pitot in. H₂O P	Pitot in. H₂O VP	Orifice ΔH in. H₂O Desired	Orifice ΔH in. H₂O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum in. Hg Gauge	Sample Box Temp. °F	Impinger Temp. °F	Stack Press. in. Hg	Stack Temp. °F
SOUTH					0.60								
1	0	819.5	0.91	0.954	0.60	0.60	102	95	4.2	246	67		123
2	4	821.6	0.99	0.995	0.64	0.64	105	96	4.4	233	69		140
3	8	823.6	1.1	1.049	0.72	0.72	108	97	5.0	291	67		144
4	12	825.7	1.1	1.049	0.72	0.72	108	97	5.0	251	66		141
5	16	827.9	1.1	1.049	0.72	0.72	108	98	5.2	263	68		143
6	20	830.0	1.05	1.025	0.68	0.68	107	97	5.1	259	71		145
7	24	832.2	1.05	1.025	0.68	0.68	107	97	5.2	267	70		145
8	28	834.3	1.0	1.000	0.65	0.65	107	97	5.3	250	71		144
	32	836.4											
WEST					0.45								
1	0	836.4	0.68	0.805	0.45	0.45	101	96	4.1	263	77		109
2	4	838.2	0.99	0.995	0.64	0.64	105	97	5.0	264	76		139
3	8	841.9	0.99	0.995	0.64	0.64	106	97	5.0	265	66		141
4	12	842.2	1.2	1.095	0.78	0.78	107	98	6.0	267	61		141
5	16	844.4	1.2	1.095	0.78	0.78	107	98	6.3	270	63		143
6	20	846.7	1.2	1.095	0.78	0.78	107	98	6.2	268	63		142
7	24	849.0	1.1	1.049	0.72	0.72	107	97	6.1	261	59		140
8	28	851.2	0.88	0.938	0.57	0.57	107	97	5.9	259	59		140
	32	853.174											
							3261						2225
Total			16.23		10.77		101.9°F						139.1°F
Average			TP: 1.014		ΔH: .673		561.9°R						599.1°R

TEST NO. 88-11-S-P DATE 06/02/88

VELOCITY AND VOLUME DETERMINATION

****

DRY GAS VOLUME

Vmstd=(17.71 deg R/in. Hg)*Vm*(Pbar+deltaH/13.6)/Tm)

Where Vmstd=Volume(ft3) of gas sample at 70F and 29.92 in. Hg
Vm=Volume (ft3) of gas at meter conditions
Tm=Average dry gas meter temperature (R)
Pbar=Barometric pressure (in. Hg)
deltaH=Pressure drop across orifice (in. WG)

Vmstd=17.71* 76.43*(24.17+0.846/13.6)/556.3 = 58.962 ft3

VOLUME OF WATER VAPOR

Vwstd=(0.0474 ft3/ml)*Vlc

Where Vwstd=Volume (ft3) of water vapor
Vlc=Total volume of water collected (ml)

Vwstd = .00474* 438.0 = 20.761 ft3

MOISTURE CONTENT

Bwo=Vwstd*100/(Vwstd+Vmstd)

Where Bwo=Percent moisture

Bwo = 20.76*100/(20.76+ 58.96) = 26.042 percent

CONCENTRATION

Cs'=(15.43 grains/gm)*Mn/(Vmstd+Vwstd)

Where Cs'=Concentration (grains/scf)
Mn=Total particulate collected (gm)

Cs' = 15.43*0.3647/(58.96+ 20.76) = 0.0706 grains/scf

STACK VELOCITY

Where V=Stack velocity (ft/sec)
Ts=Stack absolute temperature (R)
deltaP=Average pitot reading (in. WG)
Mw=Molecular wt. of stack gas (lb/lb mole)
Kp=Pitot tube coefficient

Mw=0.18*26.04+0.44* 3.40+0.32* 9.76+0.28*60.79 = 26.331 lb/mole

RA-23A V=0.84*85.48*1.240*SQR(598.4/(26.33*24.17)) = 86.336 ft/sec
RA-23B V=0.84*85.48*1.014*SQR(599.1/(26.33*24.17)) = 70.642 ft/sec

STACK VOLUME

ACFM=V*A*60 AND SCFM=ACFM*530*Ps/(Ts*29.92)

Where ACFM=Actual cubic Ft per minute at stack conditions
A=Stack area (ft2)
SCFM=Standard cubic ft. per min. (29.92 in. Hg & 530 R)

RA-23A ACFM = 86.34* 7.069*60 = 36619 acfm
RA-23B ACFM = 70.64* 7.069*60 = 29962 acfm
RA-23A SCFM = 36619*530*24.17/(598.4*29.92) = 26200 scfm
RA-23B SCFM = 29962*530*24.17/(599.1*29.92) = 21412 scfm

CALCULATED DUST LOAD

lb/hr=Cs'*SCFM*60/7000 grains/lb

DUST LOAD= 0.0706* 47612*60/7000 = 28.81 Lb/Hr

ISOKINETIC RATE

I = 105.1219 %

(3)

LABORATORY DATA

Company FMC Run No.: 88-11-S-P

Sampling Location RA-23A & B Date: 6-2-88

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	832.6	
	Initial Weight/Volume	566.4	
	Increase	266.2	266.2
IMPINGER 2	Final Weight/Volume	717.4	
	Initial Weight/Volume	568.0	
	Increase	149.4	149.4
IMPINGER 3	Final Weight/Volume	447.1	
	Initial Weight/Volume	442.8	
	Increase	4.3	4.3
IMPINGER 4	Final Weight/Volume	666.5	
	Initial Weight/Volume	648.4	
	Increase	18.1	18.1
	TOTAL MOISTURE CATCH		438.0

PARTICULATE COLLECTED

3S
73.3410
73.3315
0.0095

FRONT-HALF ANALYSIS (Nozzle, Probe, Cyclone, Filter Front-Half)

Filter & Particulates	0.9311
Filter Tare Weight	0.5760
Particulate	0.3551
Washings	0.0095
Particulate Catch	0.3646
Acetone Blank	0.0003
TOTAL FRONT CATCH	0.3649

BACK-HALF ANALYSIS (Impingers, Filter Back-Half)

3BH

3B 74.8803
74.8800
0.0003

Extractable Weight	72.8116
Boil Down Weight	72.8115
Impinger Catch	0.0001
Water Blank	-0-
TOTAL BACK CATCH	0.0001
TOTAL TRAIN CATCH	0.3647

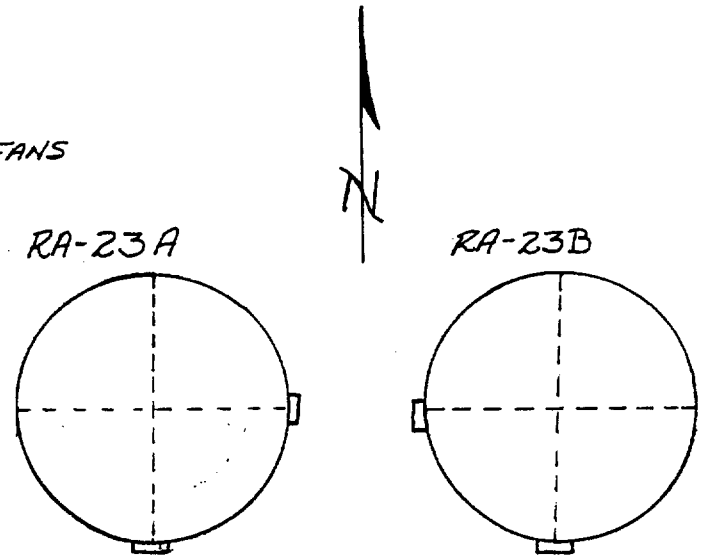
0.3644

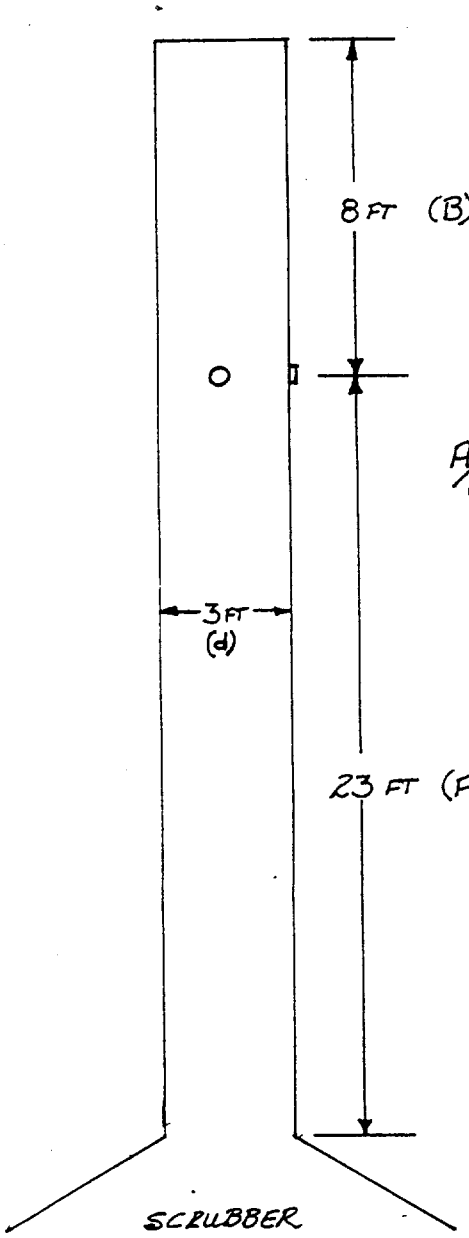
Section A-2, Information

- Drawing showing location of sample ports and number of points per traverse

RA-23 A&B

ONE UNIT –
TWO IDENTICAL SCRUBBERS, DUCTS, AND FANS





$A/d = 7.7$

No. OF POINTS PER TRAVERSE = 16
No. OF POINTS PER DIAMETER = 8
No. OF DIAMETERS PER RUN = 4 (2 PER STACK)

TRAVERSE POINTS ON EACH DIAMETER

	% OF DIAMETER	DISTANCE FROM INSIDE WALL, (IN.)	DISTANCE FROM COUPLING, (IN.)
1	3.3	1.18	4.18
2	10.5	3.78	6.78
3	19.4	6.98	9.98
4	32.3	11.63	14.63
5	67.7	24.37	27.37
6	80.6	29.02	32.02
7	89.5	32.20	35.20
8	96.7	34.81	37.81