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# MOLECULAR SIEVE TESTS FOR CONTROL OF $NO_x$ EMISSIONS FROM A NITRIC ACID PLANT

## Volume II - Appendices

Industrial Environmental Research Laboratory
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# MOLECULAR SIEVE TESTS FOR CONTROL OF $NO_x$ EMISSIONS FROM A NITRIC ACID PLANT

## VOLUME II--APPENDICES

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## APPENDIX A

The outputs of the UV-visible photometric analyzers used to measure the inlet and outlet $NO_2/NO_x$ concentrations were recorded on strip chart recorders. Separate recorders were used for each of the test sites. Figure A-1 is a copy of the recorded instrument output for inlet test site HV-23 during the first 115 minutes of test 11. Figure A-2 is a copy of the recorded instrument output for outlet test site HV-13 during the same period. Both copies provide the basis for example calculations in this section.

A data reduction technique was used to provide instantaneous sieve inlet and outlet $NO_x$ concentrations at appropriate intervals suitable for application of the trapezoidal rule for integration. The major assumption in the integration method is that concentration changed linearly between the endpoints of an interval, thus it was required that the points defining the intervals be carefully selected. The following method was used for reducing the strip charts.

1. The nearly continuous strip chart records of inlet and outlet $NO_2$ measurements were converted to continuous form using linear interpolation in order to provide an estimate of the $NO_2$ concentrations which existed while the analyzers were being operated in either the $NO_x$ or zero modes. First, the zero drift which occurred during the intervals between zeroing of the instruments was distributed over each interval using linear interpolations. The technique was applied by drawing a straight line on the strip chart between the points where the zero baseline was established. This provided an estimate of the instrument zero baseline at any point in time. Second, the $NO_2$ measurements which were missed as a result of switching the instruments to the $NO_x$ or zero modes were approximated by drawing straight line on the strip chart between points where the $NO_2$ measurements terminated and started again. Examples of the distribution of zero baseline drift are found between 0700 and 0905 on Figure A-1 and between 0700, 0758

FIGURE A-1. EXAMPLE OF RECORDED $NO_2/NO_x$ STRIP CHART DATA (FIRST 115 MINUTES OF TEST - 11, INLET SITE HV-23)

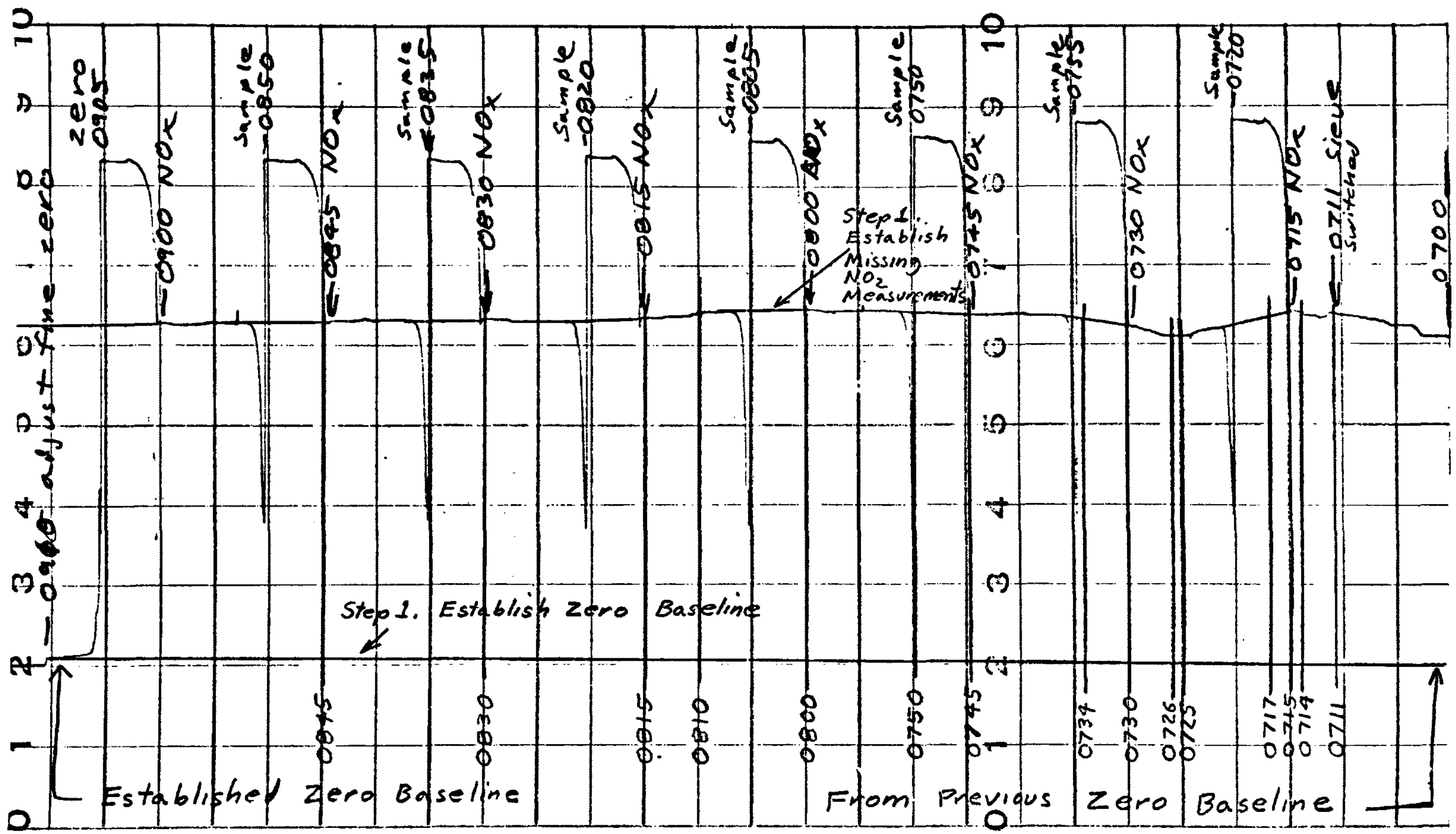
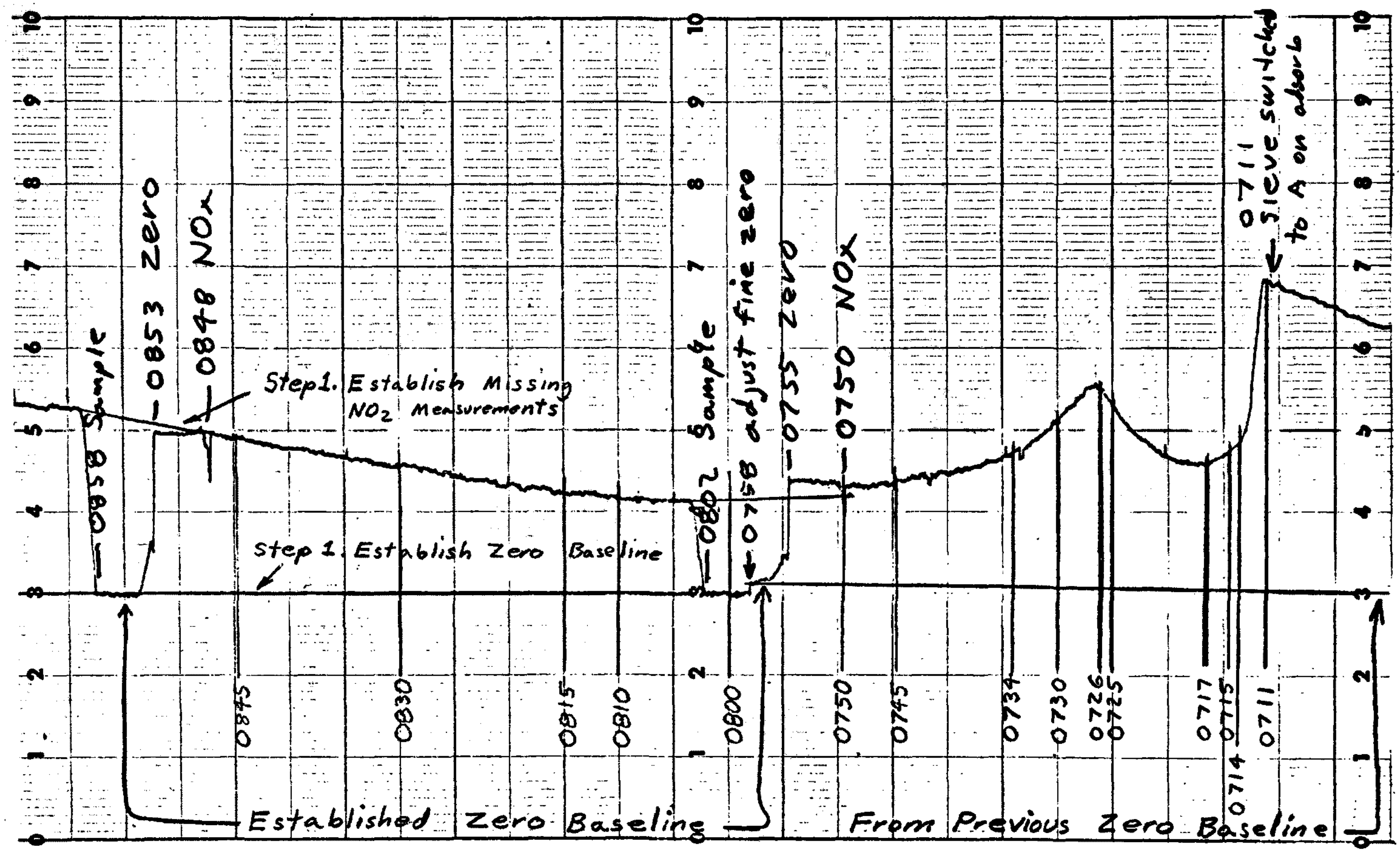


FIGURE A-2. EXAMPLE OF RECORDED $NO_2/NO_x$ STRIP CHART DATA (FIRST 115 MINUTES OF TEST - 11 OUTLET SITE HV-13)



and 0853 on Figure A-2. Examples of the estimation of $NO_2$ measurements during periods when the analyzers were either in the zero or $NO_x$ mode are found from 0715 to 0720 and 0730 to 0735 on Figure A-1 and from 0750 to 0802 on Figure A-2.

2. Points were selected for reading $NO_2$ concentrations from the recorded charts at appropriate intervals for use of the trapezoidal rule. The points selected included, but were not limited to all points which corresponded to the beginning of each $NO_x$ measurement. Each point was carefully selected so that the contour of the strip chart trace could be approximated by a series of straight lines connecting the points. The location of points selected in the example are identified by vertical lines with corresponding times drawn on the strip charts.

3. For each point selected on the strip chart traces, the time and the percent of chart values for the zero baseline and $NO_2$ measurements were determined and copied on to a data reduction worksheet. Figure A-3 is a copy of the data reduction worksheet used for test 11. The times corresponding to each point appear in column 2. $NO_2$ percent of chart values for the inlet trace appear in column 3 and the zero baseline values in column 4. Outlet $NO_2$ and zero baseline percent of chart values appear in column 9 and 10 respectively.

4. The difference between each $NO_2$ percent of chart value and the corresponding zero baseline value was calculated. These values appear in columns 5 and 11 on the worksheet. $NO_2$ concentrations were calculated using the appropriate range factors. For the inlet instrument, the factor was 50 ppm of $NO_2$ per percent of chart, for the outlet instrument the factor was 5 ppm of $NO_2$ per percent of chart.

5. The percent of chart values for each of the $NO_x$ measurements and the corresponding zero baseline values were determined and copied onto the worksheet. The $NO_x$ determinations on the worksheet are identified by the mode identification in column 1. For

# FIGURE A-3. EXAMPLE DATA REDUCTION WORKSHEET

## TEST - 11

DATE 3/14/75 HERCULES INC., RUN 11, INLET IV-23, OUTLET HV-13 UNIT A 0711-1114

| Column 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | OUTLET | | | | | | | | | | |
| Mode | Time | Trace % of Chart | Baseline % of Chart | Difference | PPM $NO_2$ | PPM $NO_x$ | % $NO_2$ | Trace % of Chart | Baseline % of Chart | Difference | PPM $NO_2$ | PPM $NO_x$ | % $NO_2$ | Elapsed Time | Inlet Flow | Regen Flow | PPM $NO_x$ In | PPM $NO_2$ Out |
| $NO_2$ | 0711 | 63.75 | 20.0 | 43.75 | 2188 | | 65.4 | 68.25 | 30.25 | 38.0 | 190.0 | | | 0 | 5500 | 1020 | 3340 | 190 |
| $NO_2$ | 0714 | 63.5 | 20.0 | 43.5 | 2175 | | 65.4 | 48.5 | 30.5 | 18.0 | 900 | | | 3 | 5500 | 1020 | 3320 | 90 |
| $NO_2$ | 0715 | 64.0 | 20.0 | 44.0 | 2200 | | 65.4 | 47.0 | 30.5 | 16.5 | 82.5 | | | 4 | 5500 | 1015 | 3360 | 82 |
| $NO_x$ | | 87.25 | | 67.25 | | 3362 | | | | | | | | | | | | |
| $NO_2$ | 0717 | 63.0 | 20.0 | 43.0 | 2150 | | 65.0 | 46.0 | 30.5 | 15.5 | 77.5 | | | 6 | 5500 | 1015 | 3310 | 78 |
| $NO_2$ | 0725 | 61.0 | 20.25 | 40.75 | 2038 | | 63.2 | 53.0 | 30.5 | 22.5 | 112.5 | | | 14 | 5475 | 1020 | 3220 | 112 |
| $NO_2$ | 0726 | 61.0 | 20.25 | 40.75 | 2038 | | 63.0 | 55.25 | 30.5 | 24.75 | 123.75 | | | 15 | 5475 | 1020 | 3220 | 124 |
| $NO_2$ | 0730 | 62.25 | 20.25 | 42.0 | 2100 | | 62.0 | 51.0 | 30.75 | 20.25 | 101.25 | | | 19 | 5450 | 1020 | 3380 | 101 |
| $NO_x$ | | 88.0 | | 67.75 | | 3388 | | | | | | | | | | | | |
| $NO_2$ | 0734 | 63.0 | 20.25 | 42.75 | 2138 | | 63.1 | 47.0 | 30.75 | 16.25 | 81.25 | | | 23 | 5450 | 1020 | 3390 | 81 |
| $NO_2$ | 0745 | 63.75 | 20.5 | 43.25 | 2162 | | 65.8 | 43.75 | 31.0 | 12.75 | 63.75 | | | 34 | 5475 | 1020 | 3290 | 64 |
| $NO_x$ | | 86.25 | | 65.75 | | 3288 | | | | | | | | | | | | |
| $NO_2$ | 0750 | 64.0 | 20.5 | 43.5 | 2175 | | 66.3 | 43.25 | 31.0 | 12.25 | 61.25 | | 98 | 39 | 5475 | 1020 | 3280 | 61 |
| $NO_x$ | | | | | | | | 43.50 | | 12.50 | | 62.5 | | | | | | |
| $NO_2$ | 0800 | 64.5 | 20.5 | 44.0 | 2200 | | 67.4 | 41.5 | 30.0 | 11.50 | 57.50 | | | 49 | 5475 | 1020 | 3260 | 58 |
| $NO_x$ | | 85.75 | | 65.25 | | 3262 | | | | | | | | | | | | |
| $NO_2$ | 0810 | 64.0 | 20.5 | 43.5 | 2175 | | 68.0 | 41.5 | 30.0 | 11.50 | 57.50 | | | 59 | 5475 | 1020 | 3200 | 58 |

the inlet test site, the $NO_x$ measurements were made approximately every ten minutes for five minute intervals. On Figure A-1 the beginnings of the $NO_x$ measurements occur at 0715, 0730, 0745 and 0800. The percent of chart values on the worksheet appear in columns 3 and 4 below the $NO_2$ values for the same times. For the outlet test site, the $NO_x$ measurements were made approximately once an hour due to the absence of NO in the outlet stream. On Figure A-2 the beginning of an $NO_x$ measurement occurs at 0750. The percent of chart values for the $NO_x$ measurements were read at the end of each 5 minute $NO_x$ determination, after the complete oxidation of NO to $NO_2$ in the sealed sample cell had occurred.

6. The difference between each $NO_x$ percent of chart value and the corresponding zero baseline value was calculated, and the $NO_x$ concentrations were determined in the same manner as in step 4. The different values appear in columns 5 and 11, and the concentrations appear in column 7 and 13 on the worksheet.

7. The percent $NO_2$ in each $NO_x$ measurement was calculated from the ratio of the $NO_2$ measured at the beginning of each $NO_x$ measurement to the $NO_x$ measured. The calculated percents appear as the circled values in columns 8 and 14 on the worksheet. The percent $NO_2$ for each point where no corresponding $NO_x$ measurement existed was calculated by interpolating between known $NO_x$ percent values. For the inlet test site, the calculated values appear as uncircled values in column 8 of the worksheet.

8. The inlet $NO_2$ concentrations which appear in column 6 on the worksheet were converted to $NO_x$ concentrations using the calculated percent $NO_2$ in column 8. The calculated values for the inlet appear in column 18. The outlet $NO_x$ concentrations appearing in column 19 were calculated from the outlet $NO_2$ concentrations in column 12 using an $NO_2$ to $NO_x$ ratio of 1.0. (The average ratio of $NO_2$ to $NO_x$ at the outlet test sites during the eleven cycles was 0.999 with a standard deviation of .040. The variations about the mean were due to a combination of instrumental, recorder and chart reading imprecision.)

9. The inlet flows into the sieve and the flows diverted for regeneration (regeneration flow) were read from copies of process instrument charts for the respective times. All times were converted to elapsed time with reference to the beginning of each cycle. These values appear in columns 15, 16 and 17 on the worksheet.

10. The data appearing in columns 15 through 19 for each of the eleven cycles was keypunched and read into a computer program which produced the outputs presented in this section, Tables A-1 through A-31. An example calculation for the first 4 minutes of test cycle 11 with an explantion of each parameter preceeds the output tables.

EXAMPLE CALCULATIONS

FOR

TABLE A-31

The first five columns of Table A-31 contain the reduced strip chart data that was read into the computer program. The columns are:

TIME INTO CYCLE - (TIC) - The elapsed time from the beginning of an adsorption cycle. Units: minutes.

INLET FLOW - (IF) - The flow rate of the tail gas stream into the adsorbing bed. Units: standard cubic feet per minute.

REGEN FLOW - (RF) - The flow rate of the cleaned tail gas stream which is diverted after leaving the adsorption bed for regenerations of the second bed. Units: standard cubic feet per minute.

INLET CONC - (IC) - The concentration of $NO_x$ in the inlet stream to the adsorption bed. For test cycles 1 through 8 this represents the $NO_x$ concentration at site HV-12, after the feed chiller and mist eliminator. For test cycles 9-11, this represents the $NO_x$ concentrations at HV-23. Units: parts per million.

OUTLET CONC - (OC) - The concentration of the $NO_x$ in the outlet stream after passing through the adsorption bed. For test cycles 1 through 11 this represents the $NO_x$ concentrations at site HV-13.

The last seven columns are calculated instanteous mass flow rates and control efficiencies. The columns are:

MASS FLOW RATE IN - (MFRI) - The $NO_x$ mass flow rate into the adsorption bed. This value is calculated as follows:

$$MFRI = IF \times IC \times C$$

where C is the conversion factor for converting ppm $ft^3$ at 15.556°C (60°F) and 760 milimeters of mercury pressure to grams of $NO_x$ as $NO_2$ (M.W. = 46)

$$C = \frac{46 \text{ gm mole}^{-1}}{22.414 \ \ell \text{ mole}^{-1} \times \frac{288.716°K}{273.15°K}} \times 10^{-6} \text{ ppm}^{-1} \times 28.316 \ \ell \text{ ft}^{-3}$$

$$= 5.49815 \times 10^{-5} \text{ gm ppm}^{-1} \text{ ft}^{-3}$$

Example Calculation, Test 11

| TIC (min) | MFRI ($gm\ min^{-1}$) | IF ($ft^3\ min^{-1}$) | IC (ppm) | C ($gm\ ppm^{-1}\ ft^{-3}$) |
|---|---|---|---|---|
| 0 | 1010.010 | 5500 | 3340 | $5.49815 \times 10^{-5}$ |
| 3 | 1003.962 | 5500 | 3320 | $5.49815 \times 10^{-5}$ |
| 4 | 1016.058 | 5500 | 3360 | $5.49815 \times 10^{-5}$ |

MASS FLOW RATE ADS - (MFRA) - The instantaneous mass flow rate at which $NO_x$ is absorbed by the molecular sieve bed. This value is calculated as follows:

$$MFRA = IF \times (IC-OC) \times C$$

Example Calculation, Test 11

| TIC (min) | MFRA ($gm\ min^{-1}$) | IF ($ft^3\ min^{-1}$) | IC (ppm) | OC (ppm) | C ($gm\ ppm^{-1}\ ft^{-3}$) |
|---|---|---|---|---|---|
| 0 | 952.554 | 5500 | 3340 | 190 | $5.49815 \times 10^{-5}$ |
| 3 | 976.746 | 5500 | 3320 | 90 | $5.49815 \times 10^{-5}$ |
| 4 | 991.261 | 5500 | 3360 | 82 | $5.49815 \times 10^{-5}$ |

MASS FLOW RATE REGEN - (MFRR) - The instantaneous mass flow rate of the $NO_x$ diverted for the regeneration of the second bed. This value is calculated as follows:

$$MFRR = RF \times OC \times C$$

Example Calculation, Test 11

| TIC (min) | MFRR ($gm\ min^{-1}$) | RF ($ft^3\ min^{-1}$) | OC (ppm) | C ($gm\ ppm^{-1}\ ft^{-3}$) |
|---|---|---|---|---|
| 0 | 10.655 | 1020 | 190 | $5.49815 \times 10^{-5}$ |
| 3 | 5.047 | 1020 | 90 | $5.49815 \times 10^{-5}$ |
| 4 | 4.576 | 1015 | 82 | $5.49815 \times 10^{-5}$ |

MASS FLOW RATE EMIT - (MFRE) - The instantaneous mass flow rate of $NO_x$ emitted to the atmosphere from the stack outlet. This value is calculated as follows:

MFRE = MFRI - MFRA - MFRR

Example Calculation, Test 11

| TIC (min) | MFRE ($gm\ min^{-1}$) | MFRI ($gm\ min^{-1}$) | MFRA ($gm\ min^{-1}$) | MFRR ($gm\ min^{-1}$) |
|---|---|---|---|---|
| 0 | 46.801 | 1010.010 | 952.554 | 10.655 |
| 3 | 22.169 | 1003.962 | 976.746 | 5.047 |
| 4 | 20.221 | 1016.058 | 991.261 | 4.576 |

% REDUC OF $NO_x$ DUE TO ADS - (RDTA) - The percentage of the instantaneous $NO_x$ removal efficiency of the PuraSiv N unit due to adsorption. This value is calculated as follows:

% RDTA = (MFRA ÷ MFRI) x 100

Example Calculation, Test 11

| TIC (min) | % RDTA (%) | MFRA ($gm\ min^{-1}$) | MFRI ($gm\ min^{-1}$) |
|---|---|---|---|
| 0 | 94.3113 | 952.554 | 1010.010 |
| 3 | 97.2891 | 976.746 | 1003.962 |
| 4 | 97.5594 | 991.261 | 1016.058 |

% REDUC OF $NO_x$ DUE TO REGEN - (% RDTR) - The percentage of the instantaneous $NO_x$ removal efficiency of the PuraSiv N unit due to regeneration. This value is calculated as follows:

% RDTR = (FMRR ÷ MFRI) x 100

Example Calculation, Test 11

| TIC (min) | % RDTR (%) | MFRR (gm $min^{-1}$) | MFRI (gm $min^{-1}$) |
|---|---|---|---|
| 0 | 1.0549 | 10.655 | 1010.010 |
| 3 | 0.5027 | 5.047 | 1003.962 |
| 4 | 0.4504 | 4.576 | 1016.058 |

% REDUC OF $NO_x$ - (%R) - The instantaneous $NO_x$ removal efficiency of the PuraSiv N unit. This value is calculated as follows:

% R = % RDTA + % RDTR

Example Calculation, Test 11

| TIC (min) | % R (%) | % RDTA (%) | % RDTR (%) |
|---|---|---|---|
| 0 | 95.366 | 94.311 | 1.055 |
| 3 | 97.792 | 97.289 | 0.503 |
| 4 | 98.009 | 97.559 | 0.450 |

EXAMPLE CALCULATIONS

FOR

TABLE A-32

The first column contains the time interval of the cycle for which the calculations pertain. The next eight columns are calculated $NO_x$ mass loadings and average control efficiencies for each interval. The last column lists the average ppm emitted during each interval. The columns are:

$NO_x$ IN DURING INTERVAL - (NIDI) - The mass of $NO_x$ which enters the inlet to the adsorption bed during the designated interval (a,b). This value is calculated as follows:

NIDI = ((MFRI(a) + MFRI(b)) x (b-a)) ÷ 2

Example Calculation, Test 11

| INT (a,b) | NIDI (gm) | MFRI(a) (gm $min^{-1}$) | MFRI(b) (gm $min^{-1}$) | (b-a) (min) |
|---|---|---|---|---|
| 0,3 | 3020.958 | 1010.010 | 1003.962 | 3 |
| 3,4 | 1010.010 | 1003.962 | 1016.058 | 1 |

$NO_x$ ABSORBED DURING INTERVAL - (NADI) - The mass of $NO_x$ which is adsorbed by the adsorption bed during the designated interval (a,b). This value is calculated as follows:

NADI = ((MFRA(a) + MFRA(b)) x (b-a) ÷ 2

Example Calculation, Test 11

| INT (a,b) | NIDI (gm) | MFRI(a) (gm $min^{-1}$) | MFRI(b) (gm $min^{-1}$) | (b-a) (min) |
|---|---|---|---|---|
| 0,3 | 2893.950 | 952.554 | 976.746 | 3 |
| 3,4 | 984.004 | 976.746 | 991.261 | 1 |

$NO_x$ REGEN DURING INTERVAL - (NRDI) - The mass of $NO_x$ which is diverted during the regeneration of the second bed during the designated interval (a,b). This value is calculated as follows:

NRDI = ((MFRR(a) + MFRR(b)) x (b-a)) ÷ 2

Example Calculation, Test 11

| INT (a,b) | NRDI (gm) | MFRR(a) ($gm\ min^{-1}$) | MFRR(b) ($gm\ min^{-1}$) | (b-a) (min) |
|---|---|---|---|---|
| 0,3 | 23.553 | 10.655 | 5.047 | 3 |
| 3,4 | 4.811 | 5.047 | 4.576 | 1 |

$NO_x$ EMITTED DURING INTERVAL - (NEDI) - The mass of $NO_x$ emitted to the atmosphere from the stack outlet during the interval (a,b). This value is calculated as follows:

NEDI = NIDI - NADI - NRDI

Example Calculation, Test 11

| INT (a,b) | NEDI (gm) | NIDI (gm) | NADI (gm) | NRDF (gm) |
|---|---|---|---|---|
| 0,3 | 103.455 | 3020.958 | 2893.950 | 23.553 |
| 3,4 | 21.194 | 1010.010 | 984.004 | 4.812 |

PERCENT OF $NO_x$ ADSORBED DURING INTERVAL - (% ADI) - The percentage of the $NO_x$ removal efficiency due to adsorption during the interval (a,b). This value is calculated as follows:

% ADI = (NADI ÷ NIDI) x 100

Example Calculation, Test 11

| INT (a,b) | % ADI (%) | NADI (gm) | NIDI (gm) |
|---|---|---|---|
| 0,3 | 95.796 | 2893.950 | 3020.958 |
| 3,4 | 97.425 | 984.004 | 1010.010 |

PERCENT $NO_x$ FOR REGEN DURING INTERVAL - (%RDI) - The precentage of the $NO_x$ removal efficiency due to regeneration during the interval (a,b). This value is calculated as follows:

% RDI = (NRDI ÷ NIDI) x 100

Example Calculation, Test 11

| INT (a,b) | % RDI (%) | NRDI (gm) | NIDI (gm) |
|---|---|---|---|
| 0,3 | 0.780 | 23.553 | 3020.958 |
| 3,4 | 0.476 | 4.812 | 1010.010 |

PERCENT REDUCTION OF $NO_x$ DURING INTERVAL - (% RI) - The $NO_x$ removal efficiency of the PuraSiv N unit during the interval (a,b). This value is calculated as follows:

% RI = % NADI + % NFRDI

Example Calculation, Test 11

| INT (a,b) | % RI (%) | % NADI (%) | % NFRDI (%) |
|---|---|---|---|
| 0,3 | 96.576 | 95.796 | 0.780 |
| 3,4 | 97.901 | 97.425 | 0.476 |

AVERAGE PPM OF $NO_x$ EMIT DURING INTERVAL - (APPM) - The average concentrations of $NO_x$ emitted to the atmospheric from the stack outlet during the interval (a,b). This value is calculated as follows:

APPM = (OC(a) + OC(b)) ÷ 2

Example Calculation, Test 11

| INT (a,b) | APPM (ppm) | OC(a) (ppm) | OC(b) (ppm) |
|---|---|---|---|
| 0,3 | 140 | 190 | 90 |
| 3,4 | 86 | 90 | 82 |

## EXAMPLE CALCULATIONS
## FOR
## TABLE A-33

The first column contains the elapsed time from the beginning of the cycle. Columns 2 through 5 contains the cumulative mass loadings which occurred from the beginning of the cycle to the time indicated. Columns 6 through 8 contain the average $NO_x$ reductions achieved over the indicated time period. Column 9 contains the average ppm of $NO_x$ emitted from the beginning of the cycle to the indicated time. The columns are:

TOTAL $NO_x$ IN - (TNI) - The total mass of $NO_x$ which entered the adsorption bed from the beginning of the cycle to the indicated time (TIC). This value is calculated as follows:

$$TNI = \sum_{0}^{TIC} NIDI$$

Example Calculation, Test 11

| TIC (min) | INT (min) | TNI (gm) | NIDI (gm) |
|---|---|---|---|
| 3 | (0,3) | 3020.958 | 3020.958 |
| 4 | (3,4) | 4030.968 | 1010.010 |

TOTAL $NO_x$ ADS - (TNA) - The total mass of $NO_x$ adsorbed molecular sieve bed from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNA = \sum_{0}^{TIC} NADI$$

Example Calculation, Test 11

| TIC (min) | INT (min) | TNA (gm) | NADI (gm) |
|---|---|---|---|
| 3 | 0,3 | 2893.950 | 2893.950 |
| 4 | 3,4 | 3877.954 | 984.004 |

TOTAL $NO_X$ USED FOR REGEN - (TNR) - The total mass of $NO_x$ diverted for the regeneraton of the second bed from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNR = \sum_{0}^{TIC} NRDI$$

Example Calculation, Test 11

| TIC (min) | INT (min) | TNR (gm) | NRDI (gm) |
|---|---|---|---|
| 3 | 0,3 | 23.553 | 23.553 |
| 4 | 3,4 | 28.364 | 4.811 |

TOTAL $NO_X$ EMITTED - (TNE) - The total mass of $NO_x$ emitted to the atmosphere from the stack outlet from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNE = \sum_{0}^{TIC} NEDI$$

Example Calculation, Test 11

| TIC (min) | INT (min) | TNE (gm) | NEDI (gm) |
|---|---|---|---|
| 3 | 0,3 | 103.455 | 103.455 |
| 4 | 3,4 | 124.649 | 21.199 |

% $NO_X$ REDUC DUE TO ADS - (% NRDTA) - The percentage of the average $NO_x$ removal efficiency due to adsorption from the beginning of the cycle to the indiciated time. This value is calculated as follows:

$$\% \ NRDTA = TNA \div TNI \times 100$$

Example Calculation, Test 11

| TIC (min) | % NRDTA (%) | TNA (gm) | TNI (gm) |
|---|---|---|---|
| 3 | 95.795 | 2893.950 | 3020.958 |
| 4 | 96.204 | 3877.954 | 4030.968 |

% $NO_x$ REDUC DUE TO REGEN - (%NRDTR) - The percentage of the average $NO_x$ removal efficiency due to regeneration from the beginning of the cycle to the indicated time. This value is calculated as follows:

% NRDTR = TNUFR ÷ TNI x 100

Example Calculation, Text 11

| TIC (min) | % NRDTR (%) | TNUFR (gm) | TNI (gm) |
|---|---|---|---|
| 3 | 0.780 | 23.553 | 3020.958 |
| 4 | 0.703 | 28.364 | 4030.968 |

AVG % REDUC OF $NO_x$ - (A % R) - The average $NO_x$ removal efficiency of the PuraSiv N unit from the beginning of the cycle to the indicated time. This value is calculated as follows:

A % R = % NRDTA + % NRDTR

Example Calculation, Test 11

| TIC (min) | A % R (%) | % NRDTA (%) | % NRDTR (%) |
|---|---|---|---|
| 3 | 96.575 | 95.795 | 0.780 |
| 4 | 96.907 | 96.204 | 0.703 |

AVG PPM OF $NO_x$ EMIT DURING INTERVAL - (APPME) - The average concentration of $NO_x$ emitted to the atmosphere from the stack outlet, from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$APPME = (\Sigma(b-a) \times APPM) \div TIC$$

Example Calculation, Test 11

| TIC (min) | APPME (ppm) | (a,b) (min) | (b-a) (min) | APPM (ppm) |
|---|---|---|---|---|
| 3 | 140.0 | 0,3 | 3 | 140 |
| 4 | 126.5 | 3,4 | 1 | 86 |

# TABLE A-1. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT 8, 1412-1800 3/5/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5625 | 1025 | 2090 | 166 | 646.4 | 595.0 | 9.36 | 41.98 | 92.06 | 1.45 | 93.50 |
| 3.0 | 5975 | 1025 | 2080 | 92 | 683.3 | 653.1 | 5.18 | 25.04 | 95.58 | 0.76 | 96.34 |
| 8.0 | 5975 | 1020 | 2080 | 80 | 683.3 | 657.0 | 4.49 | 21.79 | 95.15 | 0.66 | 96.81 |
| 18.0 | 5975 | 1020 | 2020 | 109 | 663.6 | 627.8 | 6.11 | 29.70 | 94.60 | 0.92 | 95.53 |
| 23.0 | 5975 | 1020 | 2020 | 84 | 663.6 | 636.0 | 4.71 | 22.88 | 95.84 | 0.71 | 96.55 |
| 33.0 | 5975 | 1025 | 1980 | 65 | 650.5 | 629.1 | 3.66 | 17.69 | 95.72 | 0.56 | 97.28 |
| 38.0 | 5950 | 1025 | 2070 | 70 | 677.2 | 654.3 | 3.94 | 18.95 | 96.62 | 0.58 | 97.20 |
| 42.0 | 5950 | 1025 | 2200 | 64 | 719.7 | 698.8 | 3.61 | 17.33 | 97.09 | 0.50 | 97.59 |
| 49.0 | 5950 | 1025 | 2670 | 75 | 873.5 | 848.9 | 4.23 | 20.31 | 97.19 | 0.48 | 97.67 |
| 56.0 | 5975 | 1025 | 2800 | 79 | 919.8 | 893.9 | 4.45 | 21.50 | 97.18 | 0.48 | 97.66 |
| 64.0 | 5975 | 1025 | 2550 | 81 | 837.7 | 811.1 | 4.56 | 22.04 | 96.82 | 0.54 | 97.37 |
| 68.0 | 5975 | 1025 | 2600 | 81 | 854.1 | 827.5 | 4.56 | 22.04 | 96.88 | 0.53 | 97.42 |
| 78.0 | 5700 | 1025 | 2660 | 84 | 833.6 | 807.3 | 4.73 | 21.59 | 96.84 | 0.57 | 97.41 |
| 83.0 | 5675 | 1025 | 2660 | 86 | 830.0 | 803.1 | 4.85 | 21.99 | 96.77 | 0.58 | 97.35 |
| 93.0 | 5675 | 1025 | 2650 | 89 | 826.9 | 799.1 | 5.02 | 22.75 | 96.64 | 0.61 | 97.25 |
| 98.0 | 5675 | 1025 | 2650 | 91 | 826.9 | 798.5 | 5.13 | 23.27 | 96.57 | 0.62 | 97.19 |
| 103.0 | 5675 | 1025 | 2680 | 95 | 836.2 | 806.6 | 5.35 | 24.29 | 96.46 | 0.64 | 97.10 |
| 113.0 | 5675 | 1025 | 2690 | 99 | 839.3 | 808.4 | 5.58 | 25.31 | 96.32 | 0.66 | 96.98 |
| 123.0 | 5675 | 1025 | 2660 | 95 | 830.0 | 800.3 | 5.35 | 24.29 | 96.43 | 0.65 | 97.07 |
| 133.0 | 5650 | 1025 | 2600 | 114 | 807.7 | 772.3 | 6.42 | 28.99 | 95.62 | 0.80 | 96.41 |
| 143.0 | 5675 | 1025 | 2770 | 118 | 864.3 | 827.5 | 6.65 | 30.17 | 95.74 | 0.77 | 96.51 |
| 153.0 | 5650 | 1025 | 2930 | 130 | 910.2 | 869.8 | 7.33 | 33.06 | 95.56 | 0.80 | 96.37 |
| 158.0 | 5650 | 1025 | 2900 | 135 | 900.9 | 858.9 | 7.61 | 34.33 | 95.34 | 0.84 | 96.19 |
| 168.0 | 5625 | 1025 | 2750 | 141 | 850.5 | 806.9 | 7.95 | 35.66 | 94.87 | 0.93 | 95.81 |
| 173.0 | 5625 | 1025 | 2700 | 142 | 835.0 | 791.1 | 8.00 | 35.91 | 94.74 | 0.96 | 95.70 |
| 183.0 | 5750 | 1025 | 2650 | 151 | 837.8 | 790.0 | 8.51 | 39.23 | 94.30 | 1.02 | 95.32 |
| 188.0 | 5650 | 1025 | 2650 | 155 | 823.2 | 775.1 | 8.74 | 39.41 | 94.15 | 1.06 | 95.21 |
| 198.0 | 5675 | 1025 | 2610 | 161 | 814.4 | 764.1 | 9.07 | 41.16 | 93.83 | 1.11 | 94.95 |
| 205.0 | 5700 | 1025 | 2650 | 170 | 830.5 | 777.2 | 9.58 | 43.70 | 93.58 | 1.15 | 94.74 |
| 213.0 | 5700 | 1025 | 2680 | 174 | 839.9 | 785.4 | 9.81 | 44.72 | 93.51 | 1.17 | 94.67 |
| 218.0 | 5675 | 1025 | 2660 | 179 | 830.0 | 774.1 | 10.09 | 45.76 | 93.27 | 1.22 | 94.49 |
| 228.0 | 5650 | 1025 | 2640 | 185 | 820.1 | 762.6 | 10.43 | 47.04 | 92.99 | 1.27 | 94.26 |

## TABLE A-2. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT B, 1412-1800 3/5/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 3.0 | 1994.5 | 1872.2 | 21.81 | 100.53 | 93.87 | 1.09 | 94.96 | 128 |
| 3.0- 8.0 | 3416.5 | 3275.3 | 24.18 | 117.08 | 95.87 | 0.71 | 96.57 | 86 |
| 8.0- 18.0 | 6734.5 | 6424.1 | 53.00 | 257.45 | 95.39 | 0.79 | 96.18 | 95 |
| 18.0- 23.0 | 3318.0 | 3159.5 | 27.06 | 131.45 | 95.22 | 0.82 | 96.04 | 97 |
| 23.0- 33.0 | 6570.3 | 6325.5 | 41.87 | 202.87 | 96.27 | 0.64 | 96.91 | 75 |
| 33.0- 38.0 | 3319.1 | 3208.5 | 19.02 | 91.61 | 96.67 | 0.57 | 97.24 | 67 |
| 38.0- 42.0 | 2793.8 | 2706.1 | 15.10 | 72.57 | 96.86 | 0.54 | 97.40 | 67 |
| 42.0- 49.0 | 5576.1 | 5416.9 | 27.42 | 131.74 | 97.15 | 0.49 | 97.64 | 70 |
| 49.0- 56.0 | 6276.6 | 6099.9 | 30.38 | 146.33 | 97.18 | 0.48 | 97.67 | 77 |
| 56.0- 64.0 | 7030.2 | 6820.0 | 36.07 | 174.18 | 97.01 | 0.51 | 97.52 | 80 |
| 64.0- 68.0 | 3383.7 | 3277.3 | 18.26 | 88.18 | 96.85 | 0.54 | 97.39 | 81 |
| 68.0- 78.0 | 8438.8 | 8174.2 | 46.49 | 218.18 | 96.86 | 0.55 | 97.41 | 82 |
| 78.0- 83.0 | 4159.0 | 4026.1 | 23.95 | 108.95 | 96.80 | 0.58 | 97.38 | 85 |
| 83.0- 93.0 | 8284.1 | 8011.1 | 49.31 | 223.71 | 96.70 | 0.60 | 97.30 | 87 |
| 93.0- 98.0 | 4134.3 | 3993.9 | 25.36 | 115.05 | 96.60 | 0.61 | 97.22 | 90 |
| 98.0-108.0 | 8315.3 | 8025.1 | 52.41 | 237.77 | 96.51 | 0.63 | 97.14 | 93 |
| 108.0-113.0 | 4188.9 | 4037.5 | 27.33 | 124.00 | 96.39 | 0.65 | 97.04 | 97 |
| 113.0-123.0 | 8346.5 | 8043.9 | 54.67 | 247.99 | 96.37 | 0.65 | 97.03 | 97 |
| 123.0-138.0 | 12282.4 | 11794.5 | 88.34 | 399.58 | 96.03 | 0.72 | 96.75 | 104 |
| 133.0-143.0 | 4179.9 | 3999.3 | 32.69 | 147.89 | 95.68 | 0.78 | 96.46 | 116 |
| 143.0-153.0 | 8872.4 | 8486.4 | 69.88 | 316.13 | 95.65 | 0.79 | 96.44 | 124 |
| 153.0-158.0 | 4527.7 | 4321.8 | 37.34 | 168.47 | 95.45 | 0.82 | 96.28 | 133 |
| 158.0-168.0 | 8756.8 | 8329.1 | 77.77 | 349.95 | 95.12 | 0.89 | 96.00 | 138 |
| 168.0-173.0 | 4213.8 | 3995.0 | 39.87 | 178.94 | 94.81 | 0.95 | 95.75 | 141 |
| 173.0-183.0 | 8364.1 | 7905.8 | 82.56 | 375.71 | 94.52 | 0.99 | 95.51 | 147 |
| 183.0-188.0 | 4152.5 | 3912.8 | 43.11 | 196.61 | 94.23 | 1.04 | 95.27 | 153 |
| 188.0-198.0 | 8187.9 | 7696.0 | 89.04 | 402.88 | 93.99 | 1.09 | 95.08 | 158 |
| 198.0-205.0 | 5757.0 | 5394.7 | 65.29 | 297.00 | 93.71 | 1.13 | 94.84 | 166 |
| 205.0-213.0 | 6681.6 | 6250.3 | 77.55 | 353.68 | 93.55 | 1.16 | 94.71 | 172 |
| 213.0-218.0 | 4174.7 | 3898.7 | 49.73 | 226.22 | 93.39 | 1.19 | 94.58 | 176 |
| 218.0-228.0 | 8250.4 | 7683.8 | 102.57 | 464.04 | 93.13 | 1.24 | 94.38 | 182 |

# TABLE A-3. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT B, 1412-1800 3/5/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 3.0 | 1994.5 | 1872.2 | 21.8 | 100.5 | 93.87 | 1.09 | 94.96 | 128 |
| 8.0 | 5411.1 | 5147.5 | 46.0 | 217.6 | 95.13 | 0.85 | 95.98 | 101 |
| 18.0 | 12145.6 | 11571.6 | 99.0 | 475.1 | 95.27 | 0.81 | 96.09 | 97 |
| 23.0 | 15463.6 | 14731.1 | 126.0 | 606.5 | 95.26 | 0.82 | 96.08 | 97 |
| 33.0 | 22033.9 | 21056.6 | 167.9 | 809.4 | 95.56 | 0.76 | 96.33 | 90 |
| 38.0 | 25353.0 | 24265.1 | 186.9 | 901.0 | 95.71 | 0.74 | 96.45 | 87 |
| 42.0 | 28146.8 | 26971.2 | 202.0 | 973.6 | 95.82 | 0.72 | 96.54 | 85 |
| 49.0 | 33722.9 | 32388.1 | 229.5 | 1105.3 | 96.04 | 0.68 | 96.72 | 83 |
| 56.0 | 39999.4 | 38487.9 | 259.8 | 1251.6 | 96.22 | 0.65 | 96.87 | 82 |
| 64.0 | 47029.6 | 45307.9 | 295.9 | 1425.8 | 96.34 | 0.63 | 96.97 | 82 |
| 68.0 | 50413.3 | 48585.2 | 314.2 | 1514.0 | 96.37 | 0.62 | 97.00 | 82 |
| 78.0 | 58852.1 | 56759.3 | 360.7 | 1732.2 | 96.44 | 0.61 | 97.06 | 82 |
| 83.0 | 63011.1 | 60785.4 | 384.6 | 1841.1 | 96.47 | 0.61 | 97.08 | 82 |
| 93.0 | 71295.3 | 68796.5 | 433.9 | 2064.8 | 96.50 | 0.61 | 97.10 | 83 |
| 98.0 | 75429.5 | 72790.4 | 459.3 | 2179.9 | 96.50 | 0.61 | 97.11 | 83 |
| 108.0 | 83744.9 | 80815.5 | 511.7 | 2417.6 | 96.50 | 0.61 | 97.11 | 84 |
| 113.0 | 87933.7 | 84853.1 | 539.0 | 2541.6 | 96.50 | 0.61 | 97.11 | 85 |
| 123.0 | 96280.3 | 92896.9 | 593.7 | 2789.6 | 96.49 | 0.62 | 97.10 | 86 |
| 138.0 | 108562.6 | 104691.4 | 682.0 | 3189.2 | 96.43 | 0.63 | 97.06 | 88 |
| 143.0 | 112742.5 | 108690.7 | 714.7 | 3337.1 | 96.41 | 0.63 | 97.04 | 88 |
| 153.0 | 121615.0 | 117177.2 | 784.6 | 3653.2 | 96.35 | 0.65 | 97.00 | 91 |
| 158.0 | 126142.6 | 121499.0 | 821.9 | 3821.7 | 96.32 | 0.65 | 96.97 | 92 |
| 168.0 | 134899.5 | 129828.1 | 899.7 | 4171.7 | 96.24 | 0.67 | 96.91 | 95 |
| 173.0 | 139113.3 | 133823.1 | 939.6 | 4350.6 | 96.20 | 0.68 | 96.87 | 96 |
| 183.0 | 147477.3 | 141728.9 | 1022.1 | 4726.3 | 96.10 | 0.69 | 96.80 | 99 |
| 188.0 | 151629.8 | 145641.7 | 1065.2 | 4922.9 | 96.05 | 0.70 | 96.75 | 100 |
| 198.0 | 159817.7 | 153337.6 | 1154.3 | 5325.8 | 95.95 | 0.72 | 96.67 | 103 |
| 205.0 | 165574.7 | 158732.4 | 1219.6 | 5622.8 | 95.87 | 0.74 | 96.60 | 105 |
| 213.0 | 172256.3 | 164982.7 | 1297.1 | 5976.5 | 95.78 | 0.75 | 96.53 | 108 |
| 218.0 | 176431.0 | 168881.4 | 1346.9 | 6202.7 | 95.72 | 0.76 | 96.48 | 109 |
| 228.0 | 184681.4 | 176565.2 | 1449.4 | 6666.7 | 95.61 | 0.78 | 96.39 | 112 |

## TABLE A-4. Summary of calculated $NO_X$ mass flow rates and control efficiencies for instantaneous flow and concentration data for test -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT B, 1010-1408 3/6/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5750 | 1050 | 2470 | 141 | 730.9 | 736.3 | 8.14 | 36.44 | 94.29 | 1.04 | 95.33 |
| 2.0 | 5575 | 1055 | 2430 | 41 | 744.8 | 732.3 | 2.38 | 10.19 | 98.31 | 0.32 | 98.63 |
| 5.0 | 5575 | 1055 | 2410 | 62 | 738.7 | 719.7 | 3.60 | 15.41 | 97.43 | 0.49 | 97.91 |
| 10.0 | 5575 | 1055 | 2630 | 90 | 806.2 | 778.6 | 5.22 | 22.37 | 96.58 | 0.65 | 97.23 |
| 12.0 | 5575 | 1055 | 2670 | 85 | 818.4 | 792.4 | 4.93 | 21.12 | 96.82 | 0.60 | 97.42 |
| 20.0 | 5675 | 1055 | 2680 | 74 | 836.2 | 813.1 | 4.29 | 18.80 | 97.24 | 0.51 | 97.75 |
| 30.0 | 5725 | 1055 | 2630 | 50 | 827.8 | 812.1 | 2.90 | 12.84 | 98.10 | 0.35 | 98.45 |
| 35.0 | 5725 | 1055 | 2680 | 49 | 843.6 | 828.2 | 2.84 | 12.58 | 98.17 | 0.34 | 98.51 |
| 40.0 | 5725 | 1055 | 2710 | 49 | 853.0 | 837.6 | 2.84 | 12.58 | 98.19 | 0.33 | 98.53 |
| 45.0 | 5725 | 1055 | 2650 | 50 | 834.1 | 818.4 | 2.90 | 12.84 | 98.11 | 0.35 | 98.46 |
| 50.0 | 5725 | 1055 | 2770 | 52 | 871.9 | 855.5 | 3.02 | 13.35 | 98.12 | 0.35 | 98.47 |
| 55.0 | 5725 | 1050 | 2820 | 54 | 887.6 | 870.7 | 3.12 | 13.88 | 98.09 | 0.35 | 98.44 |
| 58.0 | 5725 | 1050 | 2870 | 56 | 903.4 | 885.8 | 3.23 | 14.39 | 98.05 | 0.36 | 98.41 |
| 62.0 | 5725 | 1050 | 3043 | 61 | 957.8 | 938.6 | 3.52 | 15.68 | 98.00 | 0.37 | 98.36 |
| 65.0 | 5725 | 1050 | 3100 | 61 | 975.8 | 956.6 | 3.52 | 15.68 | 98.03 | 0.36 | 98.39 |
| 70.0 | 5725 | 1050 | 3180 | 71 | 1001.0 | 978.6 | 4.10 | 18.25 | 97.77 | 0.41 | 98.18 |
| 78.0 | 5725 | 1050 | 3300 | 82 | 1038.7 | 1012.9 | 4.73 | 21.08 | 97.52 | 0.46 | 97.97 |
| 80.0 | 5725 | 1050 | 3260 | 85 | 1026.1 | 999.4 | 4.91 | 21.85 | 97.39 | 0.48 | 97.87 |
| 85.0 | 5725 | 1045 | 3310 | 90 | 1041.9 | 1013.6 | 5.17 | 23.16 | 97.28 | 0.50 | 97.78 |
| 89.0 | 5725 | 1050 | 3440 | 96 | 1082.8 | 1052.6 | 5.54 | 24.68 | 97.21 | 0.51 | 97.72 |
| 95.0 | 5725 | 1050 | 3390 | 104 | 1067.1 | 1034.3 | 6.00 | 26.73 | 96.93 | 0.56 | 97.49 |
| 110.0 | 5725 | 1040 | 3220 | 125 | 1013.6 | 974.2 | 7.15 | 32.20 | 96.12 | 0.71 | 96.82 |
| 115.0 | 5725 | 1040 | 3150 | 130 | 991.5 | 950.6 | 7.43 | 33.49 | 95.87 | 0.75 | 96.62 |
| 120.0 | 5725 | 1040 | 3100 | 135 | 975.8 | 933.3 | 7.72 | 34.77 | 95.65 | 0.79 | 96.44 |
| 125.0 | 5725 | 1035 | 3100 | 139 | 975.8 | 932.0 | 7.91 | 35.84 | 95.52 | 0.81 | 96.33 |
| 130.0 | 5725 | 1025 | 3120 | 145 | 982.1 | 936.4 | 8.17 | 37.47 | 95.35 | 0.83 | 96.18 |
| 135.0 | 5725 | 1025 | 3280 | 154 | 1032.4 | 984.0 | 8.68 | 39.80 | 95.30 | 0.84 | 96.15 |
| 140.0 | 5725 | 1030 | 3350 | 171 | 1054.5 | 1000.6 | 9.68 | 44.14 | 94.90 | 0.92 | 95.81 |
| 150.0 | 5700 | 1025 | 3300 | 188 | 1034.2 | 975.3 | 10.59 | 48.32 | 94.30 | 1.02 | 95.33 |
| 152.0 | 5700 | 1025 | 3300 | 185 | 1034.2 | 976.2 | 10.43 | 47.55 | 94.39 | 1.01 | 95.40 |
| 155.0 | 5725 | 1025 | 3310 | 195 | 1041.9 | 980.5 | 10.99 | 50.39 | 94.11 | 1.05 | 95.16 |
| 160.0 | 5725 | 1025 | 3360 | 204 | 1057.6 | 993.4 | 11.50 | 52.72 | 93.93 | 1.09 | 95.02 |
| 165.0 | 5725 | 1025 | 3380 | 215 | 1063.9 | 996.2 | 12.12 | 55.56 | 93.64 | 1.14 | 94.78 |
| 170.0 | 5700 | 1025 | 3300 | 232 | 1034.2 | 961.5 | 13.07 | 59.63 | 92.97 | 1.26 | 94.23 |
| 176.0 | 5675 | 1040 | 3360 | 238 | 1048.4 | 974.1 | 13.61 | 60.65 | 92.92 | 1.30 | 94.21 |
| 185.0 | 5650 | 1045 | 3480 | 253 | 1081.0 | 1002.5 | 14.54 | 64.06 | 92.73 | 1.34 | 94.07 |
| 190.0 | 5625 | 1045 | 3320 | 268 | 1026.8 | 943.9 | 15.40 | 67.49 | 91.93 | 1.50 | 93.43 |
| 198.0 | 5625 | 1050 | 3000 | 275 | 927.8 | 842.8 | 15.88 | 69.17 | 90.83 | 1.71 | 92.54 |
| 200.0 | 5650 | 1050 | 2990 | 274 | 928.8 | 843.7 | 15.82 | 69.30 | 90.84 | 1.70 | 92.54 |
| 205.0 | 5650 | 1055 | 2980 | 272 | 925.7 | 841.2 | 15.78 | 68.72 | 90.87 | 1.70 | 92.58 |
| 210.0 | 5625 | 1055 | 2970 | 274 | 918.5 | 833.8 | 15.89 | 68.85 | 90.77 | 1.73 | 92.50 |
| 215.0 | 5625 | 1055 | 2960 | 276 | 915.4 | 830.1 | 16.01 | 69.35 | 90.68 | 1.75 | 92.42 |
| 220.0 | 5625 | 1055 | 3030 | 279 | 937.1 | 850.8 | 16.18 | 70.10 | 90.79 | 1.73 | 92.52 |
| 230.0 | 5625 | 1055 | 3120 | 288 | 964.9 | 875.9 | 16.71 | 72.36 | 90.77 | 1.73 | 92.50 |
| 235.0 | 5625 | 1055 | 2970 | 290 | 918.5 | 828.8 | 16.82 | 72.87 | 90.24 | 1.83 | 92.07 |
| 238.0 | 5625 | 1055 | 2910 | 291 | 900.0 | 810.0 | 16.88 | 73.12 | 90.00 | 1.88 | 91.88 |

# TABLE A-5. SUMMARY OF $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED FOR INTERVALS DURING TEST -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT B, 1010-1408 3/6/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 2.0 | 1525.7 | 1468.6 | 10.52 | 46.63 | 96.25 | 0.69 | 96.94 | 92 |
| 2.0- 5.0 | 2225.3 | 2178.0 | 8.96 | 38.40 | 97.87 | 0.40 | 98.27 | 51 |
| 5.0- 10.0 | 3862.2 | 3745.7 | 22.04 | 94.44 | 96.98 | 0.57 | 97.55 | 76 |
| 10.0- 12.0 | 1624.6 | 1570.9 | 10.15 | 43.49 | 96.70 | 0.62 | 97.32 | 88 |
| 12.0- 20.0 | 6618.5 | 6421.9 | 36.89 | 159.68 | 97.03 | 0.56 | 97.59 | 79 |
| 20.0- 30.0 | 8320.3 | 8126.1 | 35.96 | 158.18 | 97.67 | 0.43 | 98.10 | 62 |
| 30.0- 35.0 | 4178.6 | 4100.6 | 14.36 | 63.55 | 98.14 | 0.34 | 98.48 | 49 |
| 35.0- 40.0 | 4241.5 | 4164.4 | 14.21 | 62.91 | 98.18 | 0.34 | 98.52 | 49 |
| 40.0- 45.0 | 4217.9 | 4140.0 | 14.36 | 63.55 | 98.15 | 0.34 | 98.49 | 49 |
| 45.0- 50.0 | 4265.1 | 4184.9 | 14.79 | 65.47 | 98.12 | 0.35 | 98.46 | 51 |
| 50.0- 55.0 | 4398.9 | 4315.5 | 15.33 | 68.08 | 98.10 | 0.35 | 98.45 | 53 |
| 55.0- 58.0 | 2686.6 | 2634.6 | 9.53 | 42.41 | 98.07 | 0.35 | 98.42 | 55 |
| 58.0- 62.0 | 3722.5 | 3648.8 | 13.51 | 60.15 | 98.02 | 0.36 | 98.38 | 59 |
| 62.0- 65.0 | 2900.4 | 2842.8 | 10.56 | 47.04 | 98.01 | 0.36 | 98.38 | 61 |
| 65.0- 70.0 | 4941.9 | 4838.0 | 19.05 | 84.82 | 97.90 | 0.39 | 98.28 | 66 |
| 70.0- 78.0 | 8158.8 | 7966.2 | 35.33 | 157.31 | 97.64 | 0.43 | 98.07 | 77 |
| 78.0- 80.0 | 2064.9 | 2012.3 | 9.64 | 42.93 | 97.45 | 0.47 | 97.92 | 83 |
| 80.0- 85.0 | 5170.1 | 5032.4 | 25.20 | 112.52 | 97.34 | 0.49 | 97.82 | 88 |
| 85.0- 89.0 | 4249.4 | 4132.3 | 21.43 | 95.67 | 97.24 | 0.50 | 97.75 | 93 |
| 89.0- 95.0 | 6449.6 | 6260.8 | 34.64 | 154.22 | 97.07 | 0.54 | 97.61 | 100 |
| 95.0-110.0 | 15604.7 | 15064.0 | 98.64 | 441.98 | 96.54 | 0.63 | 97.17 | 115 |
| 110.0-115.0 | 5012.7 | 4812.0 | 36.45 | 164.21 | 96.00 | 0.73 | 96.72 | 128 |
| 115.0-120.0 | 4918.3 | 4709.7 | 37.88 | 170.65 | 95.76 | 0.77 | 96.53 | 133 |
| 120.0-125.0 | 4878.9 | 4663.3 | 39.07 | 176.54 | 95.58 | 0.80 | 96.38 | 137 |
| 125.0-130.0 | 4894.7 | 4671.2 | 40.20 | 183.28 | 95.43 | 0.82 | 96.26 | 142 |
| 130.0-135.0 | 5035.3 | 4801.0 | 42.13 | 193.16 | 95.33 | 0.84 | 96.16 | 150 |
| 135.0-140.0 | 5217.3 | 4961.5 | 45.91 | 209.84 | 95.10 | 0.88 | 95.98 | 162 |
| 140.0-150.0 | 10443.4 | 9879.7 | 101.39 | 462.32 | 94.60 | 0.97 | 95.57 | 179 |
| 150.0-152.0 | 2068.4 | 1951.5 | 21.02 | 95.88 | 94.35 | 1.02 | 95.36 | 187 |
| 152.0-155.0 | 3114.1 | 2935.1 | 32.12 | 146.91 | 94.25 | 1.03 | 95.28 | 190 |
| 155.0-160.0 | 5248.8 | 4934.8 | 56.22 | 257.77 | 94.02 | 1.07 | 95.09 | 199 |
| 160.0-165.0 | 5303.9 | 4974.1 | 59.03 | 270.69 | 93.78 | 1.11 | 94.90 | 210 |
| 165.0-170.0 | 5245.3 | 4894.3 | 62.98 | 287.98 | 93.31 | 1.20 | 94.51 | 223 |
| 170.0-176.0 | 6247.3 | 5806.9 | 80.05 | 360.85 | 92.94 | 1.28 | 94.22 | 235 |
| 175.0-185.0 | 9582.4 | 8894.6 | 126.65 | 561.19 | 92.82 | 1.32 | 94.14 | 245 |
| 185.0-190.0 | 5269.6 | 4865.9 | 74.84 | 328.86 | 92.34 | 1.42 | 93.76 | 260 |
| 190.0-198.0 | 7818.4 | 7146.6 | 125.10 | 546.64 | 91.41 | 1.60 | 93.01 | 271 |
| 198.0-200.0 | 1856.6 | 1686.5 | 31.69 | 138.47 | 90.83 | 1.71 | 92.54 | 274 |
| 200.0-205.0 | 4636.4 | 4212.3 | 78.99 | 345.04 | 90.85 | 1.70 | 92.56 | 273 |
| 205.0-210.0 | 4610.6 | 4187.6 | 79.18 | 343.91 | 90.82 | 1.72 | 92.54 | 273 |
| 210.0-215.0 | 4584.9 | 4159.7 | 79.76 | 345.49 | 90.73 | 1.74 | 92.46 | 275 |
| 215.0-220.0 | 4631.3 | 4202.2 | 80.48 | 348.63 | 90.73 | 1.74 | 92.47 | 278 |
| 220.0-230.0 | 9510.1 | 8633.3 | 164.45 | 712.34 | 90.78 | 1.73 | 92.51 | 283 |
| 230.0-235.0 | 4708.6 | 4261.7 | 83.82 | 363.08 | 90.51 | 1.78 | 92.29 | 289 |
| 235.0-238.0 | 2727.8 | 2458.2 | 50.55 | 218.98 | 90.12 | 1.85 | 91.97 | 290 |

# TABLE A-6. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT B, 1010-1408 3/6/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 2.0 | 1525.7 | 1468.6 | 10.5 | 46.6 | 96.25 | 0.69 | 96.94 | 92 |
| 5.0 | 3751.1 | 3646.6 | 19.5 | 85.0 | 97.21 | 0.52 | 97.73 | 68 |
| 10.0 | 7613.2 | 7392.3 | 41.5 | 179.5 | 97.10 | 0.55 | 97.64 | 72 |
| 12.0 | 9237.8 | 8963.2 | 51.7 | 222.9 | 97.03 | 0.56 | 97.59 | 75 |
| 20.0 | 15856.3 | 15385.1 | 88.6 | 382.6 | 97.03 | 0.56 | 97.59 | 76 |
| 30.0 | 24176.6 | 23511.3 | 124.5 | 540.8 | 97.25 | 0.52 | 97.76 | 72 |
| 35.0 | 28355.1 | 27611.9 | 138.9 | 604.4 | 97.38 | 0.49 | 97.87 | 68 |
| 40.0 | 32596.7 | 31776.3 | 153.1 | 667.3 | 97.48 | 0.47 | 97.95 | 66 |
| 45.0 | 36814.6 | 35916.3 | 167.5 | 730.8 | 97.56 | 0.45 | 98.01 | 64 |
| 50.0 | 41079.7 | 40101.1 | 182.2 | 796.3 | 97.62 | 0.44 | 98.06 | 63 |
| 55.0 | 45478.6 | 44416.6 | 197.6 | 864.4 | 97.66 | 0.43 | 98.10 | 62 |
| 58.0 | 48165.1 | 47051.2 | 207.1 | 906.8 | 97.69 | 0.43 | 98.12 | 61 |
| 62.0 | 51887.6 | 50700.0 | 220.6 | 966.9 | 97.71 | 0.43 | 98.14 | 61 |
| 65.0 | 54788.0 | 53542.9 | 231.2 | 1014.0 | 97.73 | 0.42 | 98.15 | 61 |
| 70.0 | 59729.9 | 58380.9 | 250.2 | 1098.8 | 97.74 | 0.42 | 98.16 | 62 |
| 78.0 | 67888.7 | 66347.0 | 285.6 | 1256.1 | 97.73 | 0.42 | 98.15 | 63 |
| 80.0 | 69953.6 | 68359.4 | 295.2 | 1299.0 | 97.72 | 0.42 | 98.14 | 64 |
| 85.0 | 75123.6 | 73391.7 | 320.4 | 1411.5 | 97.69 | 0.43 | 98.12 | 65 |
| 89.0 | 79373.0 | 77524.0 | 341.8 | 1507.2 | 97.67 | 0.43 | 98.10 | 66 |
| 95.0 | 85822.6 | 83784.8 | 376.5 | 1661.4 | 97.63 | 0.44 | 98.06 | 68 |
| 110.0 | 101427.3 | 98848.8 | 475.1 | 2103.4 | 97.46 | 0.47 | 97.93 | 75 |
| 115.0 | 106440.0 | 103660.8 | 511.5 | 2267.6 | 97.39 | 0.48 | 97.87 | 77 |
| 120.0 | 111358.3 | 108370.6 | 549.4 | 2438.3 | 97.32 | 0.49 | 97.81 | 79 |
| 125.0 | 116237.2 | 113033.9 | 588.5 | 2614.8 | 97.24 | 0.51 | 97.75 | 82 |
| 130.0 | 121131.8 | 117705.0 | 628.7 | 2798.1 | 97.17 | 0.52 | 97.69 | 84 |
| 135.0 | 126163.1 | 122506.0 | 670.8 | 2991.3 | 97.10 | 0.53 | 97.63 | 87 |
| 140.0 | 131385.4 | 127467.6 | 716.7 | 3201.1 | 97.02 | 0.55 | 97.56 | 89 |
| 150.0 | 141828.8 | 137347.2 | 818.1 | 3663.4 | 96.84 | 0.58 | 97.42 | 95 |
| 152.0 | 143897.2 | 139298.7 | 839.2 | 3759.3 | 96.80 | 0.58 | 97.39 | 97 |
| 155.0 | 147011.3 | 142233.8 | 871.3 | 3906.2 | 96.75 | 0.59 | 97.34 | 98 |
| 160.0 | 152260.1 | 147168.6 | 927.5 | 4164.0 | 96.66 | 0.61 | 97.27 | 102 |
| 165.0 | 157564.0 | 152142.8 | 986.5 | 4434.7 | 96.56 | 0.63 | 97.19 | 105 |
| 170.0 | 162809.3 | 157037.1 | 1049.5 | 4722.6 | 96.45 | 0.64 | 97.10 | 108 |
| 176.0 | 169057.0 | 162844.0 | 1129.6 | 5083.5 | 96.32 | 0.67 | 96.99 | 113 |
| 185.0 | 178639.5 | 171738.6 | 1256.2 | 5644.7 | 96.14 | 0.70 | 96.84 | 119 |
| 190.0 | 183909.0 | 176604.4 | 1331.0 | 5973.6 | 96.03 | 0.72 | 96.75 | 123 |
| 198.0 | 191727.4 | 183751.1 | 1456.1 | 6520.2 | 95.84 | 0.76 | 96.60 | 129 |
| 200.0 | 193584.0 | 185437.5 | 1487.8 | 6658.7 | 95.79 | 0.77 | 96.56 | 130 |
| 205.0 | 198220.4 | 189649.9 | 1566.8 | 7003.7 | 95.68 | 0.79 | 96.47 | 134 |
| 210.0 | 202831.1 | 193837.4 | 1646.0 | 7347.6 | 95.57 | 0.81 | 96.38 | 137 |
| 215.0 | 207416.0 | 197997.1 | 1725.8 | 7693.1 | 95.46 | 0.83 | 96.29 | 140 |
| 220.0 | 212047.3 | 202199.3 | 1806.2 | 8041.7 | 95.36 | 0.85 | 96.21 | 143 |
| 230.0 | 221557.4 | 210832.6 | 1970.7 | 8754.1 | 95.16 | 0.89 | 96.05 | 149 |
| 235.0 | 226266.0 | 215094.4 | 2054.5 | 9117.2 | 95.06 | 0.91 | 95.97 | 152 |
| 238.0 | 228993.8 | 217552.6 | 2105.1 | 9336.1 | 95.00 | 0.92 | 95.92 | 154 |

# TABLE A-7. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5625 | 1055 | 2910 | 291 | 900.0 | 810.0 | 16.88 | 73.12 | 90.00 | 1.88 | 91.88 |
| 6.0 | 5875 | 1045 | 2800 | 168 | 904.4 | 850.2 | 9.65 | 44.61 | 94.00 | 1.07 | 95.07 |
| 7.0 | 5875 | 1045 | 2910 | 161 | 940.0 | 888.0 | 9.25 | 42.76 | 94.47 | 0.98 | 95.45 |
| 12.0 | 5875 | 1040 | 2800 | 186 | 904.4 | 844.4 | 10.64 | 49.45 | 93.36 | 1.18 | 94.53 |
| 22.0 | 5850 | 1040 | 2820 | 126 | 907.0 | 866.5 | 7.20 | 33.32 | 95.53 | 0.79 | 96.33 |
| 27.0 | 5850 | 1040 | 2840 | 160 | 913.5 | 862.0 | 9.15 | 42.31 | 94.37 | 1.00 | 95.37 |
| 37.0 | 5850 | 1040 | 2820 | 89 | 907.0 | 878.4 | 5.09 | 23.54 | 96.84 | 0.56 | 97.41 |
| 42.0 | 5850 | 1040 | 2870 | 86 | 923.1 | 895.4 | 4.92 | 22.74 | 97.00 | 0.53 | 97.54 |
| 47.0 | 5850 | 1040 | 2900 | 82 | 932.8 | 906.4 | 4.69 | 21.69 | 97.17 | 0.50 | 97.68 |
| 52.0 | 5850 | 1040 | 2920 | 82 | 939.2 | 912.8 | 4.69 | 21.69 | 97.19 | 0.50 | 97.69 |
| 57.0 | 5850 | 1035 | 3060 | 84 | 984.2 | 957.2 | 4.78 | 22.24 | 97.25 | 0.49 | 97.74 |
| 67.0 | 5850 | 1035 | 3350 | 90 | 1077.5 | 1048.6 | 5.12 | 23.83 | 97.31 | 0.48 | 97.79 |
| 72.0 | 5850 | 1035 | 3480 | 92 | 1119.3 | 1089.7 | 5.24 | 24.36 | 97.36 | 0.47 | 97.82 |
| 82.0 | 5825 | 1035 | 3520 | 104 | 1127.3 | 1094.0 | 5.92 | 27.39 | 97.05 | 0.52 | 97.57 |
| 87.0 | 5850 | 1035 | 3420 | 108 | 1100.0 | 1065.3 | 6.15 | 28.59 | 96.84 | 0.56 | 97.40 |
| 97.0 | 5850 | 1035 | 3350 | 114 | 1077.5 | 1040.8 | 6.49 | 30.18 | 96.60 | 0.60 | 97.20 |
| 102.0 | 5875 | 1035 | 3320 | 116 | 1072.4 | 1034.9 | 6.60 | 30.87 | 96.51 | 0.62 | 97.12 |
| 112.0 | 5850 | 1035 | 3450 | 122 | 1109.7 | 1070.4 | 6.94 | 32.30 | 96.46 | 0.63 | 97.09 |
| 117.0 | 5875 | 1035 | 3360 | 129 | 1085.3 | 1043.7 | 7.34 | 34.33 | 96.16 | 0.68 | 96.84 |
| 123.0 | 5875 | 1035 | 3340 | 139 | 1078.9 | 1034.0 | 7.91 | 36.99 | 95.84 | 0.73 | 96.57 |
| 132.0 | 5875 | 1035 | 3280 | 142 | 1059.5 | 1013.6 | 8.08 | 37.79 | 95.67 | 0.76 | 96.43 |
| 144.0 | 5850 | 1035 | 3190 | 155 | 1026.0 | 976.2 | 8.82 | 41.03 | 95.14 | 0.86 | 96.00 |
| 147.0 | 5850 | 1035 | 3160 | 156 | 1016.4 | 966.2 | 8.88 | 41.30 | 95.06 | 0.87 | 95.94 |
| 157.0 | 5825 | 1020 | 3100 | 164 | 992.8 | 940.3 | 9.20 | 43.33 | 94.71 | 0.93 | 95.64 |
| 162.0 | 5825 | 1020 | 3080 | 170 | 986.4 | 932.0 | 9.53 | 44.91 | 94.48 | 0.97 | 95.45 |
| 172.0 | 5825 | 1020 | 3080 | 174 | 986.4 | 930.7 | 9.76 | 45.97 | 94.35 | 0.99 | 95.34 |
| 177.0 | 5825 | 1015 | 3040 | 178 | 973.6 | 916.6 | 9.93 | 47.07 | 94.14 | 1.02 | 95.17 |
| 182.0 | 5125 | 1050 | 3020 | 172 | 851.0 | 802.5 | 9.93 | 38.54 | 94.30 | 1.17 | 95.47 |
| 187.0 | 3425 | 1050 | 2420 | 168 | 455.7 | 424.1 | 9.70 | 21.94 | 93.06 | 2.13 | 95.19 |
| 192.0 | 3425 | 930 | 1970 | 162 | 371.0 | 340.5 | 8.28 | 22.22 | 91.78 | 2.23 | 94.01 |
| 197.0 | 3425 | 930 | 1060 | 164 | 199.6 | 168.7 | 8.39 | 22.50 | 84.53 | 4.20 | 88.73 |
| 202.0 | 3500 | 930 | 2000 | 148 | 384.9 | 356.4 | 7.57 | 20.91 | 92.60 | 1.97 | 94.57 |
| 206.0 | 2700 | 930 | 1510 | 308 | 224.2 | 178.4 | 15.75 | 29.97 | 79.60 | 7.03 | 86.63 |
| 207.0 | 2700 | 1125 | 1380 | 274 | 204.9 | 164.2 | 16.95 | 23.73 | 80.14 | 8.27 | 88.42 |
| 209.0 | 2700 | 1125 | 1100 | 156 | 163.3 | 140.1 | 9.65 | 13.51 | 85.82 | 5.91 | 91.73 |
| 212.0 | 4100 | 1050 | 750 | 148 | 169.1 | 135.7 | 8.54 | 24.82 | 80.27 | 5.05 | 85.32 |
| 217.0 | 5750 | 1020 | 1200 | 131 | 379.4 | 338.0 | 7.35 | 34.07 | 89.08 | 1.94 | 91.02 |
| 222.0 | 5125 | 1040 | 1560 | 138 | 439.6 | 400.7 | 7.89 | 30.99 | 91.15 | 1.80 | 92.95 |
| 232.0 | 5550 | 1030 | 2250 | 130 | 686.6 | 646.9 | 7.36 | 32.31 | 94.22 | 1.07 | 95.29 |
| 244.0 | 5450 | 1030 | 2580 | 150 | 773.1 | 728.1 | 8.49 | 36.45 | 94.19 | 1.10 | 95.28 |

# TABLE A-8. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 6.0 | 5413.3 | 4980.5 | 79.60 | 353.20 | 92.00 | 1.47 | 93.48 | 228 |
| 6.0- 7.0 | 922.2 | 869.1 | 9.45 | 43.68 | 94.24 | 1.02 | 95.26 | 165 |
| 7.0- 12.0 | 4611.1 | 4330.8 | 49.71 | 230.50 | 93.92 | 1.08 | 95.00 | 174 |
| 12.0- 22.0 | 9057.4 | 8554.3 | 89.20 | 413.84 | 94.45 | 0.98 | 95.43 | 156 |
| 22.0- 27.0 | 4551.2 | 4321.3 | 40.88 | 189.09 | 94.95 | 0.90 | 95.85 | 143 |
| 27.0- 37.0 | 9102.5 | 8702.0 | 71.19 | 329.25 | 95.60 | 0.78 | 96.38 | 124 |
| 37.0- 42.0 | 4575.3 | 4434.6 | 25.02 | 115.70 | 96.92 | 0.55 | 97.47 | 87 |
| 42.0- 47.0 | 4639.7 | 4504.6 | 24.02 | 111.07 | 97.09 | 0.52 | 97.61 | 84 |
| 47.0- 52.0 | 4679.9 | 4548.0 | 23.44 | 108.43 | 97.18 | 0.50 | 97.68 | 82 |
| 52.0- 57.0 | 4808.5 | 4675.1 | 23.67 | 109.81 | 97.22 | 0.49 | 97.72 | 83 |
| 57.0- 67.0 | 10309.6 | 10028.8 | 49.51 | 230.32 | 97.29 | 0.48 | 97.77 | 87 |
| 67.0- 72.0 | 5492.0 | 5345.7 | 25.89 | 120.45 | 97.34 | 0.47 | 97.81 | 91 |
| 72.0- 82.0 | 11233.3 | 10918.8 | 55.77 | 258.73 | 97.20 | 0.50 | 97.70 | 98 |
| 82.0- 87.0 | 5568.4 | 5398.3 | 30.16 | 139.95 | 96.95 | 0.54 | 97.49 | 106 |
| 87.0- 97.0 | 10887.6 | 10530.5 | 63.17 | 293.86 | 96.72 | 0.58 | 97.30 | 111 |
| 97.0-102.0 | 5374.8 | 5189.4 | 32.72 | 152.62 | 96.55 | 0.61 | 97.16 | 115 |
| 102.0-112.0 | 10910.4 | 10526.8 | 67.72 | 315.83 | 96.48 | 0.62 | 97.11 | 119 |
| 112.0-117.0 | 5487.5 | 5285.2 | 35.71 | 166.57 | 96.31 | 0.65 | 96.96 | 126 |
| 117.0-128.0 | 11903.1 | 11427.0 | 83.88 | 392.25 | 96.00 | 0.70 | 96.70 | 134 |
| 128.0-132.0 | 4276.7 | 4095.2 | 31.98 | 149.55 | 95.76 | 0.75 | 96.50 | 141 |
| 132.0-144.0 | 12513.2 | 11938.8 | 101.41 | 472.93 | 95.41 | 0.81 | 96.22 | 148 |
| 144.0-147.0 | 3063.6 | 2913.6 | 26.55 | 123.50 | 95.10 | 0.87 | 95.97 | 155 |
| 147.0-157.0 | 10046.1 | 9532.6 | 90.37 | 423.13 | 94.89 | 0.90 | 95.79 | 160 |
| 157.0-162.0 | 4948.1 | 4680.7 | 46.83 | 220.60 | 94.60 | 0.95 | 95.54 | 167 |
| 162.0-172.0 | 9864.2 | 9313.4 | 96.46 | 454.40 | 94.42 | 0.98 | 95.39 | 172 |
| 172.0-177.0 | 4900.1 | 4618.3 | 49.23 | 232.61 | 94.25 | 1.00 | 95.25 | 176 |
| 177.0-182.0 | 4561.5 | 4297.8 | 49.66 | 214.03 | 94.22 | 1.09 | 95.31 | 175 |
| 182.0-187.0 | 3266.7 | 3066.5 | 49.07 | 151.19 | 93.87 | 1.50 | 95.37 | 171 |
| 187.0-192.0 | 2066.7 | 1911.4 | 44.96 | 110.40 | 92.48 | 2.18 | 94.66 | 165 |
| 192.0-197.0 | 1426.5 | 1273.0 | 41.67 | 111.80 | 89.24 | 2.92 | 92.16 | 163 |
| 197.0-202.0 | 1461.2 | 1312.8 | 39.88 | 108.53 | 89.84 | 2.73 | 92.57 | 156 |
| 202.0-206.0 | 1218.1 | 1069.7 | 46.63 | 101.77 | 87.82 | 3.83 | 91.64 | 213 |
| 206.0-207.0 | 214.5 | 171.3 | 16.35 | 26.85 | 79.86 | 7.62 | 87.48 | 292 |
| 207.0-209.0 | 368.2 | 304.3 | 26.60 | 37.24 | 82.66 | 7.22 | 89.89 | 215 |
| 209.0-212.0 | 498.5 | 413.8 | 27.29 | 57.49 | 82.99 | 5.47 | 88.47 | 151 |
| 212.0-217.0 | 1371.1 | 1184.2 | 39.73 | 147.22 | 86.37 | 2.90 | 89.26 | 138 |
| 217.0-222.0 | 2047.4 | 1846.6 | 38.09 | 162.66 | 90.19 | 1.86 | 92.06 | 134 |
| 222.0-232.0 | 5630.8 | 5238.0 | 76.26 | 316.51 | 93.02 | 1.35 | 94.38 | 134 |
| 232.0-244.0 | 8758.1 | 8250.4 | 95.14 | 412.56 | 94.20 | 1.09 | 95.29 | 140 |

# TABLE A-9. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 6.0 | 5413.3 | 4980.5 | 79.6 | 353.2 | 92.00 | 1.47 | 93.48 | 228 |
| 7.0 | 6335.5 | 5849.5 | 89.0 | 396.9 | 92.33 | 1.41 | 93.74 | 219 |
| 12.0 | 10946.5 | 10180.4 | 138.8 | 627.4 | 93.00 | 1.27 | 94.27 | 200 |
| 22.0 | 20003.9 | 18734.7 | 228.0 | 1041.2 | 93.66 | 1.14 | 94.79 | 180 |
| 27.0 | 24555.1 | 23056.0 | 268.8 | 1230.3 | 93.89 | 1.09 | 94.99 | 173 |
| 37.0 | 33657.6 | 31758.0 | 340.0 | 1559.6 | 94.36 | 1.01 | 95.37 | 160 |
| 42.0 | 38232.9 | 36192.6 | 365.1 | 1675.3 | 94.66 | 0.95 | 95.62 | 151 |
| 47.0 | 42872.6 | 40697.2 | 389.1 | 1786.3 | 94.93 | 0.91 | 95.83 | 144 |
| 52.0 | 47552.5 | 45245.2 | 412.5 | 1894.8 | 95.15 | 0.87 | 96.02 | 138 |
| 57.0 | 52361.0 | 49920.3 | 436.2 | 2004.6 | 95.34 | 0.83 | 96.17 | 133 |
| 67.0 | 62669.6 | 59949.0 | 485.7 | 2234.9 | 95.66 | 0.78 | 96.43 | 126 |
| 72.0 | 68161.7 | 65294.7 | 511.6 | 2355.4 | 95.79 | 0.75 | 96.54 | 124 |
| 82.0 | 79394.9 | 76213.5 | 567.4 | 2614.1 | 95.99 | 0.71 | 96.71 | 121 |
| 87.0 | 84963.3 | 81611.8 | 597.5 | 2754.0 | 96.06 | 0.70 | 96.76 | 120 |
| 97.0 | 95850.9 | 92142.3 | 660.7 | 3047.9 | 96.13 | 0.69 | 96.82 | 119 |
| 102.0 | 101225.7 | 97331.7 | 693.4 | 3200.5 | 96.15 | 0.69 | 96.84 | 119 |
| 112.0 | 112136.0 | 107858.6 | 761.1 | 3516.3 | 96.19 | 0.68 | 96.86 | 119 |
| 117.0 | 117623.5 | 113143.8 | 796.8 | 3682.9 | 96.19 | 0.68 | 96.87 | 119 |
| 123.0 | 129526.7 | 124570.8 | 880.7 | 4075.2 | 96.17 | 0.68 | 96.85 | 120 |
| 132.0 | 133803.4 | 128666.0 | 912.7 | 4224.7 | 96.16 | 0.68 | 96.84 | 121 |
| 144.0 | 146316.6 | 140604.9 | 1014.1 | 4697.6 | 96.10 | 0.69 | 96.79 | 123 |
| 147.0 | 149380.2 | 143518.4 | 1040.6 | 4821.1 | 96.08 | 0.70 | 96.77 | 124 |
| 157.0 | 159426.3 | 153051.0 | 1131.0 | 5244.3 | 96.00 | 0.71 | 96.71 | 126 |
| 162.0 | 164374.4 | 157731.7 | 1177.8 | 5464.9 | 95.96 | 0.72 | 96.68 | 127 |
| 172.0 | 174238.6 | 167045.1 | 1274.3 | 5919.3 | 95.87 | 0.73 | 96.60 | 130 |
| 177.0 | 179138.7 | 171663.3 | 1323.5 | 6151.9 | 95.83 | 0.74 | 96.57 | 131 |
| 182.0 | 183700.2 | 175961.1 | 1373.2 | 6365.9 | 95.79 | 0.75 | 96.53 | 132 |
| 187.0 | 186966.9 | 179027.6 | 1422.3 | 6517.1 | 95.75 | 0.76 | 96.51 | 133 |
| 192.0 | 189033.6 | 180938.9 | 1467.2 | 6627.5 | 95.72 | 0.78 | 96.49 | 134 |
| 197.0 | 190460.1 | 182211.9 | 1508.9 | 6739.3 | 95.67 | 0.79 | 96.46 | 134 |
| 202.0 | 191921.3 | 183524.7 | 1548.8 | 6847.8 | 95.62 | 0.81 | 96.43 | 134 |
| 206.0 | 193139.4 | 184594.4 | 1595.4 | 6949.6 | 95.58 | 0.83 | 96.40 | 135 |
| 207.0 | 193353.9 | 184765.7 | 1611.8 | 6976.4 | 95.56 | 0.83 | 96.39 | 135 |
| 209.0 | 193722.0 | 185070.0 | 1638.4 | 7013.7 | 95.53 | 0.85 | 96.38 | 136 |
| 212.0 | 194220.6 | 185483.8 | 1665.6 | 7071.2 | 95.50 | 0.86 | 96.36 | 136 |
| 217.0 | 195591.7 | 186667.9 | 1705.4 | 7218.4 | 95.44 | 0.87 | 96.31 | 136 |
| 222.0 | 197639.0 | 188514.5 | 1743.5 | 7381.0 | 95.38 | 0.88 | 96.27 | 136 |
| 232.0 | 203269.8 | 193752.6 | 1819.7 | 7697.5 | 95.32 | 0.90 | 96.21 | 136 |
| 244.0 | 212027.9 | 202002.9 | 1914.9 | 8110.1 | 95.27 | 0.90 | 96.17 | 136 |

## TABLE A-10. SUMMARY OF CALCULATED $NO_x$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT B 0850-1255 3/7/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5700 | 1015 | 2780 | 68 | 871.2 | 849.9 | 3.79 | 17.52 | 97.55 | 0.44 | 97.99 |
| 5.0 | 5700 | 1015 | 2760 | 18 | 865.0 | 859.3 | 1.00 | 4.64 | 99.35 | 0.12 | 99.46 |
| 12.0 | 5700 | 1015 | 2760 | 75 | 865.0 | 841.5 | 4.19 | 19.32 | 97.28 | 0.48 | 97.77 |
| 25.0 | 5700 | 1015 | 2800 | 68 | 877.5 | 856.2 | 3.79 | 17.52 | 97.57 | 0.43 | 98.00 |
| 35.0 | 5700 | 1015 | 2500 | 58 | 783.5 | 765.3 | 3.24 | 14.94 | 97.68 | 0.41 | 98.09 |
| 40.0 | 5700 | 1015 | 2440 | 58 | 764.7 | 746.5 | 3.24 | 14.94 | 97.62 | 0.42 | 98.05 |
| 50.0 | 5700 | 1015 | 2510 | 58 | 786.6 | 768.4 | 3.24 | 14.94 | 97.69 | 0.41 | 98.10 |
| 55.0 | 5700 | 1015 | 2600 | 59 | 814.8 | 796.3 | 3.29 | 15.20 | 97.73 | 0.40 | 98.13 |
| 60.0 | 5700 | 1010 | 2730 | 62 | 855.6 | 836.1 | 3.44 | 15.99 | 97.73 | 0.40 | 98.13 |
| 70.0 | 4500 | 1010 | 3030 | 66 | 749.7 | 733.3 | 3.67 | 12.66 | 97.82 | 0.49 | 98.31 |
| 75.0 | 4450 | 1000 | 2320 | 68 | 567.6 | 551.0 | 3.74 | 12.90 | 97.07 | 0.66 | 97.73 |
| 80.0 | 4450 | 1020 | 1830 | 65 | 447.7 | 431.8 | 3.65 | 12.26 | 96.45 | 0.81 | 97.26 |
| 82.0 | 4450 | 1020 | 1640 | 64 | 401.3 | 385.6 | 3.59 | 12.07 | 96.10 | 0.89 | 96.99 |
| 85.0 | 4475 | 1020 | 1610 | 60 | 396.1 | 381.4 | 3.36 | 11.40 | 96.27 | 0.85 | 97.12 |
| 90.0 | 4500 | 1020 | 1600 | 56 | 395.9 | 382.0 | 3.14 | 10.71 | 96.50 | 0.79 | 97.29 |
| 97.0 | 4500 | 1020 | 1560 | 54 | 386.0 | 372.6 | 3.03 | 10.33 | 96.54 | 0.78 | 97.32 |
| 100.0 | 5625 | 965 | 1360 | 50 | 420.6 | 405.1 | 2.65 | 12.81 | 96.32 | 0.63 | 96.95 |
| 110.0 | 5675 | 1000 | 2970 | 61 | 926.7 | 907.7 | 3.35 | 15.68 | 97.95 | 0.36 | 98.31 |
| 115.0 | 5675 | 1015 | 3900 | 74 | 1216.9 | 1193.8 | 4.13 | 18.96 | 98.10 | 0.34 | 98.44 |
| 120.0 | 5675 | 1010 | 4070 | 86 | 1269.9 | 1243.1 | 4.78 | 22.06 | 97.89 | 0.38 | 98.26 |
| 130.0 | 5700 | 1010 | 4080 | 109 | 1278.6 | 1244.5 | 6.05 | 28.11 | 97.33 | 0.47 | 97.80 |
| 137.0 | 5700 | 1010 | 4180 | 121 | 1310.0 | 1272.1 | 6.72 | 31.20 | 97.11 | 0.51 | 97.62 |
| 145.0 | 5700 | 1010 | 4150 | 138 | 1300.6 | 1257.3 | 7.66 | 35.59 | 96.67 | 0.59 | 97.26 |
| 150.0 | 5700 | 1010 | 4140 | 149 | 1297.5 | 1250.8 | 8.27 | 38.42 | 96.40 | 0.64 | 97.04 |
| 160.0 | 5725 | 1010 | 3980 | 162 | 1252.8 | 1201.8 | 9.00 | 42.00 | 95.93 | 0.72 | 96.65 |
| 165.0 | 5725 | 1010 | 3670 | 175 | 1155.2 | 1100.1 | 9.72 | 45.37 | 95.23 | 0.84 | 96.07 |
| 175.0 | 5725 | 1010 | 3390 | 179 | 1067.1 | 1010.7 | 9.94 | 46.40 | 94.72 | 0.93 | 95.65 |
| 180.0 | 5725 | 1010 | 3500 | 181 | 1101.7 | 1044.7 | 10.05 | 46.92 | 94.83 | 0.91 | 95.74 |
| 190.0 | 5750 | 1010 | 3680 | 198 | 1163.4 | 1100.8 | 11.00 | 51.60 | 94.62 | 0.95 | 95.56 |
| 205.0 | 5775 | 1010 | 3910 | 222 | 1241.5 | 1171.0 | 12.33 | 58.16 | 94.32 | 0.99 | 95.32 |
| 210.0 | 5775 | 1010 | 3730 | 232 | 1184.3 | 1110.7 | 12.88 | 60.78 | 93.78 | 1.09 | 94.87 |
| 220.0 | 5775 | 1010 | 3310 | 238 | 1051.0 | 975.4 | 13.22 | 62.35 | 92.81 | 1.26 | 94.07 |
| 235.0 | 5800 | 1010 | 3260 | 242 | 1039.6 | 962.4 | 13.44 | 63.73 | 92.58 | 1.29 | 93.87 |
| 245.0 | 5800 | 1010 | 3310 | 249 | 1055.5 | 976.1 | 13.83 | 65.58 | 92.48 | 1.31 | 93.79 |

TABLE A-11. SUMMARY OF $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED FOR INTERVALS DURING TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT B 0850-1255 3/7/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 5.0 | 4340.5 | 4273.1 | 12.00 | 55.38 | 98.45 | 0.28 | 98.72 | 43 |
| 5.0- 12.0 | 6054.8 | 5952.8 | 18.16 | 83.84 | 98.32 | 0.30 | 98.62 | 46 |
| 12.0- 25.0 | 11326.1 | 11034.8 | 51.87 | 239.43 | 97.43 | 0.46 | 97.89 | 71 |
| 25.0- 35.0 | 8305.0 | 8107.5 | 35.16 | 162.28 | 97.62 | 0.42 | 98.05 | 63 |
| 35.0- 40.0 | 3870.4 | 3779.5 | 16.18 | 74.70 | 97.65 | 0.42 | 98.07 | 58 |
| 40.0- 50.0 | 7756.5 | 7574.7 | 32.37 | 149.40 | 97.66 | 0.42 | 98.07 | 58 |
| 50.0- 55.0 | 4003.6 | 3911.9 | 16.32 | 75.34 | 97.71 | 0.41 | 98.12 | 59 |
| 55.0- 60.0 | 4176.0 | 4081.2 | 16.84 | 77.96 | 97.73 | 0.40 | 98.13 | 61 |
| 60.0- 70.0 | 8026.2 | 7847.4 | 35.54 | 143.26 | 97.77 | 0.44 | 98.22 | 64 |
| 70.0- 75.0 | 3293.3 | 3210.8 | 18.51 | 63.91 | 97.50 | 0.56 | 98.06 | 67 |
| 75.0- 80.0 | 2538.4 | 2457.1 | 18.46 | 62.89 | 96.80 | 0.73 | 97.52 | 67 |
| 80.0- 82.0 | 849.0 | 817.4 | 7.23 | 24.33 | 96.28 | 0.85 | 97.13 | 64 |
| 82.0- 85.0 | 1196.1 | 1150.4 | 10.43 | 35.20 | 96.18 | 0.87 | 97.06 | 62 |
| 85.0- 90.0 | 1983.0 | 1908.4 | 16.26 | 55.28 | 96.39 | 0.82 | 97.21 | 58 |
| 90.0- 97.0 | 2736.4 | 2641.2 | 21.59 | 73.66 | 96.52 | 0.79 | 97.31 | 55 |
| 97.0-100.0 | 1209.9 | 1166.6 | 8.52 | 34.71 | 96.43 | 0.70 | 97.13 | 52 |
| 100.0-110.0 | 6736.5 | 6564.0 | 30.03 | 142.45 | 97.44 | 0.45 | 97.89 | 56 |
| 110.0-115.0 | 5358.9 | 5253.6 | 18.71 | 86.60 | 98.03 | 0.35 | 98.38 | 67 |
| 115.0-120.0 | 6217.0 | 6092.2 | 22.26 | 102.54 | 97.99 | 0.36 | 98.35 | 80 |
| 120.0-130.0 | 12742.9 | 12437.9 | 54.14 | 250.83 | 97.61 | 0.42 | 98.03 | 98 |
| 130.0-137.0 | 9060.2 | 8807.9 | 44.70 | 207.58 | 97.22 | 0.49 | 97.71 | 115 |
| 137.0-145.0 | 10442.3 | 10117.6 | 57.53 | 267.15 | 96.89 | 0.55 | 97.44 | 129 |
| 145.0-150.0 | 6495.1 | 6270.2 | 39.84 | 185.02 | 96.54 | 0.61 | 97.15 | 144 |
| 150.0-160.0 | 12751.2 | 12262.7 | 86.35 | 402.09 | 96.17 | 0.68 | 96.85 | 156 |
| 160.0-166.0 | 7223.9 | 6905.7 | 56.14 | 262.09 | 95.59 | 0.78 | 96.37 | 169 |
| 166.0-175.0 | 10000.2 | 9498.8 | 88.46 | 412.97 | 94.99 | 0.88 | 95.87 | 177 |
| 175.0-180.0 | 5421.9 | 5138.6 | 49.98 | 233.31 | 94.78 | 0.92 | 95.70 | 180 |
| 180.0-190.0 | 11325.5 | 10727.6 | 105.23 | 492.62 | 94.72 | 0.93 | 95.65 | 190 |
| 190.0-205.0 | 18036.8 | 17038.6 | 174.92 | 823.22 | 94.47 | 0.97 | 95.44 | 210 |
| 205.0-210.0 | 6064.6 | 5704.2 | 63.03 | 297.35 | 94.06 | 1.04 | 95.10 | 227 |
| 210.0-220.0 | 11176.6 | 10430.5 | 130.50 | 615.67 | 93.32 | 1.17 | 94.49 | 235 |
| 220.0-235.0 | 15679.3 | 14533.7 | 199.91 | 945.65 | 92.69 | 1.28 | 93.97 | 240 |
| 235.0-245.0 | 10475.6 | 9692.7 | 136.33 | 646.55 | 92.53 | 1.30 | 93.83 | 246 |

## TABLE A-12. CUMULATIVE $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED DURING TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT 8 0850-1255 3/7/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 5.0 | 4340.5 | 4273.1 | 12.0 | 55.4 | 98.45 | 0.28 | 98.72 | 43 |
| 12.0 | 10395.3 | 10225.9 | 30.2 | 139.2 | 98.37 | 0.29 | 98.66 | 45 |
| 25.0 | 21721.4 | 21260.7 | 82.0 | 378.7 | 97.88 | 0.38 | 98.26 | 59 |
| 35.0 | 30026.3 | 29368.2 | 117.2 | 540.9 | 97.81 | 0.39 | 98.20 | 60 |
| 40.0 | 33896.7 | 33147.7 | 133.4 | 615.6 | 97.79 | 0.39 | 98.18 | 60 |
| 50.0 | 41653.2 | 40722.5 | 165.7 | 765.0 | 97.77 | 0.40 | 98.16 | 59 |
| 55.0 | 45656.9 | 44634.4 | 182.1 | 840.4 | 97.76 | 0.40 | 98.16 | 59 |
| 60.0 | 49832.8 | 48715.6 | 198.9 | 918.3 | 97.76 | 0.40 | 98.16 | 59 |
| 70.0 | 57859.0 | 56563.0 | 234.4 | 1061.6 | 97.76 | 0.41 | 98.17 | 60 |
| 75.0 | 61152.3 | 59773.8 | 253.0 | 1125.5 | 97.75 | 0.41 | 98.16 | 60 |
| 80.0 | 63690.7 | 62230.9 | 271.4 | 1188.4 | 97.71 | 0.43 | 98.13 | 61 |
| 82.0 | 64539.7 | 63048.3 | 278.7 | 1212.7 | 97.69 | 0.43 | 98.12 | 61 |
| 85.0 | 65735.8 | 64198.8 | 289.1 | 1247.9 | 97.66 | 0.44 | 98.10 | 61 |
| 90.0 | 67715.8 | 66107.2 | 305.3 | 1303.2 | 97.62 | 0.45 | 98.08 | 61 |
| 97.0 | 70452.2 | 68748.4 | 326.9 | 1376.9 | 97.58 | 0.46 | 98.05 | 60 |
| 100.0 | 71662.1 | 69915.0 | 335.5 | 1411.6 | 97.56 | 0.47 | 98.03 | 60 |
| 110.0 | 78398.6 | 76479.1 | 365.5 | 1554.0 | 97.55 | 0.47 | 98.02 | 60 |
| 115.0 | 83757.5 | 81732.7 | 384.2 | 1640.6 | 97.58 | 0.46 | 98.04 | 60 |
| 120.0 | 89974.5 | 87824.9 | 406.5 | 1743.2 | 97.61 | 0.45 | 98.06 | 61 |
| 130.0 | 102717.4 | 100262.8 | 460.6 | 1994.0 | 97.61 | 0.45 | 98.06 | 64 |
| 137.0 | 111777.6 | 109070.7 | 505.3 | 2201.6 | 97.58 | 0.45 | 98.03 | 67 |
| 145.0 | 122219.9 | 119188.3 | 562.8 | 2468.7 | 97.52 | 0.46 | 97.98 | 70 |
| 150.0 | 128715.0 | 125458.6 | 602.7 | 2653.8 | 97.47 | 0.47 | 97.94 | 73 |
| 160.0 | 141466.2 | 137721.3 | 689.0 | 3055.8 | 97.35 | 0.49 | 97.84 | 78 |
| 166.0 | 148690.1 | 144627.0 | 745.2 | 3317.9 | 97.27 | 0.50 | 97.77 | 82 |
| 175.0 | 158690.3 | 154125.8 | 833.6 | 3730.9 | 97.12 | 0.53 | 97.65 | 87 |
| 180.0 | 164112.2 | 159264.4 | 883.6 | 3964.2 | 97.05 | 0.54 | 97.58 | 90 |
| 190.0 | 175437.7 | 169992.0 | 988.8 | 4456.8 | 96.90 | 0.56 | 97.46 | 95 |
| 205.0 | 193474.5 | 187030.6 | 1163.8 | 5280.0 | 96.67 | 0.60 | 97.27 | 104 |
| 210.0 | 199539.1 | 192734.9 | 1226.8 | 5577.4 | 96.59 | 0.61 | 97.20 | 107 |
| 220.0 | 210715.7 | 203165.3 | 1357.3 | 6193.1 | 96.42 | 0.64 | 97.06 | 113 |
| 235.0 | 226395.0 | 217699.1 | 1557.2 | 7138.7 | 96.16 | 0.69 | 96.85 | 122 |
| 245.0 | 236870.6 | 227391.8 | 1693.5 | 7785.3 | 96.00 | 0.71 | 96.71 | 127 |

## TABLE A-13. SUMMARY OF CALCULATED $NO_x$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5800 | 1010 | 3310 | 249 | 1055.5 | 976.1 | 13.83 | 65.58 | 92.48 | 1.31 | 93.79 |
| 3.0 | 5575 | 1015 | 3330 | 150 | 1020.7 | 974.7 | 8.37 | 37.61 | 95.50 | 0.82 | 96.32 |
| 5.0 | 5575 | 1010 | 3350 | 140 | 1026.8 | 983.9 | 7.77 | 35.14 | 95.82 | 0.76 | 96.58 |
| 9.0 | 5575 | 1010 | 3200 | 129 | 980.9 | 941.3 | 7.16 | 32.38 | 95.97 | 0.73 | 96.70 |
| 13.0 | 5650 | 1030 | 3080 | 146 | 956.8 | 911.4 | 8.27 | 37.09 | 95.26 | 0.86 | 96.12 |
| 15.0 | 5650 | 1025 | 2960 | 189 | 919.5 | 860.8 | 10.65 | 48.06 | 93.61 | 1.16 | 94.77 |
| 17.0 | 5650 | 1020 | 2760 | 235 | 857.4 | 784.4 | 13.18 | 59.82 | 91.49 | 1.54 | 93.02 |
| 20.0 | 5675 | 1020 | 2410 | 180 | 752.0 | 695.8 | 10.09 | 46.07 | 92.53 | 1.34 | 93.87 |
| 23.0 | 5675 | 1020 | 2340 | 106 | 730.1 | 697.1 | 5.94 | 27.13 | 95.47 | 0.81 | 96.28 |
| 30.0 | 5675 | 1025 | 2180 | 72 | 680.2 | 657.7 | 4.06 | 18.41 | 96.70 | 0.60 | 97.29 |
| 35.0 | 5700 | 1025 | 2040 | 61 | 639.3 | 620.2 | 3.44 | 15.68 | 97.01 | 0.54 | 97.55 |
| 41.0 | 5700 | 1025 | 2060 | 52 | 645.6 | 629.3 | 2.93 | 13.37 | 97.48 | 0.45 | 97.93 |
| 50.0 | 5700 | 1025 | 2090 | 49 | 655.0 | 639.6 | 2.76 | 12.59 | 97.66 | 0.42 | 98.08 |
| 65.0 | 5725 | 1020 | 2090 | 54 | 657.9 | 640.9 | 3.03 | 13.97 | 97.42 | 0.46 | 97.88 |
| 80.0 | 5725 | 1020 | 2050 | 61 | 645.3 | 626.1 | 3.42 | 15.78 | 97.02 | 0.53 | 97.55 |
| 85.0 | 5650 | 1020 | 2150 | 64 | 667.9 | 648.0 | 3.59 | 16.29 | 97.02 | 0.54 | 97.56 |
| 95.0 | 5625 | 1020 | 2260 | 75 | 699.0 | 675.8 | 4.21 | 18.99 | 96.68 | 0.60 | 97.28 |
| 102.0 | 5625 | 1020 | 2340 | 80 | 723.7 | 699.0 | 4.49 | 20.26 | 96.58 | 0.62 | 97.20 |
| 110.0 | 5450 | 1015 | 2340 | 81 | 701.2 | 676.9 | 4.52 | 19.75 | 96.54 | 0.64 | 97.18 |
| 115.0 | 5450 | 1020 | 2320 | 85 | 695.2 | 669.7 | 4.77 | 20.70 | 96.34 | 0.69 | 97.02 |
| 121.0 | 5450 | 1020 | 2290 | 85 | 686.2 | 660.7 | 4.77 | 20.70 | 96.29 | 0.69 | 96.98 |
| 125.0 | 5450 | 1020 | 2260 | 86 | 677.2 | 651.4 | 4.82 | 20.95 | 96.19 | 0.71 | 96.91 |
| 140.0 | 5450 | 1020 | 2250 | 92 | 674.2 | 646.6 | 5.16 | 22.41 | 95.91 | 0.77 | 96.68 |
| 148.0 | 5450 | 1020 | 2250 | 95 | 674.2 | 645.7 | 5.33 | 23.14 | 95.78 | 0.79 | 96.57 |
| 155.0 | 5450 | 1020 | 2220 | 99 | 665.2 | 635.6 | 5.55 | 24.11 | 95.54 | 0.83 | 96.38 |
| 163.0 | 5450 | 1020 | 2150 | 105 | 644.2 | 612.8 | 5.89 | 25.57 | 95.12 | 0.91 | 96.03 |
| 170.0 | 5450 | 1020 | 2160 | 110 | 647.2 | 614.3 | 6.17 | 26.79 | 94.91 | 0.95 | 95.86 |
| 185.0 | 5500 | 1020 | 1890 | 114 | 571.5 | 537.1 | 6.39 | 28.08 | 93.97 | 1.12 | 95.09 |
| 190.0 | 5500 | 1020 | 2090 | 115 | 632.0 | 597.2 | 6.45 | 28.33 | 94.50 | 1.02 | 95.52 |
| 200.0 | 5550 | 1020 | 2200 | 120 | 671.3 | 634.7 | 6.73 | 29.89 | 94.55 | 1.00 | 95.55 |
| 205.0 | 5550 | 1020 | 2200 | 125 | 671.3 | 633.2 | 7.01 | 31.13 | 94.32 | 1.04 | 95.36 |
| 211.0 | 5500 | 1020 | 2200 | 129 | 665.3 | 626.3 | 7.23 | 31.77 | 94.14 | 1.09 | 95.22 |
| 215.0 | 5525 | 1020 | 2200 | 130 | 668.3 | 628.8 | 7.29 | 32.20 | 94.09 | 1.09 | 95.18 |
| 230.0 | 5550 | 1020 | 2260 | 134 | 689.6 | 648.7 | 7.51 | 33.37 | 94.07 | 1.09 | 95.16 |
| 235.0 | 5550 | 1020 | 2300 | 138 | 701.[illegible] | 659.7 | 7.74 | 34.37 | 94.00 | 1.10 | 95.10 |
| 243.0 | 5550 | 1020 | 2310 | 140 | 704.9 | 662.2 | 7.85 | 34.87 | 93.94 | 1.11 | 95.05 |

## TABLE A-14. SUMMARY OF $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED FOR INTERVALS DURING TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 3.0 | 3114.4 | 2926.3 | 33.30 | 154.78 | 93.96 | 1.07 | 95.03 | 201 |
| 3.0- 5.0 | 2047.6 | 1958.7 | 16.15 | 72.75 | 95.66 | 0.79 | 96.45 | 145 |
| 5.0- 9.0 | 4015.4 | 3850.5 | 29.88 | 135.03 | 95.89 | 0.74 | 96.64 | 135 |
| 9.0- 13.0 | 3875.3 | 3705.5 | 30.86 | 138.93 | 95.62 | 0.80 | 96.42 | 138 |
| 13.0- 15.0 | 1876.3 | 1772.2 | 18.92 | 85.15 | 94.45 | 1.01 | 95.46 | 168 |
| 15.0- 17.0 | 1776.9 | 1645.2 | 23.83 | 107.88 | 92.59 | 1.34 | 93.93 | 212 |
| 17.0- 20.0 | 2414.0 | 2220.3 | 34.91 | 158.84 | 91.97 | 1.45 | 93.42 | 207 |
| 20.0- 23.0 | 2223.1 | 2089.3 | 24.06 | 109.80 | 93.98 | 1.08 | 95.06 | 143 |
| 23.0- 30.0 | 4936.2 | 4741.8 | 35.01 | 159.38 | 96.06 | 0.71 | 96.77 | 89 |
| 30.0- 35.0 | 3298.8 | 3194.9 | 18.74 | 85.22 | 96.85 | 0.57 | 97.42 | 66 |
| 35.0- 41.0 | 3854.8 | 3748.5 | 19.10 | 87.14 | 97.24 | 0.50 | 97.74 | 57 |
| 41.0- 50.0 | 5852.6 | 5710.2 | 25.61 | 116.82 | 97.57 | 0.44 | 98.00 | 51 |
| 50.0- 65.0 | 9846.5 | 9603.8 | 43.42 | 199.23 | 97.54 | 0.44 | 97.98 | 52 |
| 65.0- 80.0 | 9773.6 | 9502.1 | 48.37 | 223.12 | 97.22 | 0.49 | 97.72 | 57 |
| 80.0- 85.0 | 3282.9 | 3185.2 | 17.53 | 80.18 | 97.02 | 0.53 | 97.56 | 62 |
| 85.0- 95.0 | 6834.2 | 6618.8 | 38.98 | 176.41 | 96.85 | 0.57 | 97.42 | 69 |
| 95.0-102.0 | 4979.3 | 4811.5 | 30.42 | 137.36 | 96.63 | 0.61 | 97.24 | 78 |
| 102.0-110.0 | 5699.5 | 5503.4 | 36.03 | 160.03 | 96.56 | 0.63 | 97.19 | 80 |
| 110.0-115.0 | 3490.9 | 3366.6 | 23.22 | 101.14 | 96.44 | 0.67 | 97.10 | 83 |
| 115.0-121.0 | 4144.1 | 3991.3 | 28.60 | 124.22 | 96.31 | 0.69 | 97.00 | 85 |
| 121.0-125.0 | 2726.8 | 2624.3 | 19.18 | 83.30 | 96.24 | 0.70 | 96.95 | 86 |
| 125.0-140.0 | 10135.6 | 9735.6 | 74.87 | 325.16 | 96.05 | 0.74 | 96.79 | 89 |
| 140.0-148.0 | 5393.7 | 5169.5 | 41.95 | 182.19 | 95.84 | 0.78 | 96.62 | 94 |
| 148.0-155.0 | 4683.0 | 4484.5 | 38.08 | 165.38 | 95.65 | 0.81 | 96.47 | 97 |
| 155.0-163.0 | 5237.9 | 4993.3 | 45.76 | 198.75 | 95.33 | 0.87 | 96.21 | 102 |
| 163.0-170.0 | 4520.2 | 4294.7 | 42.20 | 183.28 | 95.01 | 0.93 | 95.95 | 108 |
| 170.0-185.0 | 9140.8 | 8635.0 | 94.22 | 411.54 | 94.47 | 1.03 | 95.50 | 112 |
| 185.0-190.0 | 3008.9 | 2835.7 | 32.11 | 141.02 | 94.25 | 1.07 | 95.31 | 115 |
| 190.0-200.0 | 6516.7 | 6159.7 | 65.90 | 291.07 | 94.52 | 1.01 | 95.53 | 118 |
| 200.0-205.0 | 3356.6 | 3169.7 | 34.35 | 152.55 | 94.43 | 1.02 | 95.46 | 123 |
| 205.0-211.0 | 4009.8 | 3778.3 | 42.73 | 188.72 | 94.23 | 1.07 | 95.29 | 127 |
| 211.0-215.0 | 2667.2 | 2510.2 | 29.05 | 127.95 | 94.11 | 1.09 | 95.20 | 130 |
| 215.0-230.0 | 10184.5 | 9581.6 | 111.04 | 491.81 | 94.08 | 1.09 | 95.17 | 132 |
| 230.0-235.0 | 3478.7 | 3271.2 | 38.14 | 169.36 | 94.04 | 1.10 | 95.13 | 136 |
| 235.0-243.0 | 5626.9 | 5287.6 | 62.36 | 276.96 | 93.97 | 1.11 | 95.08 | 139 |

## TABLE A-15. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$. EMITTED DURING TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 3.0 | 3114.4 | 2926.3 | 33.3 | 154.8 | 93.96 | 1.07 | 95.03 | 201 |
| 5.0 | 5161.9 | 4885.0 | 49.4 | 227.5 | 94.63 | 0.96 | 95.59 | 179 |
| 9.0 | 9177.4 | 8735.5 | 79.3 | 362.6 | 95.19 | 0.86 | 96.05 | 159 |
| 13.0 | 13052.7 | 12441.0 | 110.2 | 501.5 | 95.31 | 0.84 | 96.16 | 153 |
| 15.0 | 14929.0 | 14213.3 | 129.1 | 586.6 | 95.21 | 0.86 | 96.07 | 155 |
| 17.0 | 16705.9 | 15858.4 | 152.9 | 694.5 | 94.93 | 0.92 | 95.84 | 161 |
| 20.0 | 19119.9 | 18078.7 | 187.8 | 853.4 | 94.55 | 0.98 | 95.54 | 168 |
| 23.0 | 21343.0 | 20168.0 | 211.9 | 963.1 | 94.49 | 0.99 | 95.49 | 165 |
| 30.0 | 26279.2 | 24909.8 | 246.9 | 1122.5 | 94.79 | 0.94 | 95.73 | 147 |
| 35.0 | 29578.0 | 28104.6 | 265.6 | 1207.7 | 95.02 | 0.90 | 95.92 | 136 |
| 41.0 | 33432.3 | 31853.1 | 284.8 | 1294.9 | 95.28 | 0.85 | 96.13 | 124 |
| 50.0 | 39285.4 | 37563.3 | 310.4 | 1411.7 | 95.62 | 0.79 | 96.41 | 111 |
| 65.0 | 49131.9 | 47167.1 | 353.8 | 1610.9 | 96.00 | 0.72 | 96.72 | 97 |
| 80.0 | 58905.4 | 56669.2 | 402.2 | 1834.1 | 96.20 | 0.68 | 96.89 | 89 |
| 85.0 | 62183.3 | 59854.4 | 419.7 | 1914.2 | 96.25 | 0.67 | 96.92 | 88 |
| 95.0 | 69022.5 | 66473.2 | 458.7 | 2090.6 | 96.31 | 0.66 | 96.97 | 86 |
| 102.0 | 74001.3 | 71284.7 | 489.1 | 2228.0 | 96.33 | 0.66 | 96.99 | 85 |
| 110.0 | 79701.3 | 76788.1 | 525.1 | 2388.0 | 96.34 | 0.66 | 97.00 | 85 |
| 115.0 | 83192.2 | 80154.7 | 548.3 | 2489.2 | 96.35 | 0.66 | 97.01 | 85 |
| 121.0 | 87336.3 | 84146.0 | 576.9 | 2613.4 | 96.35 | 0.66 | 97.01 | 85 |
| 125.0 | 90063.1 | 86770.3 | 596.1 | 2696.7 | 96.34 | 0.66 | 97.01 | 85 |
| 140.0 | 100198.8 | 96505.9 | 671.0 | 3021.8 | 96.31 | 0.67 | 96.98 | 85 |
| 148.0 | 105592.4 | 101675.5 | 712.9 | 3204.0 | 96.29 | 0.68 | 96.97 | 86 |
| 155.0 | 110280.4 | 106160.0 | 751.0 | 3369.4 | 96.26 | 0.68 | 96.94 | 86 |
| 163.0 | 115518.3 | 111153.4 | 796.8 | 3568.2 | 96.22 | 0.69 | 96.91 | 87 |
| 170.0 | 120038.5 | 115448.1 | 839.0 | 3751.5 | 96.18 | 0.70 | 96.87 | 88 |
| 185.0 | 129179.3 | 124083.1 | 933.2 | 4163.0 | 96.05 | 0.72 | 96.78 | 90 |
| 190.0 | 132188.2 | 126918.9 | 965.3 | 4304.0 | 96.01 | 0.73 | 96.74 | 90 |
| 200.0 | 138704.9 | 133078.6 | 1031.2 | 4595.1 | 95.94 | 0.74 | 96.69 | 92 |
| 205.0 | 142061.5 | 136248.3 | 1065.5 | 4747.6 | 95.91 | 0.75 | 96.66 | 92 |
| 211.0 | 146071.3 | 140026.6 | 1108.3 | 4936.4 | 95.86 | 0.76 | 96.62 | 93 |
| 215.0 | 148738.4 | 142536.8 | 1137.3 | 5064.3 | 95.83 | 0.76 | 96.60 | 94 |
| 230.0 | 158922.9 | 152118.4 | 1248.4 | 5556.1 | 95.72 | 0.79 | 96.50 | 97 |
| 235.0 | 162401.6 | 155389.6 | 1286.5 | 5725.5 | 95.68 | 0.79 | 96.47 | 97 |
| 243.0 | 168028.5 | 160677.2 | 1348.9 | 6002.4 | 95.62 | 0.80 | 96.43 | 99 |

# TABLE A-16. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 3150 | 1030 | 1150 | 8 | 199.2 | 197.8 | 0.45 | 0.93 | 99.30 | 0.23 | 99.53 |
| 15.0 | 4250 | 1035 | 1060 | 11 | 247.7 | 245.1 | 0.63 | 1.94 | 98.96 | 0.25 | 99.21 |
| 20.0 | 4300 | 1035 | 890 | 10 | 210.4 | 208.0 | 0.57 | 1.80 | 98.88 | 0.27 | 99.15 |
| 30.0 | 4350 | 1030 | 750 | 10 | 179.4 | 177.0 | 0.57 | 1.83 | 98.67 | 0.32 | 98.98 |
| 35.0 | 4350 | 1030 | 720 | 8 | 172.2 | 170.3 | 0.45 | 1.46 | 98.89 | 0.26 | 99.15 |
| 45.0 | 4350 | 1030 | 710 | 6 | 169.8 | 168.4 | 0.34 | 1.10 | 99.15 | 0.20 | 99.36 |
| 50.0 | 4350 | 1030 | 710 | 6 | 169.8 | 168.4 | 0.34 | 1.10 | 99.15 | 0.20 | 99.36 |
| 60.0 | 4350 | 1030 | 710 | 9 | 169.8 | 167.7 | 0.51 | 1.64 | 98.73 | 0.30 | 99.03 |
| 65.0 | 4350 | 1030 | 710 | 9 | 169.8 | 167.7 | 0.51 | 1.64 | 98.73 | 0.30 | 99.03 |
| 75.0 | 4350 | 1030 | 710 | 10 | 169.8 | 167.4 | 0.57 | 1.83 | 98.59 | 0.33 | 98.93 |
| 80.0 | 4350 | 1030 | 680 | 10 | 162.6 | 160.2 | 0.57 | 1.83 | 98.53 | 0.35 | 98.88 |
| 90.0 | 5200 | 1025 | 800 | 10 | 228.7 | 225.9 | 0.56 | 2.30 | 98.75 | 0.25 | 99.00 |
| 95.0 | 5175 | 1025 | 880 | 11 | 250.4 | 247.3 | 0.62 | 2.51 | 98.75 | 0.25 | 99.00 |
| 105.0 | 5175 | 1025 | 970 | 14 | 276.0 | 272.0 | 0.79 | 3.19 | 98.56 | 0.29 | 98.84 |
| 110.0 | 5175 | 1025 | 1020 | 14 | 290.2 | 286.2 | 0.79 | 3.19 | 98.63 | 0.27 | 98.90 |
| 120.0 | 5200 | 1025 | 1190 | 15 | 340.2 | 335.9 | 0.85 | 3.44 | 98.74 | 0.25 | 98.99 |
| 125.0 | 5200 | 1025 | 1230 | 16 | 351.7 | 347.1 | 0.90 | 3.67 | 98.70 | 0.26 | 98.96 |
| 135.0 | 5200 | 1025 | 1260 | 18 | 360.2 | 355.1 | 1.01 | 4.13 | 98.57 | 0.28 | 98.85 |
| 140.0 | 5200 | 1025 | 1260 | 16 | 360.2 | 355.7 | 0.90 | 3.67 | 98.73 | 0.25 | 98.98 |
| 150.0 | 5200 | 1025 | 1200 | 20 | 343.1 | 337.4 | 1.13 | 4.59 | 98.33 | 0.33 | 98.66 |
| 165.0 | 5200 | 1025 | 1150 | 21 | 328.8 | 322.8 | 1.18 | 4.82 | 98.17 | 0.36 | 98.53 |
| 170.0 | 5200 | 1025 | 1150 | 21 | 328.8 | 322.8 | 1.18 | 4.82 | 98.17 | 0.36 | 98.53 |
| 180.0 | 5200 | 1025 | 1140 | 24 | 325.9 | 319.1 | 1.35 | 5.51 | 97.89 | 0.41 | 98.31 |
| 195.0 | 5175 | 1025 | 1140 | 25 | 324.4 | 317.2 | 1.41 | 5.70 | 97.81 | 0.43 | 98.24 |
| 200.0 | 5175 | 1025 | 1150 | 29 | 327.2 | 319.0 | 1.63 | 6.62 | 97.48 | 0.50 | 97.98 |
| 210.0 | 5175 | 1025 | 1150 | 29 | 327.2 | 319.0 | 1.63 | 6.62 | 97.48 | 0.50 | 97.98 |
| 225.0 | 5175 | 1025 | 1130 | 29 | 321.5 | 313.3 | 1.63 | 6.62 | 97.43 | 0.51 | 97.94 |
| 230.0 | 5175 | 1025 | 1110 | 29 | 315.8 | 307.6 | 1.63 | 6.62 | 97.39 | 0.52 | 97.90 |
| 234.0 | 5175 | 1025 | 1090 | 29 | 310.1 | 301.9 | 1.63 | 6.62 | 97.34 | 0.53 | 97.87 |

TABLE A-17. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 15.0 | 3351.5 | 3321.8 | 8.09 | 21.58 | 99.11 | 0.24 | 99.36 | 10 |
| 15.0- 20.0 | 1145.3 | 1132.9 | 2.99 | 9.35 | 98.92 | 0.26 | 99.18 | 10 |
| 20.0- 30.0 | 1949.0 | 1925.2 | 5.68 | 18.10 | 98.78 | 0.29 | 99.07 | 10 |
| 30.0- 35.0 | 878.9 | 868.2 | 2.55 | 8.21 | 98.78 | 0.29 | 99.07 | 9 |
| 35.0- 45.0 | 1710.1 | 1693.3 | 3.96 | 12.78 | 99.02 | 0.23 | 99.25 | 7 |
| 45.0- 50.0 | 849.1 | 841.9 | 1.70 | 5.48 | 99.15 | 0.20 | 99.36 | 6 |
| 50.0- 60.0 | 1698.1 | 1680.2 | 4.25 | 13.69 | 98.94 | 0.25 | 99.19 | 7 |
| 60.0- 65.0 | 849.1 | 838.3 | 2.55 | 8.21 | 98.73 | 0.30 | 99.03 | 9 |
| 65.0- 75.0 | 1698.1 | 1675.4 | 5.38 | 17.34 | 98.66 | 0.32 | 98.98 | 9 |
| 75.0- 80.0 | 831.1 | 819.2 | 2.83 | 9.13 | 98.56 | 0.34 | 98.90 | 10 |
| 80.0- 90.0 | 1956.8 | 1930.5 | 5.65 | 20.60 | 98.66 | 0.29 | 98.95 | 10 |
| 90.0- 95.0 | 1197.8 | 1182.8 | 2.96 | 12.01 | 98.75 | 0.25 | 99.00 | 10 |
| 95.0-105.0 | 2631.9 | 2596.3 | 7.04 | 28.52 | 98.65 | 0.27 | 98.92 | 12 |
| 105.0-110.0 | 1415.5 | 1395.6 | 3.94 | 15.97 | 98.59 | 0.28 | 98.87 | 14 |
| 110.0-120.0 | 3152.2 | 3110.9 | 8.17 | 33.19 | 98.69 | 0.26 | 98.95 | 15 |
| 120.0-125.0 | 1729.7 | 1707.6 | 4.37 | 17.79 | 98.72 | 0.25 | 98.97 | 15 |
| 125.0-135.0 | 3559.5 | 3510.9 | 9.58 | 39.02 | 98.63 | 0.27 | 98.90 | 17 |
| 135.0-140.0 | 1801.2 | 1776.9 | 4.79 | 19.51 | 98.65 | 0.27 | 98.92 | 17 |
| 140.0-150.0 | 3516.6 | 3465.2 | 10.14 | 41.32 | 98.54 | 0.29 | 98.83 | 18 |
| 150.0-165.0 | 5039.1 | 4951.1 | 17.33 | 70.59 | 98.26 | 0.34 | 98.60 | 21 |
| 165.0-170.0 | 1643.9 | 1613.9 | 5.92 | 24.10 | 98.17 | 0.36 | 98.53 | 21 |
| 170.0-180.0 | 3273.6 | 3209.3 | 12.68 | 51.65 | 98.03 | 0.39 | 98.42 | 23 |
| 180.0-195.0 | 4877.2 | 4772.4 | 20.71 | 84.10 | 97.85 | 0.42 | 98.28 | 24 |
| 195.0-200.0 | 1628.9 | 1590.5 | 7.61 | 30.80 | 97.64 | 0.47 | 98.11 | 27 |
| 200.0-210.0 | 3272.1 | 3189.6 | 16.34 | 66.17 | 97.48 | 0.50 | 97.98 | 29 |
| 210.0-225.0 | 4865.4 | 4741.7 | 24.51 | 99.26 | 97.46 | 0.50 | 97.96 | 29 |
| 225.0-230.0 | 1593.4 | 1552.1 | 8.17 | 33.09 | 97.41 | 0.51 | 97.92 | 29 |
| 230.0-234.0 | 1251.9 | 1218.9 | 6.54 | 26.47 | 97.36 | 0.52 | 97.89 | 29 |

## TABLE A-18. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 15.0 | 3351.5 | 3321.8 | 8.1 | 21.6 | 99.11 | 0.24 | 99.36 | 10 |
| 20.0 | 4496.7 | 4454.7 | 11.1 | 30.9 | 99.07 | 0.25 | 99.31 | 10 |
| 30.0 | 6445.7 | 6379.9 | 16.8 | 49.0 | 98.98 | 0.26 | 99.24 | 10 |
| 35.0 | 7324.6 | 7248.1 | 19.3 | 57.2 | 98.95 | 0.26 | 99.22 | 10 |
| 45.0 | 9034.7 | 8941.4 | 23.3 | 70.0 | 98.97 | 0.26 | 99.22 | 9 |
| 50.0 | 9883.7 | 9783.3 | 25.0 | 75.5 | 98.98 | 0.25 | 99.24 | 9 |
| 60.0 | 11581.8 | 11463.4 | 29.2 | 89.2 | 98.98 | 0.25 | 99.23 | 9 |
| 65.0 | 12430.9 | 12301.7 | 31.8 | 97.4 | 98.96 | 0.26 | 99.22 | 9 |
| 75.0 | 14129.0 | 13977.1 | 37.1 | 114.7 | 98.93 | 0.26 | 99.19 | 9 |
| 80.0 | 14960.1 | 14796.3 | 40.0 | 123.9 | 98.90 | 0.27 | 99.17 | 9 |
| 90.0 | 16916.9 | 16726.8 | 45.6 | 144.5 | 98.88 | 0.27 | 99.15 | 9 |
| 95.0 | 18114.7 | 17909.6 | 48.6 | 156.5 | 98.87 | 0.27 | 99.14 | 9 |
| 105.0 | 20746.6 | 20505.9 | 55.6 | 185.0 | 98.84 | 0.27 | 99.11 | 9 |
| 110.0 | 22162.1 | 21901.6 | 59.6 | 201.0 | 98.82 | 0.27 | 99.09 | 10 |
| 120.0 | 25514.3 | 25012.4 | 67.7 | 234.2 | 98.81 | 0.27 | 99.07 | 10 |
| 125.0 | 27044.0 | 26720.0 | 72.1 | 252.0 | 98.80 | 0.27 | 99.07 | 10 |
| 135.0 | 30603.5 | 30230.9 | 81.7 | 291.0 | 98.78 | 0.27 | 99.05 | 11 |
| 140.0 | 32404.7 | 32007.8 | 86.5 | 310.5 | 98.77 | 0.27 | 99.04 | 11 |
| 150.0 | 35921.4 | 35472.9 | 96.6 | 351.8 | 98.75 | 0.27 | 99.02 | 12 |
| 165.0 | 40960.4 | 40424.1 | 114.0 | 422.4 | 98.69 | 0.28 | 98.97 | 13 |
| 170.0 | 42604.4 | 42038.0 | 119.9 | 446.5 | 98.67 | 0.28 | 98.95 | 13 |
| 180.0 | 45878.0 | 45247.2 | 132.6 | 498.1 | 98.63 | 0.29 | 98.91 | 14 |
| 195.0 | 50755.2 | 50019.6 | 153.3 | 582.2 | 98.55 | 0.30 | 98.85 | 15 |
| 200.0 | 52384.1 | 51610.2 | 160.9 | 613.1 | 98.52 | 0.31 | 98.83 | 15 |
| 210.0 | 55656.2 | 54799.7 | 177.2 | 679.2 | 98.46 | 0.32 | 98.78 | 16 |
| 225.0 | 60521.6 | 59541.4 | 201.7 | 778.5 | 98.38 | 0.33 | 98.71 | 17 |
| 230.0 | 62115.0 | 61093.5 | 209.9 | 811.6 | 98.36 | 0.34 | 98.69 | 17 |
| 234.0 | 63366.9 | 62312.4 | 216.4 | 838.0 | 98.34 | 0.34 | 98.68 | 17 |

# TABLE A-19. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT B 1002-1404 3/12/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 4300 | 1025 | 1950 | 78 | 461.0 | 442.6 | 4.40 | 14.05 | 96.00 | 0.95 | 96.95 |
| 1.0 | 4300 | 1025 | 1910 | 48 | 451.6 | 440.2 | 2.71 | 8.64 | 97.49 | 0.60 | 98.09 |
| 7.0 | 4300 | 1025 | 2030 | 54 | 479.9 | 467.2 | 3.04 | 9.72 | 97.34 | 0.63 | 97.97 |
| 12.0 | 4300 | 1025 | 2080 | 58 | 491.8 | 478.0 | 3.27 | 10.44 | 97.21 | 0.66 | 97.88 |
| 20.0 | 4300 | 1025 | 2100 | 68 | 496.5 | 480.4 | 3.83 | 12.24 | 96.76 | 0.77 | 97.53 |
| 25.0 | 4300 | 1025 | 2050 | 68 | 484.7 | 468.6 | 3.83 | 12.24 | 96.68 | 0.79 | 97.47 |
| 38.0 | 4300 | 1025 | 2100 | 46 | 496.5 | 485.6 | 2.59 | 8.28 | 97.81 | 0.52 | 98.33 |
| 43.0 | 4300 | 1025 | 2150 | 46 | 508.3 | 497.4 | 2.59 | 8.28 | 97.86 | 0.51 | 98.37 |
| 48.0 | 4300 | 1025 | 2170 | 46 | 513.0 | 502.2 | 2.59 | 8.28 | 97.88 | 0.51 | 98.39 |
| 53.0 | 4300 | 1025 | 2250 | 46 | 531.9 | 521.1 | 2.59 | 8.28 | 97.96 | 0.49 | 98.44 |
| 78.0 | 4300 | 1025 | 2650 | 50 | 626.5 | 614.7 | 2.82 | 9.00 | 98.11 | 0.45 | 98.56 |
| 80.0 | 4300 | 1025 | 2690 | 50 | 636.0 | 624.1 | 2.82 | 9.00 | 98.14 | 0.44 | 98.58 |
| 84.0 | 4300 | 1025 | 2770 | 49 | 654.9 | 643.3 | 2.76 | 8.82 | 98.23 | 0.42 | 98.65 |
| 88.0 | 4300 | 1025 | 2710 | 52 | 640.7 | 628.4 | 2.93 | 9.36 | 98.08 | 0.46 | 98.54 |
| 93.0 | 4300 | 1020 | 2690 | 61 | 636.0 | 621.5 | 3.42 | 11.00 | 97.73 | 0.54 | 98.27 |
| 103.0 | 4300 | 1020 | 2750 | 61 | 650.2 | 635.7 | 3.42 | 11.00 | 97.78 | 0.53 | 98.31 |
| 108.0 | 4300 | 1020 | 2600 | 62 | 614.7 | 600.0 | 3.48 | 11.18 | 97.62 | 0.57 | 98.18 |
| 118.0 | 4300 | 1020 | 2480 | 61 | 586.3 | 571.9 | 3.42 | 11.00 | 97.54 | 0.58 | 98.12 |
| 133.0 | 4300 | 1020 | 2290 | 59 | 541.4 | 527.5 | 3.31 | 10.64 | 97.42 | 0.61 | 98.03 |
| 138.0 | 4300 | 1020 | 2300 | 59 | 543.8 | 529.8 | 3.31 | 10.64 | 97.43 | 0.61 | 98.04 |
| 148.0 | 4300 | 1020 | 2280 | 60 | 539.0 | 524.9 | 3.36 | 10.82 | 97.37 | 0.62 | 97.99 |
| 153.0 | 4300 | 1020 | 2240 | 62 | 529.6 | 514.9 | 3.48 | 11.18 | 97.23 | 0.66 | 97.89 |
| 163.0 | 4300 | 1020 | 2260 | 64 | 534.3 | 519.2 | 3.59 | 11.54 | 97.17 | 0.67 | 97.84 |
| 173.0 | 4300 | 1020 | 2320 | 70 | 548.5 | 531.9 | 3.93 | 12.62 | 96.98 | 0.72 | 97.70 |
| 178.0 | 4325 | 1020 | 2350 | 71 | 558.8 | 541.9 | 3.98 | 12.90 | 96.98 | 0.71 | 97.69 |
| 183.0 | 4325 | 1020 | 2390 | 72 | 568.3 | 551.2 | 4.04 | 13.08 | 96.99 | 0.71 | 97.70 |
| 194.0 | 4325 | 1020 | 2280 | 74 | 542.2 | 524.6 | 4.15 | 13.45 | 96.75 | 0.77 | 97.52 |
| 198.0 | 4325 | 1020 | 2330 | 76 | 554.1 | 536.0 | 4.26 | 13.81 | 96.74 | 0.77 | 97.51 |
| 203.0 | 4325 | 1020 | 2210 | 78 | 525.5 | 507.0 | 4.37 | 14.17 | 96.47 | 0.83 | 97.30 |
| 208.0 | 4325 | 1020 | 2190 | 78 | 520.8 | 502.2 | 4.37 | 14.17 | 96.44 | 0.84 | 97.28 |
| 213.0 | 4850 | 1015 | 2190 | 76 | 584.0 | 563.7 | 4.24 | 16.02 | 96.53 | 0.73 | 97.26 |
| 223.0 | 5225 | 1020 | 2160 | 75 | 620.5 | 599.0 | 4.21 | 17.34 | 96.53 | 0.68 | 97.21 |
| 229.0 | 5225 | 1020 | 2280 | 81 | 655.0 | 631.7 | 4.54 | 18.73 | 96.45 | 0.69 | 97.14 |
| 238.0 | 5225 | 1020 | 2740 | 92 | 787.1 | 760.7 | 5.16 | 21.27 | 96.64 | 0.66 | 97.30 |
| 242.0 | 5200 | 1020 | 2740 | 95 | 783.4 | 756.2 | 5.33 | 21.83 | 96.53 | 0.68 | 97.21 |

## TABLE A-20. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT B 1002-1404 3/12/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 1.0 | 456.3 | 441.4 | 3.55 | 11.34 | 96.74 | 0.78 | 97.51 | 63 |
| 1.0- 7.0 | 2794.5 | 2722.1 | 17.24 | 55.10 | 97.41 | 0.62 | 98.03 | 51 |
| 7.0- 12.0 | 2429.2 | 2363.0 | 15.78 | 50.42 | 97.27 | 0.65 | 97.92 | 56 |
| 12.0- 20.0 | 3952.9 | 3833.8 | 28.40 | 90.75 | 96.99 | 0.72 | 97.70 | 63 |
| 20.0- 25.0 | 2452.9 | 2372.5 | 19.16 | 61.22 | 96.72 | 0.78 | 97.50 | 68 |
| 25.0- 38.0 | 6377.4 | 6202.2 | 41.76 | 133.43 | 97.25 | 0.65 | 97.91 | 57 |
| 38.0- 43.0 | 2512.0 | 2457.6 | 12.96 | 41.41 | 97.84 | 0.52 | 98.35 | 46 |
| 43.0- 48.0 | 2553.3 | 2499.0 | 12.96 | 41.41 | 97.87 | 0.51 | 98.38 | 46 |
| 48.0- 58.0 | 5224.9 | 5116.1 | 25.92 | 82.83 | 97.92 | 0.50 | 98.41 | 46 |
| 58.0- 78.0 | 11584.6 | 11357.6 | 54.10 | 172.86 | 98.04 | 0.47 | 98.51 | 48 |
| 78.0- 80.0 | 1262.5 | 1238.8 | 5.64 | 18.01 | 98.13 | 0.45 | 98.57 | 50 |
| 80.0- 84.0 | 2581.7 | 2534.9 | 11.16 | 35.65 | 98.19 | 0.43 | 98.62 | 49 |
| 84.0- 88.0 | 2591.2 | 2543.4 | 11.38 | 36.37 | 98.15 | 0.44 | 98.60 | 50 |
| 88.0- 98.0 | 6383.3 | 6249.8 | 31.76 | 101.82 | 97.91 | 0.50 | 98.40 | 57 |
| 98.0-103.0 | 3215.3 | 3143.2 | 17.10 | 55.00 | 97.76 | 0.53 | 98.29 | 61 |
| 103.0-108.0 | 3162.1 | 3089.4 | 17.24 | 55.45 | 97.70 | 0.55 | 98.25 | 62 |
| 108.0-118.0 | 6005.1 | 5859.7 | 34.49 | 110.91 | 97.58 | 0.57 | 98.15 | 62 |
| 118.0-133.0 | 8457.9 | 8245.2 | 50.47 | 162.31 | 97.48 | 0.60 | 98.08 | 60 |
| 133.0-138.0 | 2712.9 | 2643.2 | 16.54 | 53.20 | 97.43 | 0.61 | 98.04 | 59 |
| 138.0-148.0 | 5414.0 | 5273.4 | 33.37 | 107.30 | 97.40 | 0.62 | 98.02 | 60 |
| 148.0-153.0 | 2671.6 | 2599.4 | 17.10 | 55.00 | 97.30 | 0.64 | 97.94 | 61 |
| 153.0-163.0 | 5319.5 | 5170.5 | 35.33 | 113.61 | 97.20 | 0.66 | 97.86 | 63 |
| 163.0-173.0 | 5414.0 | 5255.6 | 37.57 | 120.83 | 97.07 | 0.69 | 97.77 | 67 |
| 173.0-178.0 | 2768.3 | 2684.7 | 19.77 | 63.81 | 96.98 | 0.71 | 97.69 | 71 |
| 178.0-183.0 | 2817.9 | 2732.9 | 20.05 | 64.96 | 96.98 | 0.71 | 97.69 | 71 |
| 183.0-194.0 | 6107.8 | 5916.8 | 45.03 | 145.92 | 96.87 | 0.74 | 97.61 | 73 |
| 194.0-198.0 | 2192.5 | 2121.1 | 16.82 | 54.51 | 96.75 | 0.77 | 97.51 | 75 |
| 198.0-203.0 | 2699.0 | 2607.4 | 21.59 | 69.96 | 96.61 | 0.80 | 97.41 | 77 |
| 203.0-208.0 | 2615.7 | 2523.0 | 21.87 | 70.87 | 96.45 | 0.84 | 97.29 | 78 |
| 208.0-213.0 | 2761.9 | 2664.9 | 21.54 | 75.50 | 96.49 | 0.78 | 97.27 | 77 |
| 213.0-223.0 | 6022.5 | 5813.5 | 42.24 | 166.82 | 96.53 | 0.70 | 97.23 | 75 |
| 223.0-229.0 | 3826.5 | 3692.1 | 26.25 | 108.20 | 96.49 | 0.69 | 97.17 | 78 |
| 229.0-238.0 | 6489.6 | 6266.0 | 43.66 | 179.99 | 96.55 | 0.67 | 97.23 | 86 |
| 238.0-242.0 | 3141.0 | 3033.9 | 20.97 | 86.21 | 96.59 | 0.67 | 97.26 | 93 |

TABLE A-21. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT B 1002-1404 3/12/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1.0 | 456.3 | 441.4 | 3.6 | 11.3 | 96.74 | 0.78 | 97.51 | 63 |
| 7.0 | 3250.8 | 3163.5 | 20.8 | 66.4 | 97.32 | 0.64 | 97.96 | 53 |
| 12.0 | 5680.0 | 5526.6 | 36.6 | 116.9 | 97.30 | 0.64 | 97.94 | 54 |
| 20.0 | 9632.9 | 9360.4 | 65.0 | 207.6 | 97.17 | 0.67 | 97.84 | 58 |
| 25.0 | 12085.8 | 11732.8 | 84.1 | 268.8 | 97.08 | 0.70 | 97.78 | 60 |
| 38.0 | 18463.2 | 17935.1 | 125.9 | 402.3 | 97.14 | 0.68 | 97.82 | 59 |
| 43.0 | 20975.2 | 20392.7 | 138.9 | 443.7 | 97.22 | 0.66 | 97.88 | 57 |
| 48.0 | 23528.5 | 22891.6 | 151.8 | 485.1 | 97.29 | 0.65 | 97.94 | 56 |
| 58.0 | 28753.4 | 28007.8 | 177.7 | 567.9 | 97.41 | 0.62 | 98.02 | 54 |
| 78.0 | 40338.0 | 39365.4 | 231.8 | 740.8 | 97.59 | 0.57 | 98.16 | 53 |
| 83.0 | 41600.5 | 40604.2 | 237.5 | 758.8 | 97.61 | 0.57 | 98.18 | 53 |
| 84.0 | 44182.2 | 43139.1 | 248.6 | 794.4 | 97.64 | 0.56 | 98.20 | 53 |
| 88.0 | 46773.4 | 45682.6 | 260.0 | 830.8 | 97.67 | 0.56 | 98.22 | 52 |
| 98.0 | 53156.7 | 51932.3 | 291.8 | 932.6 | 97.70 | 0.55 | 98.25 | 53 |
| 103.0 | 56372.1 | 55075.5 | 308.9 | 987.6 | 97.70 | 0.55 | 98.25 | 53 |
| 108.0 | 59534.2 | 58165.0 | 326.1 | 1043.1 | 97.70 | 0.55 | 98.25 | 54 |
| 118.0 | 65539.3 | 64024.6 | 360.6 | 1154.0 | 97.69 | 0.55 | 98.24 | 54 |
| 133.0 | 73997.2 | 72269.8 | 411.1 | 1316.3 | 97.67 | 0.56 | 98.22 | 55 |
| 138.0 | 76710.1 | 74913.0 | 427.6 | 1369.5 | 97.66 | 0.56 | 98.21 | 55 |
| 148.0 | 82124.1 | 80186.3 | 461.0 | 1476.8 | 97.64 | 0.56 | 98.20 | 55 |
| 153.0 | 84795.7 | 82785.8 | 478.1 | 1531.8 | 97.63 | 0.56 | 98.19 | 56 |
| 163.0 | 90115.1 | 87956.3 | 513.4 | 1645.4 | 97.60 | 0.57 | 98.17 | 56 |
| 173.0 | 95529.2 | 93211.9 | 551.0 | 1766.3 | 97.57 | 0.58 | 98.15 | 57 |
| 178.0 | 98297.5 | 95896.6 | 570.8 | 1830.1 | 97.56 | 0.58 | 98.14 | 57 |
| 183.0 | 101115.3 | 98629.5 | 590.8 | 1895.0 | 97.54 | 0.58 | 98.13 | 57 |
| 194.0 | 107223.1 | 104546.3 | 635.9 | 2040.9 | 97.50 | 0.59 | 98.10 | 58 |
| 198.0 | 109415.5 | 106667.4 | 652.7 | 2095.5 | 97.49 | 0.60 | 98.08 | 59 |
| 203.0 | 112114.5 | 109274.8 | 674.3 | 2165.4 | 97.47 | 0.60 | 98.07 | 59 |
| 208.0 | 114730.3 | 111797.8 | 696.2 | 2236.3 | 97.44 | 0.61 | 98.05 | 60 |
| 213.0 | 117492.2 | 114462.7 | 717.7 | 2311.8 | 97.42 | 0.61 | 98.03 | 60 |
| 223.0 | 123514.7 | 120276.1 | 759.9 | 2478.6 | 97.38 | 0.62 | 97.99 | 61 |
| 229.0 | 127341.2 | 123968.2 | 786.2 | 2586.8 | 97.35 | 0.62 | 97.97 | 61 |
| 238.0 | 133830.8 | 130234.2 | 829.8 | 2766.8 | 97.31 | 0.62 | 97.93 | 63 |
| 242.0 | 136971.9 | 133268.1 | 850.8 | 2853.0 | 97.30 | 0.62 | 97.92 | 63 |

TABLE A-22. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5200 | 1020 | 2740 | 95 | 783.4 | 756.2 | 5.33 | 21.83 | 96.53 | 0.68 | 97.21 |
| 2.0 | 5200 | 1020 | 2730 | 50 | 780.5 | 766.2 | 2.80 | 11.49 | 98.17 | 0.36 | 98.53 |
| 5.0 | 5050 | 1020 | 2720 | 45 | 755.2 | 742.7 | 2.52 | 9.97 | 98.35 | 0.33 | 98.68 |
| 11.0 | 5050 | 1020 | 2630 | 56 | 730.2 | 714.7 | 3.14 | 12.41 | 97.87 | 0.43 | 98.30 |
| 15.0 | 5050 | 1020 | 2480 | 76 | 688.6 | 667.5 | 4.26 | 16.84 | 95.94 | 0.62 | 97.55 |
| 18.0 | 5050 | 1020 | 2440 | 84 | 677.5 | 654.2 | 4.71 | 18.61 | 96.56 | 0.70 | 97.25 |
| 26.0 | 5025 | 1020 | 2350 | 58 | 649.3 | 633.2 | 3.25 | 12.77 | 97.53 | 0.50 | 98.03 |
| 31.0 | 5050 | 1020 | 2270 | 49 | 630.3 | 616.7 | 2.75 | 10.86 | 97.84 | 0.44 | 98.28 |
| 41.0 | 5050 | 1020 | 2340 | 46 | 649.7 | 636.9 | 2.58 | 10.19 | 98.03 | 0.40 | 98.43 |
| 45.0 | 5050 | 1020 | 2380 | 45 | 660.8 | 648.3 | 2.52 | 9.97 | 98.11 | 0.38 | 98.49 |
| 56.0 | 5050 | 1020 | 2350 | 45 | 652.5 | 640.0 | 2.52 | 9.97 | 98.09 | 0.39 | 98.47 |
| 72.0 | 5050 | 1020 | 2280 | 51 | 633.1 | 618.9 | 2.86 | 11.30 | 97.76 | 0.45 | 98.21 |
| 76.0 | 5050 | 1020 | 2270 | 51 | 630.3 | 616.1 | 2.86 | 11.30 | 97.75 | 0.45 | 98.21 |
| 85.0 | 5050 | 1020 | 2340 | 56 | 649.7 | 634.2 | 3.14 | 12.41 | 97.61 | 0.48 | 98.09 |
| 101.0 | 5075 | 1020 | 2410 | 61 | 672.5 | 655.4 | 3.42 | 13.60 | 97.47 | 0.51 | 97.98 |
| 115.0 | 5025 | 1020 | 2520 | 70 | 696.2 | 676.9 | 3.93 | 15.41 | 97.22 | 0.56 | 97.79 |
| 131.0 | 5025 | 1020 | 2520 | 71 | 696.2 | 676.6 | 3.98 | 15.63 | 97.18 | 0.57 | 97.75 |
| 136.0 | 5025 | 1020 | 2460 | 72 | 679.7 | 659.8 | 4.04 | 15.85 | 97.07 | 0.59 | 97.67 |
| 146.0 | 5025 | 1020 | 2180 | 75 | 602.3 | 581.6 | 4.21 | 16.52 | 96.56 | 0.70 | 97.26 |
| 154.0 | 5025 | 1020 | 2060 | 76 | 569.1 | 548.1 | 4.26 | 16.74 | 96.31 | 0.75 | 97.06 |
| 161.0 | 5025 | 1020 | 2050 | 78 | 566.4 | 544.8 | 4.37 | 17.18 | 96.20 | 0.77 | 96.97 |
| 176.0 | 5025 | 1020 | 2050 | 84 | 566.4 | 543.2 | 4.71 | 18.50 | 95.90 | 0.83 | 96.73 |
| 192.0 | 5025 | 1020 | 2040 | 91 | 563.6 | 538.5 | 5.10 | 20.04 | 95.54 | 0.91 | 96.44 |
| 196.0 | 5025 | 1020 | 2060 | 91 | 569.1 | 544.0 | 5.10 | 20.04 | 95.58 | 0.90 | 96.48 |
| 205.0 | 5025 | 1020 | 2190 | 96 | 605.1 | 578.5 | 5.38 | 21.14 | 95.62 | 0.89 | 96.51 |
| 216.0 | 5000 | 1020 | 2540 | 106 | 698.3 | 669.1 | 5.94 | 23.20 | 95.83 | 0.85 | 96.68 |
| 221.0 | 4975 | 1020 | 2590 | 114 | 708.5 | 677.3 | 6.39 | 24.79 | 95.60 | 0.90 | 96.50 |
| 227.0 | 4975 | 1020 | 2560 | 120 | 700.2 | 667.4 | 6.73 | 26.09 | 95.31 | 0.96 | 96.27 |
| 236.0 | 4975 | 1020 | 2150 | 121 | 588.1 | 555.0 | 6.79 | 26.31 | 94.37 | 1.15 | 95.53 |
| 242.0 | 4975 | 1020 | 2310 | 121 | 631.9 | 598.8 | 6.79 | 26.31 | 94.76 | 1.07 | 95.84 |

## TABLE A-23. SUMMARY OF $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED FOR INTERVALS DURING TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 2.0 | 1563.9 | 1522.4 | 8.13 | 33.32 | 97.35 | 0.52 | 97.87 | 73 |
| 2.0- 5.0 | 2303.6 | 2263.4 | 7.99 | 32.19 | 98.26 | 0.35 | 98.60 | 48 |
| 5.0- 11.0 | 4456.4 | 4372.3 | 16.99 | 67.14 | 98.11 | 0.38 | 98.49 | 51 |
| 11.0- 16.0 | 3547.1 | 3455.4 | 18.51 | 73.12 | 97.42 | 0.52 | 97.94 | 66 |
| 16.0- 18.0 | 1366.1 | 1321.6 | 8.97 | 35.45 | 96.75 | 0.66 | 97.40 | 80 |
| 18.0- 26.0 | 5307.0 | 5149.6 | 31.85 | 125.54 | 97.03 | 0.60 | 97.63 | 71 |
| 26.0- 31.0 | 3198.9 | 3124.8 | 15.00 | 59.07 | 97.68 | 0.47 | 98.15 | 53 |
| 31.0- 41.0 | 6400.0 | 6268.1 | 26.64 | 105.25 | 97.94 | 0.42 | 98.36 | 48 |
| 41.0- 46.0 | 3276.3 | 3213.2 | 12.76 | 50.41 | 98.07 | 0.39 | 98.46 | 46 |
| 46.0- 56.0 | 6566.6 | 6441.6 | 25.24 | 99.71 | 98.10 | 0.38 | 98.48 | 45 |
| 56.0- 72.0 | 10284.4 | 10071.2 | 43.07 | 170.17 | 97.93 | 0.42 | 98.35 | 48 |
| 72.0- 76.0 | 2526.7 | 2470.0 | 11.44 | 45.20 | 97.76 | 0.45 | 98.21 | 51 |
| 76.0- 86.0 | 6400.0 | 6251.4 | 30.00 | 118.54 | 97.68 | 0.47 | 98.15 | 54 |
| 86.0-101.0 | 9916.4 | 9672.1 | 49.21 | 195.06 | 97.54 | 0.50 | 98.03 | 59 |
| 101.0-116.0 | 10265.2 | 9992.5 | 55.10 | 217.60 | 97.34 | 0.54 | 97.88 | 65 |
| 116.0-131.0 | 10443.5 | 10151.3 | 59.31 | 232.86 | 97.20 | 0.57 | 97.77 | 70 |
| 131.0-136.0 | 3439.7 | 3340.9 | 20.05 | 78.72 | 97.13 | 0.58 | 97.71 | 72 |
| 136.0-146.0 | 6409.7 | 6206.7 | 41.22 | 161.85 | 96.83 | 0.64 | 97.47 | 74 |
| 146.0-154.0 | 4685.7 | 4518.9 | 33.87 | 133.00 | 96.44 | 0.72 | 97.16 | 76 |
| 154.0-161.0 | 3974.3 | 3825.4 | 30.23 | 118.69 | 96.25 | 0.76 | 97.01 | 77 |
| 161.0-176.0 | 8495.7 | 8160.0 | 68.14 | 267.54 | 96.05 | 0.80 | 96.85 | 81 |
| 176.0-192.0 | 9039.9 | 8653.1 | 78.51 | 308.28 | 95.72 | 0.87 | 96.59 | 87 |
| 192.0-196.0 | 2265.5 | 2164.9 | 20.41 | 80.15 | 95.56 | 0.90 | 96.46 | 91 |
| 196.0-206.0 | 5871.0 | 5612.7 | 52.44 | 205.89 | 95.60 | 0.89 | 96.49 | 93 |
| 206.0-216.0 | 6516.6 | 6238.3 | 56.64 | 221.67 | 95.73 | 0.87 | 96.60 | 101 |
| 216.0-221.0 | 3516.8 | 3366.0 | 30.84 | 119.96 | 95.71 | 0.88 | 96.59 | 110 |
| 221.0-227.0 | 4226.1 | 4034.1 | 39.37 | 152.65 | 95.46 | 0.93 | 96.39 | 117 |
| 227.0-236.0 | 5797.5 | 5500.9 | 60.82 | 235.83 | 94.88 | 1.05 | 95.93 | 120 |
| 236.0-242.0 | 3659.9 | 3461.3 | 40.71 | 157.87 | 94.57 | 1.11 | 95.69 | 121 |

## TABLE A-24. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 2.0 | 1563.9 | 1522.4 | 8.1 | 33.3 | 97.35 | 0.52 | 97.87 | 72 |
| 5.0 | 3867.5 | 3785.9 | 16.1 | 65.5 | 97.89 | 0.42 | 98.31 | 58 |
| 11.0 | 8323.9 | 8158.1 | 33.1 | 132.7 | 98.01 | 0.40 | 98.41 | 54 |
| 16.0 | 11870.9 | 11613.6 | 51.6 | 205.8 | 97.83 | 0.43 | 98.27 | 58 |
| 18.0 | 13237.0 | 12935.2 | 60.6 | 241.2 | 97.72 | 0.46 | 98.18 | 60 |
| 26.0 | 18544.0 | 18084.8 | 92.4 | 366.8 | 97.52 | 0.50 | 98.02 | 63 |
| 31.0 | 21742.8 | 21209.6 | 107.5 | 425.8 | 97.55 | 0.49 | 98.04 | 62 |
| 41.0 | 28142.8 | 27477.7 | 134.1 | 531.1 | 97.64 | 0.48 | 98.11 | 58 |
| 46.0 | 31419.2 | 30690.8 | 146.8 | 581.5 | 97.68 | 0.47 | 98.15 | 57 |
| 56.0 | 37985.7 | 37132.5 | 172.1 | 681.2 | 97.75 | 0.45 | 98.21 | 55 |
| 72.0 | 48270.1 | 47203.6 | 215.2 | 851.4 | 97.79 | 0.45 | 98.24 | 53 |
| 76.0 | 50796.8 | 49673.6 | 226.6 | 896.6 | 97.79 | 0.45 | 98.23 | 53 |
| 86.0 | 57196.8 | 55925.1 | 256.6 | 1015.1 | 97.78 | 0.45 | 98.23 | 53 |
| 101.0 | 67113.1 | 65597.2 | 305.8 | 1210.2 | 97.74 | 0.46 | 98.20 | 54 |
| 116.0 | 77378.4 | 75589.7 | 360.9 | 1427.8 | 97.69 | 0.47 | 98.15 | 55 |
| 131.0 | 87821.8 | 85741.0 | 420.2 | 1660.6 | 97.63 | 0.48 | 98.11 | 57 |
| 136.0 | 91261.5 | 89081.9 | 440.3 | 1739.4 | 97.61 | 0.48 | 98.09 | 58 |
| 145.0 | 97671.3 | 95288.6 | 481.5 | 1901.2 | 97.56 | 0.49 | 98.05 | 59 |
| 154.0 | 102357.0 | 99807.4 | 515.4 | 2034.2 | 97.51 | 0.50 | 98.01 | 60 |
| 161.0 | 106331.3 | 103632.8 | 545.6 | 2152.9 | 97.46 | 0.51 | 97.98 | 60 |
| 175.0 | 114827.0 | 111792.8 | 613.7 | 2420.4 | 97.36 | 0.53 | 97.89 | 62 |
| 192.0 | 123866.9 | 120446.0 | 692.2 | 2728.7 | 97.24 | 0.56 | 97.80 | 64 |
| 196.0 | 126132.4 | 122610.9 | 712.7 | 2808.9 | 97.21 | 0.56 | 97.77 | 65 |
| 205.0 | 132003.4 | 128223.6 | 765.1 | 3014.8 | 97.14 | 0.58 | 97.72 | 66 |
| 216.0 | 138520.0 | 134461.9 | 821.7 | 3236.4 | 97.07 | 0.59 | 97.66 | 68 |
| 221.0 | 142036.8 | 137827.8 | 852.6 | 3356.4 | 97.04 | 0.60 | 97.64 | 69 |
| 227.0 | 146262.9 | 141861.9 | 891.9 | 3509.1 | 96.99 | 0.61 | 97.60 | 70 |
| 236.0 | 152060.4 | 147362.8 | 952.8 | 3744.9 | 96.91 | 0.63 | 97.54 | 72 |
| 242.0 | 155720.3 | 150824.1 | 993.5 | 3902.8 | 96.86 | 0.64 | 97.49 | 73 |

TABLE A-25. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 4300 | 1030 | 1880 | 40 | 444.5 | 435.0 | 2.27 | 7.19 | 97.87 | 0.51 | 98.38 |
| 13.0 | 4300 | 1030 | 1900 | 45 | 449.2 | 438.6 | 2.55 | 8.09 | 97.63 | 0.57 | 98.20 |
| 18.0 | 4300 | 1030 | 1860 | 50 | 439.7 | 427.9 | 2.83 | 8.99 | 97.31 | 0.64 | 97.96 |
| 22.0 | 4300 | 1030 | 1860 | 58 | 439.7 | 426.0 | 3.28 | 10.43 | 96.88 | 0.75 | 97.63 |
| 25.0 | 3050 | 1030 | 1810 | 55 | 303.5 | 294.3 | 3.11 | 6.11 | 96.96 | 1.03 | 97.99 |
| 28.0 | 3040 | 1030 | 1800 | 52 | 300.9 | 292.2 | 2.94 | 5.75 | 97.11 | 0.98 | 98.09 |
| 32.0 | 3040 | 1030 | 1770 | 45 | 295.8 | 288.3 | 2.55 | 4.97 | 97.46 | 0.86 | 98.32 |
| 37.0 | 3040 | 1030 | 1740 | 39 | 290.8 | 284.3 | 2.21 | 4.31 | 97.76 | 0.76 | 98.52 |
| 43.0 | 3040 | 1030 | 1750 | 38 | 292.5 | 286.2 | 2.15 | 4.20 | 97.83 | 0.74 | 98.56 |
| 58.0 | 3040 | 1030 | 2050 | 32 | 342.6 | 337.3 | 1.81 | 3.54 | 98.44 | 0.53 | 98.97 |
| 73.0 | 5000 | 1035 | 1850 | 31 | 508.6 | 500.1 | 1.76 | 6.76 | 98.32 | 0.35 | 98.67 |
| 78.0 | 5175 | 1035 | 1660 | 30 | 472.3 | 463.8 | 1.71 | 6.83 | 98.19 | 0.36 | 98.55 |
| 81.0 | 3650 | 1030 | 1660 | 30 | 333.1 | 327.1 | 1.70 | 4.32 | 98.19 | 0.51 | 98.70 |
| 83.0 | 3650 | 1030 | 1500 | 30 | 301.0 | 295.0 | 1.70 | 4.32 | 98.00 | 0.56 | 98.56 |
| 85.0 | 3625 | 1030 | 1480 | 30 | 295.0 | 289.0 | 1.70 | 4.28 | 97.97 | 0.58 | 98.55 |
| 86.0 | 3625 | 1030 | 1360 | 30 | 271.1 | 265.1 | 1.70 | 4.28 | 97.79 | 0.63 | 98.42 |
| 87.0 | 3525 | 1030 | 1450 | 30 | 281.0 | 275.2 | 1.70 | 4.12 | 97.93 | 0.60 | 98.54 |
| 88.0 | 6100 | 1015 | 1447 | 30 | 485.3 | 475.2 | 1.67 | 8.39 | 97.93 | 0.34 | 98.27 |
| 93.0 | 6250 | 1020 | 1840 | 30 | 632.3 | 622.0 | 1.68 | 8.63 | 98.37 | 0.27 | 98.64 |
| 103.0 | 5800 | 1040 | 2940 | 44 | 937.5 | 923.5 | 2.52 | 11.52 | 98.50 | 0.27 | 98.77 |
| 108.0 | 5825 | 1035 | 2890 | 45 | 925.6 | 911.2 | 2.56 | 11.85 | 98.44 | 0.28 | 98.72 |
| 120.0 | 5825 | 1035 | 3020 | 54 | 967.2 | 949.9 | 3.07 | 14.22 | 98.21 | 0.32 | 98.53 |
| 125.0 | 5800 | 1035 | 3120 | 56 | 994.9 | 977.1 | 3.19 | 14.67 | 98.21 | 0.32 | 98.53 |
| 130.0 | 5800 | 1030 | 3360 | 64 | 1071.5 | 1051.1 | 3.62 | 16.78 | 98.10 | 0.34 | 98.43 |
| 145.0 | 5775 | 1030 | 3440 | 76 | 1092.3 | 1068.1 | 4.30 | 19.83 | 97.79 | 0.39 | 98.18 |
| 150.0 | 5775 | 1035 | 3640 | 81 | 1155.8 | 1130.0 | 4.61 | 21.11 | 97.77 | 0.40 | 98.17 |
| 160.0 | 5750 | 1030 | 3810 | 91 | 1204.5 | 1175.7 | 5.15 | 23.62 | 97.61 | 0.43 | 98.04 |
| 175.0 | 5825 | 1030 | 3860 | 108 | 1236.2 | 1201.6 | 6.12 | 28.47 | 97.20 | 0.49 | 97.70 |
| 180.0 | 5800 | 1030 | 3990 | 115 | 1272.4 | 1235.7 | 6.51 | 30.16 | 97.12 | 0.51 | 97.63 |
| 182.0 | 5800 | 1030 | 3900 | 118 | 1243.7 | 1206.1 | 6.68 | 30.95 | 96.97 | 0.54 | 97.51 |
| 183.0 | 5800 | 1030 | 4290 | 119 | 1368.0 | 1330.1 | 6.74 | 31.21 | 97.23 | 0.49 | 97.72 |
| 184.0 | 5800 | 1030 | 4370 | 119 | 1393.6 | 1355.6 | 6.74 | 31.21 | 97.28 | 0.48 | 97.76 |
| 190.0 | 5800 | 1030 | 4120 | 126 | 1313.8 | 1273.7 | 7.14 | 33.04 | 96.94 | 0.54 | 97.48 |
| 195.0 | 5825 | 1030 | 4170 | 134 | 1335.5 | 1292.6 | 7.59 | 35.33 | 96.79 | 0.57 | 97.35 |
| 205.0 | 5800 | 1030 | 3980 | 146 | 1269.2 | 1222.6 | 8.27 | 38.29 | 96.33 | 0.65 | 96.98 |
| 210.0 | 5800 | 1030 | 3790 | 150 | 1208.6 | 1160.8 | 8.49 | 39.34 | 96.04 | 0.70 | 96.75 |
| 211.0 | 6350 | 1015 | 3790 | 150 | 1323.2 | 1270.8 | 8.37 | 44.00 | 96.04 | 0.63 | 96.67 |
| 213.0 | 6350 | 1015 | 3810 | 150 | 1330.2 | 1277.8 | 8.37 | 44.00 | 96.06 | 0.63 | 96.69 |
| 214.0 | 6375 | 1015 | 3750 | 150 | 1314.4 | 1261.8 | 8.37 | 44.21 | 96.00 | 0.64 | 96.64 |
| 215.0 | 4325 | 1065 | 3360 | 152 | 799.0 | 762.8 | 8.90 | 27.24 | 95.48 | 1.11 | 96.59 |
| 216.0 | 4325 | 1065 | 3240 | 151 | 770.5 | 734.5 | 8.84 | 27.07 | 95.34 | 1.15 | 96.49 |
| 217.0 | 4325 | 1065 | 3230 | 151 | 768.1 | 732.2 | 8.84 | 27.07 | 95.33 | 1.15 | 96.48 |
| 218.0 | 4325 | 1065 | 3260 | 186 | 775.2 | 731.0 | 10.89 | 33.34 | 94.29 | 1.40 | 95.70 |
| 219.0 | 4325 | 1065 | 2600 | 74 | 618.3 | 600.7 | 4.33 | 13.26 | 97.15 | 0.70 | 97.85 |
| 220.0 | 4325 | 1065 | 2600 | 149 | 618.3 | 582.8 | 8.72 | 26.71 | 94.27 | 1.41 | 95.68 |
| 225.0 | 4325 | 1065 | 3080 | 150 | 732.4 | 696.7 | 8.78 | 26.89 | 95.13 | 1.20 | 96.33 |
| 230.0 | 4325 | 1065 | 3290 | 148 | 782.3 | 747.2 | 8.67 | 26.53 | 95.50 | 1.11 | 96.61 |

TABLE A-25. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 235.0 | 4325 | 1065 | 3640 | 149 | 865.6 | 830.1 | 8.72 | 26.71 | 95.91 | 1.01 | 96.91 |
| 240.0 | 4325 | 1065 | 3630 | 151 | 863.2 | 827.3 | 8.84 | 27.07 | 95.84 | 1.02 | 96.86 |
| 244.0 | 4325 | 1065 | 3090 | 158 | 734.6 | 697.2 | 9.25 | 28.32 | 94.89 | 1.26 | 96.15 |
| 246.0 | 4325 | 1065 | 3080 | 160 | 732.4 | 694.4 | 9.37 | 28.68 | 94.81 | 1.28 | 96.08 |
| 250.0 | 4325 | 1065 | 3470 | 166 | 825.1 | 785.7 | 9.72 | 29.75 | 95.22 | 1.18 | 96.39 |
| 255.0 | 6125 | 1190 | 4050 | 174 | 1363.9 | 1305.3 | 11.38 | 47.21 | 95.70 | 0.83 | 96.54 |
| 260.0 | 6125 | 1200 | 4260 | 189 | 1434.6 | 1371.0 | 12.47 | 51.18 | 95.56 | 0.87 | 96.43 |
| 264.0 | 6125 | 1140 | 4220 | 194 | 1421.1 | 1355.8 | 12.16 | 53.17 | 95.40 | 0.86 | 96.26 |
| 266.0 | 6075 | 1065 | 2850 | 195 | 951.9 | 886.8 | 11.42 | 53.71 | 93.16 | 1.20 | 94.36 |
| 267.0 | 6075 | 1035 | 2850 | 200 | 951.9 | 885.1 | 11.38 | 55.42 | 92.98 | 1.20 | 94.18 |
| 272.0 | 6050 | 1025 | 2560 | 201 | 851.6 | 784.7 | 11.33 | 55.53 | 92.15 | 1.33 | 93.48 |
| 280.0 | 6225 | 1025 | 2160 | 192 | 739.3 | 673.6 | 10.82 | 54.89 | 91.11 | 1.46 | 92.57 |
| 283.0 | 6225 | 1025 | 2060 | 188 | 705.1 | 640.7 | 10.59 | 53.75 | 90.87 | 1.50 | 92.38 |

# TABLE A-26. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 13.0 | 5808.3 | 5678.2 | 31.29 | 99.33 | 97.75 | 0.54 | 98.29 | 43 |
| 13.0- 18.0 | 2222.4 | 2166.2 | 13.45 | 42.70 | 97.47 | 0.61 | 98.08 | 47 |
| 18.0- 22.0 | 1759.0 | 1707.9 | 12.23 | 38.83 | 97.10 | 0.70 | 97.79 | 54 |
| 22.0- 26.0 | 1486.5 | 1440.7 | 12.80 | 33.07 | 96.91 | 0.86 | 97.78 | 57 |
| 26.0- 28.0 | 604.4 | 586.5 | 6.06 | 11.86 | 97.04 | 1.00 | 98.04 | 54 |
| 28.0- 32.0 | 1193.4 | 1161.0 | 10.99 | 21.44 | 97.28 | 0.92 | 98.20 | 48 |
| 32.0- 37.0 | 1466.7 | 1431.6 | 11.89 | 23.21 | 97.61 | 0.81 | 98.42 | 42 |
| 37.0- 43.0 | 1759.0 | 1711.4 | 13.08 | 25.53 | 97.79 | 0.75 | 98.54 | 39 |
| 43.0- 58.0 | 4763.6 | 4675.8 | 29.73 | 58.02 | 98.16 | 0.62 | 98.78 | 35 |
| 58.0- 73.0 | 6384.2 | 6280.1 | 26.82 | 77.21 | 98.37 | 0.42 | 98.79 | 31 |
| 73.0- 78.0 | 2452.2 | 2409.6 | 8.68 | 33.97 | 98.26 | 0.35 | 98.61 | 30 |
| 78.0- 81.0 | 1208.2 | 1186.3 | 5.11 | 16.73 | 98.19 | 0.42 | 98.62 | 30 |
| 81.0- 83.0 | 634.2 | 622.1 | 3.40 | 8.64 | 98.10 | 0.54 | 98.64 | 30 |
| 83.0- 85.0 | 596.0 | 584.0 | 3.40 | 8.60 | 97.99 | 0.57 | 98.56 | 30 |
| 85.0- 86.0 | 283.0 | 277.0 | 1.70 | 4.28 | 97.89 | 0.60 | 98.49 | 30 |
| 86.0- 87.0 | 276.0 | 270.1 | 1.70 | 4.20 | 97.86 | 0.62 | 98.48 | 30 |
| 87.0- 88.0 | 383.2 | 375.2 | 1.69 | 6.25 | 97.93 | 0.44 | 98.37 | 30 |
| 88.0- 93.0 | 2794.0 | 2743.1 | 8.39 | 42.54 | 98.18 | 0.30 | 98.48 | 30 |
| 93.0-103.0 | 7849.2 | 7727.5 | 20.99 | 100.71 | 98.45 | 0.27 | 98.72 | 37 |
| 103.0-108.0 | 4657.8 | 4586.7 | 12.69 | 58.42 | 98.47 | 0.27 | 98.75 | 45 |
| 108.0-120.0 | 11356.7 | 11166.4 | 33.80 | 156.44 | 98.32 | 0.30 | 98.62 | 50 |
| 120.0-125.0 | 4905.4 | 4817.5 | 15.65 | 72.23 | 98.21 | 0.32 | 98.53 | 55 |
| 125.0-130.0 | 5166.1 | 5070.4 | 17.03 | 78.64 | 98.15 | 0.33 | 98.48 | 60 |
| 130.0-145.0 | 16228.1 | 15894.0 | 59.46 | 274.59 | 97.94 | 0.37 | 98.31 | 70 |
| 145.0-150.0 | 5620.1 | 5495.4 | 22.28 | 102.34 | 97.78 | 0.40 | 98.18 | 78 |
| 150.0-160.0 | 11801.4 | 11528.9 | 48.81 | 223.63 | 97.69 | 0.41 | 98.11 | 86 |
| 160.0-175.0 | 18305.5 | 17830.3 | 84.52 | 390.66 | 97.40 | 0.46 | 97.87 | 100 |
| 175.0-180.0 | 6271.5 | 6093.4 | 31.57 | 146.58 | 97.16 | 0.50 | 97.66 | 111 |
| 180.0-182.0 | 2516.1 | 2441.8 | 13.20 | 61.11 | 97.05 | 0.52 | 97.57 | 116 |
| 182.0-183.0 | 1305.9 | 1268.1 | 6.71 | 31.08 | 97.11 | 0.51 | 97.62 | 118 |
| 183.0-184.0 | 1380.8 | 1342.9 | 6.74 | 31.21 | 97.25 | 0.49 | 97.74 | 119 |
| 184.0-190.0 | 8122.2 | 7887.8 | 41.62 | 192.76 | 97.11 | 0.51 | 97.63 | 123 |
| 190.0-195.0 | 6623.4 | 6415.6 | 36.81 | 170.93 | 96.86 | 0.56 | 97.42 | 130 |
| 195.0-205.0 | 13023.5 | 12576.2 | 79.28 | 368.09 | 96.56 | 0.61 | 97.17 | 140 |
| 205.0-210.0 | 6194.5 | 5958.5 | 41.91 | 1[illegible]4.07 | 96.19 | 0.68 | 96.87 | 148 |
| 210.0-211.0 | 1265.9 | 1215.8 | 8.43 | 41.67 | 96.04 | 0.67 | 96.71 | 150 |
| 211.0-213.0 | 2653.4 | 2548.7 | 16.74 | 88.00 | 96.05 | 0.63 | 96.68 | 150 |
| 213.0-214.0 | 1322.3 | 1269.8 | 8.37 | 44.10 | 96.03 | 0.63 | 96.66 | 150 |
| 214.0-215.0 | 1056.7 | 1012.3 | 8.64 | 35.72 | 95.80 | 0.82 | 96.62 | 151 |
| 215.0-216.0 | 784.7 | 748.7 | 8.87 | 27.15 | 95.41 | 1.13 | 96.54 | 151 |
| 216.0-217.0 | 769.3 | 733.4 | 8.84 | 27.07 | 95.33 | 1.15 | 96.48 | 151 |
| 217.0-218.0 | 771.6 | 731.6 | 9.87 | 30.20 | 94.81 | 1.28 | 96.09 | 168 |
| 218.0-219.0 | 696.7 | 665.8 | 7.61 | 23.30 | 95.56 | 1.09 | 96.66 | 130 |
| 219.0-220.0 | 618.3 | 591.8 | 6.53 | 19.99 | 95.71 | 1.06 | 96.77 | 111 |
| 220.0-225.0 | 3376.7 | 3198.9 | 43.77 | 133.98 | 94.74 | 1.30 | 96.03 | 149 |
| 225.0-230.0 | 3786.9 | 3609.7 | 43.62 | 133.53 | 95.32 | 1.15 | 96.47 | 149 |
| 230.0-235.0 | 4119.8 | 3943.2 | 43.48 | 133.09 | 95.71 | 1.06 | 96.77 | 148 |

## TABLE A-26. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 235.0-240.0 | 4321.9 | 4143.6 | 43.92 | 134.43 | 95.87 | 1.02 | 96.89 | 150 |
| 240.0-244.0 | 3196.0 | 3049.0 | 36.19 | 110.77 | 95.40 | 1.13 | 96.53 | 154 |
| 244.0-246.0 | 1467.2 | 1391.6 | 18.62 | 57.00 | 94.85 | 1.27 | 96.12 | 159 |
| 246.0-250.0 | 3115.1 | 2960.1 | 38.18 | 116.86 | 95.02 | 1.23 | 96.25 | 163 |
| 250.0-255.0 | 5472.6 | 5227.4 | 52.76 | 192.41 | 95.52 | 0.96 | 96.48 | 171 |
| 255.0-260.0 | 6996.2 | 6690.6 | 59.64 | 245.98 | 95.63 | 0.85 | 96.48 | 181 |
| 260.0-264.0 | 5711.5 | 5453.5 | 49.26 | 208.70 | 95.48 | 0.86 | 96.35 | 192 |
| 264.0-266.0 | 2373.1 | 2242.6 | 23.58 | 106.89 | 94.50 | 0.99 | 95.50 | 195 |
| 266.0-267.0 | 951.9 | 886.0 | 11.40 | 54.57 | 93.07 | 1.20 | 94.27 | 198 |
| 267.0-272.0 | 4508.7 | 4174.6 | 56.77 | 277.38 | 92.59 | 1.26 | 93.85 | 200 |
| 272.0-280.0 | 6363.3 | 5833.0 | 88.59 | 441.70 | 91.67 | 1.39 | 93.06 | 196 |
| 280.0-283.0 | 2166.5 | 1971.4 | 32.12 | 162.97 | 91.00 | 1.48 | 92.48 | 190 |

TABLE A-27. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 13.0 | 5808.8 | 5678.2 | 31.3 | 99.3 | 97.75 | 0.54 | 98.29 | 42 |
| 18.0 | 8031.2 | 7844.4 | 44.7 | 142.0 | 97.67 | 0.56 | 98.23 | 44 |
| 22.0 | 9790.2 | 9552.3 | 57.0 | 180.9 | 97.57 | 0.58 | 98.15 | 46 |
| 26.0 | 11276.7 | 10993.0 | 69.8 | 213.9 | 97.48 | 0.62 | 98.10 | 47 |
| 28.0 | 11881.1 | 11579.5 | 75.8 | 225.8 | 97.46 | 0.64 | 98.10 | 47 |
| 32.0 | 13074.5 | 12740.4 | 86.8 | 247.2 | 97.45 | 0.66 | 98.11 | 48 |
| 37.0 | 14541.2 | 14172.0 | 98.7 | 270.4 | 97.46 | 0.68 | 98.14 | 47 |
| 43.0 | 16291.2 | 15883.4 | 111.8 | 296.0 | 97.50 | 0.69 | 98.18 | 46 |
| 56.0 | 21054.8 | 20559.3 | 141.5 | 354.0 | 97.65 | 0.67 | 98.32 | 44 |
| 73.0 | 27438.9 | 26839.4 | 168.3 | 431.2 | 97.81 | 0.61 | 98.43 | 41 |
| 78.0 | 29691.2 | 29249.0 | 177.0 | 465.2 | 97.85 | 0.59 | 98.44 | 40 |
| 81.0 | 31099.4 | 30435.3 | 182.1 | 481.9 | 97.86 | 0.59 | 98.45 | 39 |
| 83.0 | 31733.5 | 31057.4 | 185.5 | 490.5 | 97.87 | 0.58 | 98.45 | 39 |
| 85.0 | 32329.5 | 31641.4 | 188.9 | 499.1 | 97.87 | 0.58 | 98.46 | 39 |
| 86.0 | 32612.5 | 31918.5 | 190.6 | 503.4 | 97.87 | 0.58 | 98.46 | 39 |
| 87.0 | 32888.6 | 32188.6 | 192.3 | 507.6 | 97.87 | 0.58 | 98.46 | 39 |
| 88.0 | 33271.7 | 32563.9 | 194.0 | 513.9 | 97.87 | 0.58 | 98.46 | 39 |
| 93.0 | 36065.7 | 35306.9 | 202.4 | 556.4 | 97.90 | 0.56 | 98.46 | 38 |
| 103.0 | 43914.9 | 43034.4 | 223.4 | 657.1 | 97.99 | 0.51 | 98.50 | 38 |
| 108.0 | 48572.7 | 47621.0 | 236.1 | 715.5 | 98.04 | 0.49 | 98.53 | 38 |
| 120.0 | 59929.3 | 58787.5 | 269.9 | 872.0 | 98.09 | 0.45 | 98.55 | 40 |
| 125.0 | 64834.7 | 63605.0 | 285.5 | 944.2 | 98.10 | 0.44 | 98.54 | 41 |
| 130.0 | 70000.8 | 68675.4 | 302.6 | 1022.8 | 98.11 | 0.43 | 98.54 | 42 |
| 145.0 | 86228.8 | 84569.4 | 362.0 | 1297.4 | 98.08 | 0.42 | 98.50 | 46 |
| 150.0 | 91848.9 | 90064.8 | 384.3 | 1399.8 | 98.06 | 0.42 | 98.48 | 47 |
| 160.0 | 103650.2 | 101593.7 | 433.1 | 1623.4 | 98.02 | 0.42 | 98.43 | 50 |
| 175.0 | 121955.8 | 119424.1 | 517.6 | 2014.1 | 97.92 | 0.42 | 98.35 | 56 |
| 180.0 | 128227.3 | 125517.4 | 549.2 | 2160.6 | 97.89 | 0.43 | 98.31 | 57 |
| 182.0 | 130743.3 | 127959.2 | 562.4 | 2221.7 | 97.87 | 0.43 | 98.30 | 58 |
| 183.0 | 132049.2 | 129227.3 | 569.1 | 2252.8 | 97.86 | 0.43 | 98.29 | 59 |
| 184.0 | 133430.0 | 130570.1 | 575.9 | 2284.0 | 97.86 | 0.43 | 98.29 | 59 |
| 190.0 | 141552.2 | 138457.9 | 617.5 | 2476.8 | 97.81 | 0.44 | 98.25 | 62 |
| 195.0 | 148175.6 | 144873.6 | 654.3 | 2647.7 | 97.77 | 0.44 | 98.21 | 64 |
| 205.0 | 161199.1 | 157449.7 | 733.6 | 3015.8 | 97.67 | 0.46 | 98.13 | 68 |
| 210.0 | 167393.5 | 163408.2 | 775.5 | 3209.9 | 97.62 | 0.46 | 98.08 | 71 |
| 211.0 | 168659.5 | 164624.0 | 783.9 | 3251.6 | 97.61 | 0.46 | 98.07 | 71 |
| 213.0 | 171312.9 | 167172.7 | 800.7 | 3339.6 | 97.58 | 0.47 | 98.05 | 72 |
| 214.0 | 172635.2 | 168442.5 | 809.0 | 3383.7 | 97.57 | 0.47 | 98.04 | 73 |
| 215.0 | 173691.9 | 169454.9 | 817.7 | 3419.4 | 97.56 | 0.47 | 98.03 | 73 |
| 216.0 | 174476.6 | 170203.6 | 826.5 | 3446.5 | 97.55 | 0.47 | 98.02 | 73 |
| 217.0 | 175245.9 | 170936.9 | 835.4 | 3473.6 | 97.54 | 0.48 | 98.02 | 74 |
| 218.0 | 176017.5 | 171668.5 | 845.2 | 3503.8 | 97.53 | 0.48 | 98.01 | 74 |
| 219.0 | 176714.3 | 172334.3 | 852.9 | 3527.1 | 97.52 | 0.48 | 98.00 | 74 |
| 220.0 | 177332.5 | 172926.1 | 859.4 | 3547.1 | 97.52 | 0.48 | 98.00 | 74 |
| 225.0 | 180709.2 | 176125.0 | 903.2 | 3681.1 | 97.46 | 0.50 | 97.96 | 76 |
| 230.0 | 184496.1 | 179734.7 | 946.8 | 3814.6 | 97.42 | 0.51 | 97.93 | 77 |

TABLE A-27. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 235.0 | 188615.9 | 183678.0 | 990.3 | 3947.7 | 97.38 | 0.53 | 97.91 | 78 |
| 240.0 | 192937.3 | 187821.5 | 1034.2 | 4082.1 | 97.35 | 0.54 | 97.88 | 79 |
| 244.0 | 196133.3 | 190870.5 | 1070.4 | 4192.9 | 97.32 | 0.55 | 97.86 | 81 |
| 246.0 | 197601.0 | 192262.1 | 1069.0 | 4249.9 | 97.30 | 0.55 | 97.85 | 81 |
| 250.0 | 200716.1 | 195222.2 | 1127.2 | 4366.8 | 97.26 | 0.56 | 97.82 | 82 |
| 255.0 | 206188.7 | 200449.6 | 1179.9 | 4559.2 | 97.22 | 0.57 | 97.79 | 84 |
| 260.0 | 213184.9 | 207140.2 | 1239.6 | 4805.1 | 97.16 | 0.58 | 97.75 | 86 |
| 264.0 | 218896.4 | 212593.7 | 1288.8 | 5013.8 | 97.12 | 0.59 | 97.71 | 88 |
| 265.0 | 221269.4 | 214836.3 | 1312.4 | 5120.7 | 97.09 | 0.59 | 97.69 | 89 |
| 267.0 | 222221.4 | 215722.3 | 1323.8 | 5175.3 | 97.08 | 0.60 | 97.67 | 90 |
| 272.0 | 226730.1 | 219896.8 | 1380.6 | 5452.7 | 96.99 | 0.61 | 97.60 | 93 |
| 280.0 | 233093.4 | 225729.9 | 1469.2 | 5894.4 | 96.84 | 0.63 | 97.47 | 96 |
| 283.0 | 235259.9 | 227701.3 | 1501.3 | 6057.4 | 96.79 | 0.64 | 97.43 | 98 |

## TABLE A-28. SUMMARY OF CALCULATED $NO_x$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 6225 | 1025 | 2060 | 188 | 705.1 | 640.7 | 10.59 | 53.75 | 90.87 | 1.50 | 92.38 |
| 1.0 | 5925 | 1025 | 2060 | 116 | 671.1 | 633.3 | 6.54 | 31.25 | 94.37 | 0.97 | 95.34 |
| 6.0 | 5950 | 1025 | 2510 | 89 | 821.1 | 792.0 | 5.02 | 24.10 | 96.45 | 0.61 | 97.07 |
| 7.0 | 5950 | 1025 | 2630 | 89 | 860.4 | 831.3 | 5.02 | 24.10 | 96.62 | 0.58 | 97.20 |
| 12.0 | 5925 | 1025 | 3100 | 119 | 1009.9 | 971.1 | 6.71 | 32.06 | 96.16 | 0.66 | 96.83 |
| 14.0 | 5925 | 1025 | 2970 | 145 | 967.5 | 920.3 | 8.17 | 39.06 | 95.12 | 0.84 | 95.96 |
| 18.0 | 5950 | 1025 | 3080 | 124 | 1007.6 | 967.0 | 6.99 | 33.58 | 95.97 | 0.69 | 96.67 |
| 20.0 | 5950 | 1025 | 2910 | 95 | 952.0 | 920.9 | 5.35 | 25.72 | 96.74 | 0.56 | 97.30 |
| 21.0 | 5950 | 1025 | 2880 | 85 | 942.2 | 914.4 | 4.79 | 23.02 | 97.05 | 0.51 | 97.56 |
| 22.0 | 5950 | 1025 | 2880 | 79 | 942.2 | 916.3 | 4.45 | 21.39 | 97.26 | 0.47 | 97.73 |
| 25.0 | 5975 | 1025 | 3050 | 65 | 1002.0 | 980.6 | 3.66 | 17.69 | 97.87 | 0.37 | 98.23 |
| 27.0 | 5975 | 1025 | 2980 | 66 | 979.0 | 957.3 | 3.72 | 17.96 | 97.79 | 0.38 | 98.17 |
| 32.0 | 6000 | 1025 | 2850 | 56 | 940.2 | 921.7 | 3.16 | 15.32 | 98.04 | 0.34 | 98.37 |
| 33.0 | 6000 | 1025 | 2990 | 56 | 986.4 | 967.9 | 3.16 | 15.32 | 98.13 | 0.32 | 98.45 |
| 34.0 | 6000 | 1025 | 2720 | 55 | 897.3 | 879.2 | 3.10 | 15.04 | 97.98 | 0.35 | 98.32 |
| 42.0 | 6075 | 1025 | 2860 | 54 | 955.3 | 937.2 | 3.04 | 14.99 | 98.11 | 0.32 | 98.43 |
| 48.0 | 6075 | 1025 | 3000 | 51 | 1002.0 | 985.0 | 2.87 | 14.16 | 98.30 | 0.29 | 98.59 |
| 50.0 | 6075 | 1025 | 2850 | 51 | 951.9 | 934.9 | 2.87 | 14.16 | 98.21 | 0.30 | 98.51 |
| 51.0 | 6075 | 1025 | 2980 | 51 | 995.4 | 978.3 | 2.87 | 14.16 | 98.29 | 0.29 | 98.58 |
| 53.0 | 6075 | 1025 | 3030 | 50 | 1012.1 | 995.4 | 2.82 | 13.88 | 98.35 | 0.28 | 98.63 |
| 57.0 | 6075 | 1025 | 2910 | 49 | 972.0 | 955.6 | 2.76 | 13.61 | 98.32 | 0.28 | 98.60 |
| 63.0 | 6075 | 1025 | 2960 | 51 | 988.7 | 971.6 | 2.87 | 14.16 | 98.28 | 0.29 | 98.57 |
| 66.0 | 6075 | 1025 | 3100 | 55 | 1035.4 | 1017.1 | 3.10 | 15.27 | 98.23 | 0.30 | 98.53 |
| 69.0 | 6075 | 1025 | 3020 | 59 | 1008.7 | 989.0 | 3.33 | 16.38 | 98.05 | 0.33 | 98.38 |
| 72.0 | 6100 | 1025 | 3110 | 62 | 1043.1 | 1022.3 | 3.49 | 17.30 | 98.01 | 0.33 | 98.34 |
| 78.0 | 6100 | 1025 | 2860 | 70 | 959.2 | 935.7 | 3.94 | 19.53 | 97.55 | 0.41 | 97.96 |
| 82.0 | 6100 | 1025 | 2950 | 76 | 989.4 | 963.9 | 4.28 | 21.21 | 97.42 | 0.43 | 97.86 |
| 84.0 | 6100 | 1025 | 2900 | 78 | 972.6 | 946.5 | 4.40 | 21.76 | 97.31 | 0.45 | 97.76 |
| 85.0 | 6100 | 1025 | 3040 | 79 | 1019.6 | 993.1 | 4.45 | 22.04 | 97.40 | 0.44 | 97.84 |
| 87.0 | 6075 | 1025 | 2990 | 81 | 998.7 | 971.6 | 4.56 | 22.49 | 97.29 | 0.46 | 97.75 |
| 92.0 | 6075 | 1025 | 2920 | 85 | 975.3 | 946.9 | 4.79 | 23.60 | 97.09 | 0.49 | 97.58 |
| 93.0 | 6075 | 1025 | 2940 | 89 | 982.0 | 952.3 | 5.02 | 24.71 | 96.97 | 0.51 | 97.48 |
| 96.0 | 6075 | 1025 | 2710 | 94 | 905.2 | 873.8 | 5.30 | 26.10 | 96.53 | 0.59 | 97.12 |
| 98.0 | 6075 | 1025 | 2710 | 96 | 905.2 | 873.1 | 5.41 | 26.66 | 96.46 | 0.60 | 97.06 |
| 102.0 | 6075 | 1025 | 2950 | 101 | 985.3 | 951.6 | 5.69 | 28.04 | 96.58 | 0.58 | 97.15 |
| 117.0 | 6100 | 1025 | 3160 | 119 | 1059.8 | 1019.9 | 6.71 | 33.20 | 96.23 | 0.63 | 96.87 |
| 132.0 | 6100 | 1075 | 3200 | 132 | 1073.2 | 1029.0 | 7.80 | 36.47 | 95.88 | 0.73 | 96.60 |
| 137.0 | 6125 | 1025 | 3120 | 136 | 1050.7 | 1004.9 | 7.66 | 38.14 | 95.64 | 0.73 | 96.37 |
| 147.0 | 6150 | 1025 | 3050 | 142 | 1031.3 | 983.3 | 8.00 | 40.01 | 95.34 | 0.78 | 96.12 |
| 152.0 | 6150 | 1025 | 3060 | 146 | 1034.7 | 985.3 | 8.23 | 41.14 | 95.23 | 0.80 | 96.02 |
| 162.0 | 6100 | 1025 | 3210 | 159 | 1076.6 | 1023.3 | 8.96 | 44.37 | 95.05 | 0.83 | 95.88 |
| 167.0 | 6075 | 1025 | 3160 | 165 | 1055.5 | 1000.4 | 9.30 | 45.81 | 94.78 | 0.88 | 95.66 |
| 173.0 | 6075 | 1025 | 3120 | 175 | 1042.1 | 983.7 | 9.86 | 48.59 | 94.39 | 0.95 | 95.34 |
| 177.0 | 6075 | 1025 | 3200 | 179 | 1068.8 | 1009.1 | 10.09 | 49.70 | 94.41 | 0.94 | 95.35 |
| 187.0 | 6075 | 1025 | 3380 | 196 | 1129.0 | 1063.5 | 11.05 | 54.42 | 94.20 | 0.98 | 95.18 |
| 188.0 | 6075 | 1025 | 3480 | 198 | 1162.4 | 1096.2 | 11.16 | 54.98 | 94.31 | 0.96 | 95.27 |
| 192.0 | 6050 | 1025 | 3380 | 208 | 1124.3 | 1055.1 | 11.72 | 57.47 | 93.85 | 1.04 | 94.89 |

# TABLE A-28. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23 OUTLET HV-13 UNIT A 1503-1905 3/13/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 207.0 | 6075 | 1025 | 3500 | 230 | 1169.0 | 1092.2 | 12.96 | 63.86 | 93.43 | 1.11 | 94.54 |
| 217.0 | 6050 | 1025 | 3610 | 245 | 1200.8 | 1119.3 | 13.81 | 67.69 | 93.21 | 1.15 | 94.36 |
| 223.0 | 6050 | 1025 | 3580 | 254 | 1190.8 | 1106.4 | 14.31 | 70.18 | 92.91 | 1.20 | 94.11 |
| 225.0 | 6050 | 1025 | 3560 | 258 | 1184.2 | 1098.4 | 14.54 | 71.28 | 92.75 | 1.23 | 93.98 |
| 231.0 | 6050 | 1025 | 3520 | 264 | 1170.9 | 1083.1 | 14.88 | 72.94 | 92.50 | 1.27 | 93.77 |
| 237.0 | 6050 | 1035 | 3600 | 264 | 1197.5 | 1109.7 | 15.02 | 72.79 | 92.67 | 1.25 | 93.92 |
| 242.0 | 6050 | 1025 | 3520 | 268 | 1170.9 | 1081.7 | 15.10 | 74.04 | 92.39 | 1.29 | 93.68 |

# TABLE A-29. SUMMARY OF $NO_x$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_x$ EMITTED FOR INTERVALS DURING TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 1.0 | 688.1 | 637.0 | 8.57 | 42.50 | 92.58 | 1.24 | 93.82 | 153 |
| 1.0- 6.0 | 3730.5 | 3563.2 | 28.88 | 138.38 | 95.52 | 0.77 | 96.29 | 102 |
| 6.0- 7.0 | 840.7 | 811.6 | 5.02 | 24.10 | 96.54 | 0.60 | 97.13 | 89 |
| 7.0- 12.0 | 4675.6 | 4505.9 | 29.31 | 140.40 | 96.37 | 0.63 | 97.00 | 104 |
| 12.0- 14.0 | 1977.4 | 1891.4 | 14.88 | 71.12 | 95.65 | 0.75 | 96.40 | 132 |
| 14.0- 18.0 | 3950.2 | 3774.6 | 30.32 | 145.28 | 95.55 | 0.77 | 96.32 | 134 |
| 18.0- 20.0 | 1959.6 | 1887.9 | 12.34 | 59.30 | 96.34 | 0.63 | 96.97 | 109 |
| 20.0- 21.0 | 947.1 | 917.6 | 5.07 | 24.37 | 96.89 | 0.54 | 97.43 | 90 |
| 21.0- 22.0 | 942.2 | 915.3 | 4.62 | 22.20 | 97.15 | 0.49 | 97.64 | 82 |
| 22.0- 25.0 | 2916.2 | 2845.4 | 12.17 | 58.62 | 97.57 | 0.42 | 97.99 | 72 |
| 25.0- 27.0 | 1980.9 | 1937.9 | 7.38 | 35.65 | 97.83 | 0.37 | 98.20 | 65 |
| 27.0- 32.0 | 4797.9 | 4697.5 | 17.19 | 83.20 | 97.91 | 0.36 | 98.27 | 61 |
| 32.0- 33.0 | 963.3 | 944.8 | 3.16 | 15.32 | 98.08 | 0.33 | 98.41 | 56 |
| 33.0- 34.0 | 941.3 | 923.5 | 3.13 | 15.18 | 98.06 | 0.33 | 98.39 | 55 |
| 34.0- 42.0 | 7410.3 | 7265.6 | 24.57 | 120.15 | 98.05 | 0.33 | 98.38 | 54 |
| 42.0- 48.0 | 5871.9 | 5766.7 | 17.75 | 87.46 | 98.21 | 0.30 | 98.51 | 53 |
| 48.0- 50.0 | 1954.0 | 1919.9 | 5.75 | 28.32 | 98.26 | 0.29 | 98.55 | 51 |
| 50.0- 51.0 | 973.6 | 956.6 | 2.87 | 14.16 | 98.25 | 0.30 | 98.55 | 51 |
| 51.0- 53.0 | 2007.4 | 1973.7 | 5.69 | 28.04 | 98.32 | 0.28 | 98.60 | 50 |
| 53.0- 57.0 | 3968.1 | 3901.9 | 11.16 | 54.98 | 98.33 | 0.28 | 98.61 | 50 |
| 57.0- 63.0 | 5882.0 | 5781.8 | 16.91 | 83.30 | 98.30 | 0.29 | 98.58 | 50 |
| 63.0- 66.0 | 3036.2 | 2983.1 | 8.96 | 44.15 | 98.25 | 0.30 | 98.55 | 53 |
| 66.0- 68.0 | 2044.2 | 2006.1 | 6.42 | 31.65 | 98.14 | 0.31 | 98.45 | 57 |
| 68.0- 72.0 | 4103.5 | 4022.5 | 13.64 | 67.36 | 98.03 | 0.33 | 98.36 | 61 |
| 72.0- 78.0 | 6006.8 | 5874.0 | 22.32 | 110.50 | 97.79 | 0.37 | 98.16 | 66 |
| 78.0- 82.0 | 3897.2 | 3799.3 | 16.46 | 81.48 | 97.49 | 0.42 | 97.91 | 73 |
| 82.0- 84.0 | 1962.0 | 1910.4 | 8.68 | 42.97 | 97.37 | 0.44 | 97.81 | 77 |
| 84.0- 85.0 | 996.1 | 969.8 | 4.42 | 21.90 | 97.36 | 0.44 | 97.80 | 78 |
| 85.0- 87.0 | 2018.3 | 1964.7 | 9.02 | 44.53 | 97.35 | 0.45 | 97.79 | 80 |
| 87.0- 92.0 | 4935.0 | 4796.4 | 23.39 | 115.23 | 97.19 | 0.47 | 97.67 | 83 |
| 92.0- 93.0 | 978.7 | 949.6 | 4.90 | 24.16 | 97.03 | 0.50 | 97.53 | 87 |
| 93.0- 96.0 | 2830.8 | 2739.1 | 15.47 | 76.22 | 96.76 | 0.55 | 97.31 | 91 |
| 96.0- 98.0 | 1810.3 | 1746.9 | 10.71 | 52.75 | 96.49 | 0.59 | 97.09 | 95 |
| 98.0-102.0 | 3781.0 | 3649.4 | 22.20 | 109.40 | 96.52 | 0.59 | 97.11 | 99 |
| 102.0-117.0 | 15338.7 | 14786.3 | 92.99 | 459.36 | 96.40 | 0.61 | 97.01 | 110 |
| 117.0-132.0 | 15998.0 | 15366.6 | 108.81 | 522.55 | 96.05 | 0.68 | 96.73 | 125 |
| 132.0-137.0 | 5309.8 | 5084.7 | 38.67 | 186.51 | 95.76 | 0.73 | 96.49 | 134 |
| 137.0-147.0 | 10410.1 | 9941.0 | 78.33 | 390.74 | 95.49 | 0.75 | 96.25 | 139 |
| 147.0-152.0 | 5165.0 | 4921.6 | 40.58 | 202.88 | 95.29 | 0.79 | 96.07 | 144 |
| 152.0-162.0 | 10556.4 | 10043.0 | 85.94 | 427.53 | 95.14 | 0.81 | 95.95 | 152 |
| 162.0-167.0 | 5330.2 | 5059.1 | 45.65 | 225.45 | 94.91 | 0.86 | 95.77 | 162 |
| 167.0-173.0 | 6292.8 | 5952.1 | 57.48 | 283.21 | 94.59 | 0.91 | 95.50 | 170 |
| 173.0-177.0 | 4221.9 | 3985.4 | 39.90 | 196.58 | 94.40 | 0.95 | 95.34 | 177 |
| 177.0-187.0 | 10989.0 | 10362.7 | 105.67 | 520.61 | 94.30 | 0.96 | 95.26 | 188 |
| 187.0-188.0 | 1145.7 | 1079.9 | 11.10 | 54.70 | 94.26 | 0.97 | 95.23 | 197 |
| 188.0-192.0 | 4573.4 | 4302.7 | 45.76 | 224.89 | 94.08 | 1.00 | 95.08 | 203 |
| 192.0-207.0 | 17200.2 | 16105.1 | 185.13 | 909.96 | 93.63 | 1.08 | 94.71 | 219 |

TABLE A-29. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 207.0-217.0 | 11849.3 | 11057.7 | 133.85 | 657.75 | 93.32 | 1.13 | 94.45 | 237 |
| 217.0-223.0 | 7175.0 | 6677.0 | 84.36 | 413.59 | 93.06 | 1.18 | 94.24 | 250 |
| 223.0-225.0 | 2375.0 | 2204.7 | 28.85 | 141.46 | 92.83 | 1.21 | 94.04 | 256 |
| 225.0-231.0 | 7065.2 | 6544.3 | 88.25 | 432.66 | 92.63 | 1.25 | 93.88 | 261 |
| 231.0-237.0 | 7105.1 | 6578.2 | 89.70 | 437.20 | 92.58 | 1.26 | 93.85 | 264 |
| 237.0-242.0 | 5921.0 | 5478.5 | 75.32 | 367.09 | 92.53 | 1.27 | 93.80 | 266 |

# TABLE A-30. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1.0 | 688.1 | 637.0 | 8.6 | 42.5 | 92.58 | 1.24 | 93.82 | 153 |
| 6.0 | 4418.6 | 4200.2 | 37.4 | 180.9 | 95.06 | 0.85 | 95.91 | 111 |
| 7.0 | 5259.3 | 5011.9 | 42.5 | 205.0 | 95.30 | 0.81 | 96.10 | 108 |
| 12.0 | 9934.9 | 9517.8 | 71.8 | 345.4 | 95.80 | 0.72 | 96.52 | 106 |
| 14.0 | 11912.3 | 11409.2 | 86.6 | 416.5 | 95.78 | 0.73 | 96.50 | 110 |
| 18.0 | 15862.6 | 15163.8 | 117.0 | 561.8 | 95.72 | 0.74 | 96.46 | 115 |
| 20.0 | 17822.1 | 17071.7 | 129.3 | 621.1 | 95.79 | 0.73 | 96.52 | 115 |
| 21.0 | 18769.2 | 17989.4 | 134.4 | 645.5 | 95.85 | 0.72 | 96.56 | 114 |
| 22.0 | 19711.4 | 18904.7 | 139.0 | 667.7 | 95.91 | 0.71 | 96.61 | 112 |
| 25.0 | 22627.5 | 21750.1 | 151.2 | 726.3 | 96.12 | 0.67 | 96.79 | 107 |
| 27.0 | 24608.5 | 23688.0 | 158.6 | 761.9 | 96.26 | 0.64 | 96.90 | 104 |
| 32.0 | 29406.4 | 28385.5 | 175.7 | 845.1 | 96.53 | 0.60 | 97.13 | 97 |
| 33.0 | 30369.7 | 29330.3 | 178.9 | 860.5 | 96.58 | 0.59 | 97.17 | 96 |
| 34.0 | 31311.5 | 30253.8 | 182.0 | 875.6 | 96.62 | 0.58 | 97.20 | 95 |
| 42.0 | 38721.8 | 37519.4 | 206.6 | 995.8 | 96.89 | 0.53 | 97.43 | 87 |
| 48.0 | 44593.7 | 43286.1 | 224.4 | 1083.2 | 97.07 | 0.50 | 97.57 | 83 |
| 50.0 | 46547.7 | 45206.0 | 230.1 | 1111.6 | 97.12 | 0.49 | 97.61 | 81 |
| 51.0 | 47521.3 | 46162.6 | 233.0 | 1125.7 | 97.14 | 0.49 | 97.63 | 81 |
| 53.0 | 49528.7 | 48136.3 | 238.7 | 1153.8 | 97.19 | 0.48 | 97.67 | 80 |
| 57.0 | 53496.8 | 52038.2 | 249.8 | 1208.7 | 97.27 | 0.47 | 97.74 | 78 |
| 63.0 | 59378.8 | 57820.0 | 266.7 | 1292.0 | 97.37 | 0.45 | 97.82 | 75 |
| 66.0 | 62414.9 | 60803.1 | 275.7 | 1336.2 | 97.42 | 0.44 | 97.86 | 74 |
| 68.0 | 64459.1 | 62809.1 | 282.1 | 1367.8 | 97.44 | 0.44 | 97.88 | 73 |
| 72.0 | 68562.5 | 66831.7 | 295.8 | 1435.2 | 97.48 | 0.43 | 97.91 | 73 |
| 78.0 | 74569.4 | 72705.6 | 318.1 | 1545.7 | 97.50 | 0.43 | 97.93 | 72 |
| 82.0 | 78466.6 | 76504.9 | 334.5 | 1627.2 | 97.50 | 0.43 | 97.93 | 72 |
| 84.0 | 80428.6 | 78415.3 | 343.2 | 1670.2 | 97.50 | 0.43 | 97.92 | 72 |
| 85.0 | 81424.7 | 79385.0 | 347.6 | 1692.1 | 97.49 | 0.43 | 97.92 | 72 |
| 87.0 | 83443.0 | 81349.8 | 356.6 | 1736.6 | 97.49 | 0.43 | 97.92 | 73 |
| 92.0 | 88378.0 | 86146.2 | 380.0 | 1851.8 | 97.47 | 0.43 | 97.90 | 73 |
| 93.0 | 89356.7 | 87095.8 | 384.9 | 1876.0 | 97.47 | 0.43 | 97.90 | 73 |
| 96.0 | 92187.4 | 89834.8 | 400.4 | 1952.2 | 97.45 | 0.43 | 97.88 | 74 |
| 98.0 | 93997.8 | 91581.7 | 411.1 | 2004.9 | 97.43 | 0.44 | 97.87 | 74 |
| 102.0 | 97778.8 | 95231.1 | 433.3 | 2114.3 | 97.39 | 0.44 | 97.84 | 75 |
| 117.0 | 113117.5 | 110017.5 | 526.3 | 2573.7 | 97.26 | 0.47 | 97.72 | 80 |
| 132.0 | 129115.5 | 125384.1 | 635.1 | 3096.3 | 97.11 | 0.49 | 97.60 | 85 |
| 137.0 | 134425.3 | 130468.7 | 673.8 | 3282.8 | 97.06 | 0.50 | 97.56 | 87 |
| 147.0 | 144835.3 | 140409.7 | 752.1 | 3673.5 | 96.94 | 0.52 | 97.46 | 90 |
| 152.0 | 150000.4 | 145331.3 | 792.7 | 3876.4 | 96.89 | 0.53 | 97.42 | 92 |
| 162.0 | 160556.8 | 155374.2 | 878.6 | 4303.9 | 96.77 | 0.55 | 97.32 | 96 |
| 167.0 | 165687.0 | 160433.3 | 924.3 | 4529.4 | 96.71 | 0.56 | 97.27 | 98 |
| 173.0 | 172179.8 | 166385.4 | 981.8 | 4812.6 | 96.63 | 0.57 | 97.20 | 100 |
| 177.0 | 176401.7 | 170370.9 | 1021.7 | 5009.2 | 96.58 | 0.58 | 97.16 | 102 |
| 187.0 | 187390.7 | 180733.6 | 1127.3 | 5529.8 | 96.45 | 0.60 | 97.05 | 107 |
| 188.0 | 188536.4 | 181813.5 | 1138.4 | 5584.5 | 96.43 | 0.60 | 97.04 | 107 |
| 192.0 | 193109.7 | 186116.2 | 1184.2 | 5809.3 | 96.38 | 0.61 | 96.99 | 109 |

## TABLE A-30. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 207.0 | 210309.9 | 202221.3 | 1369.3 | 6719.3 | 96.15 | 0.65 | 96.81 | 117 |
| 217.0 | 222159.2 | 213279.0 | 1503.2 | 7377.1 | 96.00 | 0.68 | 96.68 | 123 |
| 223.0 | 229334.2 | 219556.0 | 1587.5 | 7790.6 | 95.91 | 0.69 | 96.60 | 126 |
| 225.0 | 231709.3 | 222160.8 | 1616.4 | 7932.1 | 95.88 | 0.70 | 96.58 | 127 |
| 231.0 | 238774.5 | 228705.1 | 1704.7 | 8364.8 | 95.78 | 0.71 | 96.50 | 131 |
| 237.0 | 245879.6 | 235283.3 | 1794.4 | 8802.0 | 95.69 | 0.73 | 96.42 | 134 |
| 242.0 | 251800.6 | 240761.9 | 1869.7 | 9169.0 | 95.62 | 0.74 | 96.36 | 137 |

TABLE A-31. SUMMARY OF CALCULATED $NO_X$ MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

| TIME INTO CYCLE (MIN) | INLET FLOW (SCFM) | REGEN. FLOW (SCFM) | INLET CONC. (PPM) | OUTLET CONC. (PPM) | MASS FLOW RATE IN (G/MIN) | MASS FLOW RATE ADS. (G/MIN) | MASS FLOW RATE REGEN. (G/MIN) | MASS FLOW RATE EMIT. (G/MIN) | % REDUC. OF NOX DUE TO ADS. | % REDUC. OF NOX DUE TO REGEN. | % REDUC. OF NOX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 5500 | 1020 | 3340 | 190 | 1010.0 | 952.6 | 10.66 | 46.80 | 94.31 | 1.05 | 95.37 |
| 3.0 | 5500 | 1020 | 3320 | 90 | 1004.0 | 976.7 | 5.05 | 22.17 | 97.29 | 0.50 | 97.79 |
| 4.0 | 5500 | 1015 | 3360 | 82 | 1016.1 | 991.3 | 4.58 | 20.22 | 97.56 | 0.45 | 98.01 |
| 6.0 | 5500 | 1015 | 3310 | 78 | 1000.9 | 977.4 | 4.35 | 19.23 | 97.64 | 0.43 | 98.08 |
| 14.0 | 5475 | 1020 | 3220 | 112 | 969.3 | 935.6 | 6.28 | 27.43 | 96.52 | 0.65 | 97.17 |
| 15.0 | 5475 | 1020 | 3220 | 124 | 969.3 | 932.0 | 6.95 | 30.37 | 96.15 | 0.72 | 96.87 |
| 19.0 | 5450 | 1020 | 3380 | 101 | 1012.8 | 982.5 | 5.66 | 24.60 | 97.01 | 0.56 | 97.57 |
| 23.0 | 5450 | 1020 | 3390 | 81 | 1015.8 | 991.5 | 4.54 | 19.73 | 97.61 | 0.45 | 98.06 |
| 34.0 | 5475 | 1020 | 3290 | 64 | 990.4 | 971.1 | 3.59 | 15.68 | 98.05 | 0.36 | 98.42 |
| 39.0 | 5475 | 1020 | 3280 | 61 | 987.4 | 969.0 | 3.42 | 14.94 | 98.14 | 0.35 | 98.49 |
| 49.0 | 5475 | 1020 | 3260 | 58 | 981.3 | 963.9 | 3.25 | 14.21 | 98.22 | 0.33 | 98.55 |
| 59.0 | 5475 | 1020 | 3200 | 58 | 963.3 | 945.8 | 3.25 | 14.21 | 98.19 | 0.34 | 98.53 |
| 64.0 | 5475 | 1020 | 3150 | 61 | 948.2 | 929.9 | 3.42 | 14.94 | 98.06 | 0.36 | 98.42 |
| 79.0 | 5450 | 1020 | 3120 | 79 | 934.9 | 911.2 | 4.43 | 19.24 | 97.47 | 0.47 | 97.94 |
| 94.0 | 5475 | 1020 | 3110 | 95 | 936.2 | 907.6 | 5.33 | 23.27 | 96.95 | 0.57 | 97.51 |
| 97.0 | 5475 | 1020 | 3100 | 99 | 933.2 | 903.4 | 5.55 | 24.25 | 96.81 | 0.59 | 97.40 |
| 109.0 | 5475 | 1020 | 3100 | 114 | 933.2 | 898.9 | 6.39 | 27.92 | 96.32 | 0.69 | 97.01 |
| 124.0 | 5475 | 1020 | 3130 | 128 | 942.2 | 903.7 | 7.18 | 31.35 | 95.91 | 0.76 | 96.67 |
| 139.0 | 5475 | 1020 | 3090 | 141 | 930.2 | 887.7 | 7.91 | 34.54 | 95.44 | 0.85 | 96.29 |
| 154.0 | 5475 | 1020 | 3080 | 156 | 927.2 | 880.2 | 8.75 | 38.21 | 94.94 | 0.94 | 95.88 |
| 160.0 | 5450 | 1020 | 3060 | 164 | 916.9 | 867.8 | 9.20 | 39.95 | 94.64 | 1.00 | 95.64 |
| 169.0 | 5425 | 1020 | 3060 | 178 | 912.7 | 859.6 | 9.98 | 43.11 | 94.18 | 1.09 | 95.28 |
| 184.0 | 5450 | 1020 | 3050 | 200 | 913.9 | 854.0 | 11.22 | 48.71 | 93.44 | 1.23 | 94.67 |
| 199.0 | 5475 | 1020 | 2990 | 219 | 900.1 | 834.1 | 12.28 | 53.64 | 92.68 | 1.36 | 94.04 |
| 214.0 | 5475 | 1020 | 2960 | 230 | 891.0 | 821.8 | 12.90 | 56.34 | 92.23 | 1.45 | 93.68 |
| 220.0 | 5475 | 1020 | 2960 | 235 | 891.0 | 820.3 | 13.18 | 57.56 | 92.06 | 1.48 | 93.54 |
| 229.0 | 5475 | 1020 | 2940 | 240 | 885.0 | 812.8 | 13.46 | 58.79 | 91.84 | 1.52 | 93.36 |
| 243.0 | 5475 | 1020 | 2880 | 246 | 866.9 | 792.9 | 13.80 | 60.26 | 91.46 | 1.59 | 93.05 |

# TABLE A-32. SUMMARY OF $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED FOR INTERVALS DURING TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

| INTERVAL OF CYCLE (MIN) | NOX IN DURING INTERVAL (GRAMS) | NOX ADSORBED DURING INTERVAL (GRAMS) | NOX REGEN. DURING INTERVAL (GRAMS) | NOX EMITTED DURING INTERVAL (GRAMS) | PERCENT OF NOX ADSORBED DURING INTERVAL | PERCENT NOX FOR REGEN. DURING INTERVAL | PERCENT REDUC. OF NOX DURING INTERVAL | AVERAGE PPM OF NOX EMIT. DURING INTERVAL |
|---|---|---|---|---|---|---|---|---|
| 0.0- 3.0 | 3021.0 | 2894.0 | 23.55 | 103.45 | 95.80 | 0.78 | 96.58 | 140 |
| 3.0- 4.0 | 1010.0 | 984.0 | 4.81 | 21.19 | 97.43 | 0.48 | 97.90 | 86 |
| 4.0- 6.0 | 2017.0 | 1968.6 | 8.93 | 39.45 | 97.60 | 0.44 | 98.04 | 80 |
| 6.0- 14.0 | 7880.9 | 7651.7 | 42.54 | 186.67 | 97.09 | 0.54 | 97.63 | 95 |
| 14.0- 15.0 | 969.3 | 933.8 | 6.62 | 28.90 | 96.34 | 0.68 | 97.02 | 118 |
| 15.0- 19.0 | 3964.2 | 3829.0 | 25.24 | 109.95 | 96.59 | 0.64 | 97.23 | 113 |
| 19.0- 23.0 | 4057.2 | 3948.2 | 20.41 | 88.66 | 97.31 | 0.50 | 97.81 | 91 |
| 23.0- 34.0 | 11034.0 | 10794.5 | 44.72 | 194.73 | 97.83 | 0.41 | 98.24 | 72 |
| 34.0- 39.0 | 4944.3 | 4850.2 | 17.53 | 76.54 | 98.10 | 0.35 | 98.45 | 62 |
| 39.0- 49.0 | 9843.5 | 9664.4 | 33.37 | 145.74 | 98.18 | 0.34 | 98.52 | 60 |
| 49.0- 59.0 | 9723.1 | 9548.5 | 32.53 | 142.07 | 98.20 | 0.33 | 98.54 | 58 |
| 59.0- 64.0 | 4778.7 | 4689.2 | 16.68 | 72.87 | 98.13 | 0.35 | 98.48 | 59 |
| 64.0- 79.0 | 14123.5 | 13808.2 | 58.89 | 256.38 | 97.77 | 0.42 | 98.18 | 70 |
| 79.0- 94.0 | 14033.2 | 13641.1 | 73.19 | 318.84 | 97.21 | 0.52 | 97.73 | 87 |
| 94.0- 97.0 | 2804.0 | 2716.4 | 16.32 | 71.28 | 96.88 | 0.58 | 97.46 | 97 |
| 97.0-109.0 | 11198.1 | 10813.4 | 71.67 | 313.04 | 96.56 | 0.64 | 97.20 | 106 |
| 109.0-124.0 | 14065.3 | 13519.0 | 101.79 | 444.57 | 96.12 | 0.72 | 96.84 | 121 |
| 124.0-139.0 | 14042.7 | 13435.4 | 113.14 | 494.17 | 95.68 | 0.81 | 96.48 | 134 |
| 139.0-154.0 | 13929.9 | 13259.3 | 124.92 | 545.61 | 95.19 | 0.90 | 96.08 | 148 |
| 154.0-160.0 | 5532.2 | 5243.9 | 53.84 | 234.47 | 94.79 | 0.97 | 95.76 | 160 |
| 160.0-169.0 | 8233.4 | 7773.3 | 86.31 | 373.75 | 94.41 | 1.05 | 95.46 | 171 |
| 169.0-184.0 | 13699.9 | 12852.2 | 158.99 | 688.68 | 93.81 | 1.16 | 94.97 | 189 |
| 184.0-199.0 | 13604.9 | 12661.0 | 176.23 | 767.67 | 93.06 | 1.30 | 94.36 | 210 |
| 199.0-214.0 | 13433.2 | 12419.5 | 188.85 | 824.84 | 92.45 | 1.41 | 93.86 | 224 |
| 214.0-220.0 | 5346.2 | 4926.3 | 78.23 | 341.69 | 92.15 | 1.46 | 93.61 | 232 |
| 220.0-229.0 | 7992.2 | 7348.7 | 119.87 | 523.56 | 91.95 | 1.50 | 93.45 | 238 |
| 229.0-243.0 | 12263.7 | 11239.6 | 190.79 | 833.29 | 91.65 | 1.56 | 93.21 | 243 |

## TABLE A-33. CUMULATIVE $NO_X$ MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF $NO_X$ EMITTED DURING TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

| TIME INTO CYCLE (MIN) | TOTAL NOX IN (GRAMS) | TOTAL NOX ADS. (GRAMS) | NOX USED FOR REGEN. (GRAMS) | TOTAL NOX EMIT. (GRAMS) | % NOX REDUC. DUE TO ADS. | % NOX REDUC. DUE TO REGEN. | AVG. % REDUC. OF NOX | AVG. PPM OF NOX EMIT. |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 3.0 | 3021.0 | 2894.0 | 23.6 | 103.5 | 95.80 | 0.78 | 96.58 | 140 |
| 4.0 | 4031.0 | 3878.0 | 28.4 | 124.6 | 96.20 | 0.70 | 96.91 | 126 |
| 6.0 | 6048.0 | 5846.6 | 37.3 | 164.1 | 96.67 | 0.62 | 97.29 | 111 |
| 14.0 | 13928.9 | 13498.3 | 79.8 | 350.8 | 96.91 | 0.57 | 97.48 | 102 |
| 15.0 | 14898.2 | 14432.1 | 86.4 | 379.7 | 96.87 | 0.58 | 97.45 | 103 |
| 19.0 | 18862.4 | 18261.1 | 111.7 | 489.6 | 96.81 | 0.59 | 97.40 | 105 |
| 23.0 | 22919.7 | 22209.3 | 132.1 | 578.3 | 96.90 | 0.58 | 97.48 | 103 |
| 34.0 | 33953.6 | 33003.8 | 176.8 | 773.0 | 97.20 | 0.52 | 97.72 | 93 |
| 39.0 | 38897.9 | 37854.0 | 194.3 | 849.6 | 97.32 | 0.50 | 97.82 | 89 |
| 49.0 | 48741.4 | 47518.4 | 227.7 | 995.3 | 97.49 | 0.47 | 97.96 | 83 |
| 59.0 | 58464.5 | 57066.8 | 260.2 | 1137.4 | 97.61 | 0.45 | 98.05 | 79 |
| 64.0 | 63243.2 | 61756.0 | 276.9 | 1210.2 | 97.65 | 0.44 | 98.09 | 77 |
| 79.0 | 77366.7 | 75564.2 | 335.8 | 1466.6 | 97.67 | 0.43 | 98.10 | 76 |
| 94.0 | 91399.8 | 89205.4 | 409.0 | 1785.4 | 97.60 | 0.45 | 98.05 | 78 |
| 97.0 | 94203.9 | 91921.8 | 425.3 | 1856.7 | 97.58 | 0.45 | 98.03 | 78 |
| 109.0 | 105431.9 | 102735.2 | 497.0 | 2169.8 | 97.47 | 0.47 | 97.94 | 81 |
| 124.0 | 119467.3 | 116254.2 | 598.8 | 2614.3 | 97.31 | 0.50 | 97.81 | 86 |
| 139.0 | 133510.0 | 129689.6 | 711.9 | 3108.5 | 97.14 | 0.53 | 97.67 | 91 |
| 154.0 | 147439.9 | 142948.9 | 836.8 | 3654.1 | 96.95 | 0.57 | 97.52 | 97 |
| 160.0 | 152972.1 | 148192.8 | 890.7 | 3888.6 | 96.88 | 0.58 | 97.46 | 99 |
| 169.0 | 161205.5 | 155966.2 | 977.0 | 4262.3 | 96.75 | 0.61 | 97.36 | 103 |
| 184.0 | 174905.4 | 168818.4 | 1136.0 | 4951.0 | 96.52 | 0.65 | 97.17 | 110 |
| 199.0 | 188510.3 | 181479.4 | 1312.2 | 5718.7 | 96.27 | 0.70 | 96.97 | 118 |
| 214.0 | 201943.5 | 193898.9 | 1501.1 | 6543.5 | 96.02 | 0.74 | 96.76 | 125 |
| 220.0 | 207289.6 | 196825.1 | 1579.3 | 6885.2 | 95.92 | 0.76 | 96.68 | 128 |
| 229.0 | 215281.8 | 206173.9 | 1699.2 | 7408.8 | 95.77 | 0.79 | 96.56 | 132 |
| 243.0 | 227545.5 | 217413.5 | 1890.0 | 8242.1 | 95.55 | 0.83 | 96.38 | 139 |

# APPENDIX B

## $NO_X$ EMISSION DATA REPORTS FOR EPA METHOD NO. 7 TESTS

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | FLASK NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | TEMP F FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-HV-12-1 | 3/5 | 1316 | 3 | 1965 | 29.75 | 26.50 | 29.76 | 0.50 | 75 | 71 | 7550 | 5700 | 2334 | 95.04 |
| 1-HV-12-2 | 3/5 | 1345 | 5 | 1955 | 29.74 | 26.65 | 29.77 | 4.90 | 74 | 70 | 6550 | 5700 | 2426 | 98.77 |
| 1-HV-12-3 | 3/5 | 1415 | 19 | 2116 | 29.72 | 26.60 | 29.78 | 0.05 | 75 | 70 | 8900 | 5975 | 2490 | 106.28 |
| 1-HV-12-4 | 3/5 | 1446 | 9 | 2053 | 29.71 | 26.60 | 29.77 | 0.60 | 75 | 73 | 7650 | 5975 | 2267 | 96.79 |
| 1-HV-12-5 | 3/5 | 1516 | 20 | 2069 | 29.71 | 26.70 | 29.73 | 0.20 | 70 | 81 | 10500 | 5975 | 3088 | 131.83 |
| 1-HV-12-6 | 3/5 | 1545 | 13 | 2071 | 29.70 | 26.60 | 29.73 | 0.0 | 73 | 76 | 10500 | 5675 | 3039 | 123.21 |
| 1-HV-12-7 | 3/5 | 1645 | 15 | 2064 | 29.68 | 26.65 | 29.72 | 0.05 | 68 | 75 | 10650 | 5650 | 3089 | 124.68 |
| 1-HV-12-8 | 3/5 | 1745 | 1 | 2039 | 29.66 | 26.60 | 29.76 | 0.85 | 71 | 71 | 7200 | 5700 | 2159 | 87.92 |
| 2-HV-12-9 | 3/6 | 1015 | 1 | 2039 | 29.78 | 26.40 | 29.65 | 0.45 | 75 | 74 | 6850 | 5575 | 2068 | 82.35 |
| 2-HV-12-10 | 3/6 | 1115 | 3 | 1965 | 29.77 | 26.60 | 29.64 | 5.85 | 73 | 73 | 7250 | 5725 | 2840 | 116.16 |
| 2-HV-12-11 | 3/6 | 1215 | 5 | 1955 | 29.76 | 26.65 | 29.64 | 1.95 | 73 | 73 | 9900 | 5725 | 3270 | 133.76 |
| 2-HV-12-12 | 3/6 | 1316 | 19 | 2116 | 29.75 | 26.50 | 29.63 | 0.05 | 74 | 73 | 11850 | 5650 | 3372 | 136.12 |
| 3-HV-12-13 | 3/6 | 1415 | 9 | 2053 | 29.73 | 26.35 | 29.61 | 1.75 | 74 | 73 | 8350 | 5875 | 2635 | 110.60 |
| 3-HV-12-14 | 3/6 | 1515 | 20 | 2069 | 29.73 | 26.40 | 29.60 | 1.05 | 74 | 72 | 10150 | 5850 | 3078 | 128.65 |
| 3-HV-12-15 | 3/6 | 1616 | 13 | 2071 | 29.71 | 26.50 | 29.61 | 0.45 | 75 | 73 | 9100 | 5875 | 2685 | 112.68 |
| 3-HV-12-16 | 3/6 | 1715 | 15 | 2064 | 29.70 | 26.45 | 29.58 | 6.10 | 73 | 74 | 6900 | 5325 | 2627 | 99.94 |
| 4-HV-12-17 | 3/7 | 0915 | 1 | 2039 | 29.65 | 26.45 | 29.83 | 2.10 | 74 | 67 | 6850 | 5700 | 2145 | 87.34 |
| 4-HV-12-18 | 3/7 | 1015 | 3 | 1965 | 29.63 | 26.65 | 29.84 | 0.90 | 73 | 65 | 5900 | 4475 | 1805 | 57.71 |
| 4-HV-12-19 | 3/7 | 1115 | 5 | 1955 | 29.61 | 26.25 | 29.84 | 4.85 | 72 | 65 | 11200 | 5700 | 4133 | 168.30 |
| 4-HV-12-20 | 3/6 | 1215 | 19 | 2116 | 29.61 | 26.35 | 29.85 | 1.75 | 72 | 64 | 14000 | 5775 | 4145 | 170.99 |

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-HV-12-21 | 3/7 | 1316 | 9 | 2053 | 29.60 | 26.50 | 29.84 | 3.55 | 73 | 65 | 8600 | 5675 | 2817 | 114.21 |
| 5-HV-12-22 | 3/6 | 1415 | 20 | 2069 | 29.58 | 26.25 | 29.82 | 4.10 | 76 | 65 | 8200 | 5725 | 2757 | 112.78 |
| 5-HV-12-23 | 3/7 | 1517 | 13 | 2071 | 29.56 | 26.50 | 29.82 | 1.75 | 77 | 65 | 9000 | 5450 | 2708 | 105.42 |
| 5-HV-12-24 | 3/7 | 1615 | 15 | 2064 | 29.53 | 26.35 | 29.82 | 4.10 | 75 | 65 | 6850 | 5550 | 2295 | 90.98 |
| 5-HV-12-25 | 3/7 | 1658 | 6 | 2073 | 29.54 | 26.50 | 29.82 | 1.00 | 78 | 65 | 9800 | 5550 | 2857 | 113.28 |
| 6-HV-12-26 | 3/11 | 1415 | 1 | 2039 | 29.65 | 27.35 | 29.51 | 0.55 | 74 | 78 | 3650 | 4250 | 1076 | 32.67 |
| 6-HV-12-27 | 3/11 | 1445 | 3 | 1965 | 29.65 | 27.10 | 29.51 | 0.80 | 73 | 78 | 2300 | 4350 | 717 | 22.30 |
| 6-HV-12-28 | 3/11 | 1515 | 5 | 1955 | 29.62 | 26.75 | 29.50 | 0.20 | 75 | 78 | 3650 | 4350 | 1132 | 35.20 |
| 6-HV-12-29 | 3/11 | 1545 | 21 | 2080 | 29.62 | 26.60 | 29.53 | 7.50 | 77 | 78 | 4600 | 5175 | 1863 | 68.88 |
| 6-HV-12-30 | 3/11 | 1620 | 26 | 2055 | 29.61 | 26.65 | 29.53 | 0.70 | 74 | 78 | 2800 | 5200 | 844 | 31.36 |
| 6-HV-12-31 | 3/11 | 1645 | 20 | 2069 | 29.60 | 26.75 | 29.55 | 2.25 | 75 | 77 | 3450 | 5200 | 1090 | 40.51 |
| 6-HV-12-32 | 3/11 | 1715 | 8 | 2058 | 29.60 | 26.75 | 29.55 | 1.50 | 73 | 75 | 5150 | 5175 | 1582 | 58.48 |
| 6-HV-12-33 | 3/11 | 1745 | 15 | 2064 | 29.60 | 26.65 | 29.50 | 0.90 | 77 | 76 | 4750 | 5175 | 1431 | 52.90 |
| 7-HV-12-34 | 3/12 | 1023 | 1 | 2039 | 29.53 | 26.55 | 29.46 | 0.65 | 77 | 75 | 4750 | 4300 | 1435 | 44.10 |
| 7-HV-12-35 | 3/12 | 1117 | 3 | 1965 | 29.53 | 26.45 | 29.47 | 1.05 | 78 | 73 | 9000 | 4300 | 2866 | 88.04 |
| 7-HV-12-36 | 3/12 | 1215 | 5 | 1955 | 29.55 | 26.45 | 29.46 | 2.05 | 78 | 72 | 8550 | 4300 | 2846 | 87.44 |
| 7-HV-12-37 | 3/12 | 1316 | 19 | 2116 | 29.55 | 26.35 | 29.42 | 0.05 | 78 | 68 | 9500 | 4325 | 2689 | 83.09 |
| 8-HV-12 38 | 3/12 | 1430 | 22 | 2063 | 29.54 | 26.40 | 29.42 | 0.45 | 78 | 68 | 8150 | 5025 | 2398 | 86.09 |
| 8-HV-12-39 | 3/12 | 1516 | 20 | 2069 | 29.54 | 26.20 | 29.33 | 0.20 | 77 | 74 | 9550 | 5050 | 2842 | 102.54 |
| 8-HV-12-40 | 3/12 | 1615 | 8 | 2058 | 29.50 | 26.40 | 29.33 | 0.0 | 77 | 70 | 9600 | 5025 | 2801 | 100.55 |

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | FLASK NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8-HV-12-41 | 3/12 | 1745 | 15 | 2064 | 29.48 | 26.35 | 29.32 | 0.40 | 76 | 71 | 8150 | 5025 | 2417 | 86.77 |
| 9-HV-12-42 | 3/13 | 1047 | 1 | 2039 | 29.44 | 26.35 | 29.56 | 2.90 | 70 | 59 | 3750 | 3040 | 1202 | 26.11 |
| 9-HV-12-43 | 3/13 | 1132 | 3 | 1965 | 29.43 | 26.25 | 29.59 | 3.30 | 68 | 58 | 5500 | 5000 | 1863 | 66.57 |
| 9-HV-12 44 | 3/13 | 1219 | 5 | 1955 | 29.41 | 26.35 | 29.63 | 3.60 | 70 | 59 | 9750 | 5825 | 3347 | 139.28 |
| 9-HV-12-45 | 3/13 | 1317 | 19 | 2116 | 29.39 | 26.30 | 29.65 | 2.25 | 73 | 59 | 11000 | 5825 | 3291 | 136.96 |
| 10HV-12-46 | 3/13 | 1530 | 22 | 2063 | 29.32 | 26.30 | 29.70 | 2.65 | 73 | 59 | 7200 | 5975 | 2236 | 95.45 |
| 10HV-12-47 | 3/13 | 1632 | 20 | 2069 | 29.32 | 26.35 | 29.70 | 1.35 | 77 | 59 | 5550 | 6075 | 1626 | 70.58 |
| 10HV-12-48 | 3/13 | 1732 | 8 | 2058 | 29.35 | 26.30 | 29.70 | 2.25 | 70 | 59 | 9350 | 6150 | 2869 | 126.05 |
| 10HV-12-49 | 3/13 | 1847 | 15 | 2064 | 29.26 | 26.25 | 29.70 | 1.85 | 72 | 60 | 10450 | 6050 | 3146 | 135.97 |
| 11HV-12-50 | 3/14 | 0747 | 1 | 2039 | 29.59 | 26.45 | 29.79 | 0.65 | 60 | 51 | 11000 | 5475 | 3150 | 123.19 |
| 11HV-12-51 | 3/14 | 0847 | 3 | 1965 | 29.62 | 26.50 | 29.79 | 0.75 | 60 | 51 | 9500 | 5475 | 2833 | 110.79 |
| 11HV-12-52 | 3/14 | 0947 | 5 | 1955 | 29.63 | 26.70 | 29.79 | 0.35 | 60 | 54 | 13150 | 5475 | 3879 | 151.73 |
| 11HV-12-53 | 3/14 | 1047 | 19 | 2116 | 29.66 | 29.65 | 29.79 | 1.35 | 59 | 54 | 9550 | 5475 | 2428 | 94.96 |
| 1-HV-13-01 | 3/5 | 1258 | 2 | 2035 | 29.75 | 26.40 | 29.76 | 0.05 | 73 | 71 | 355 | 4675 | 104 | 3.49 |
| 1-HV-13-02 | 3/5 | 1318 | 4 | 2041 | 29.75 | 26.65 | 29.76 | 1.50 | 75 | 70 | 380 | 4675 | 116 | 3.89 |
| 1-HV-13-03 | 3/5 | 1350 | 23 | 1984 | 29.74 | 26.50 | 29.77 | 0.05 | 73 | 70 | 450 | 4950 | 135 | 4.78 |
| 1-HV-13-04 | 3/5 | 1420 | 21 | 2080 | 29.72 | 26.55 | 29.78 | 0.0 | 75 | 73 | 237 | 4955 | 67 | 2.40 |
| 1-HV-13-05 | 3/5 | 1454 | 24 | 2053 | 29.71 | 26.20 | 29.77 | 1.25 | 75 | 73 | 265 | 4925 | 81 | 2.88 |
| 1-HV-13-06 | 3/5 | 1520 | 25 | 2076 | 29.71 | 26.55 | 29.73 | 0.45 | 73 | 73 | 244 | 4950 | 71 | 2.52 |
| 1-HV-13-07 | 3/5 | 1550 | 14 | 2124 | 29.70 | 26.55 | 29.72 | 1.20 | 73 | 74 | 295 | 4650 | 87 | 2.89 |

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-HV-13-08 | 3/5 | 1650 | 16 | 2071 | 29.68 | 26.55 | 29.72 | 1.40 | 70 | 74 | 470 | 4625 | 143 | 4.74 |
| 1-HV-13-09 | 3/5 | 1750 | 18 | 2078 | 29.66 | 26.60 | 29.70 | 2.00 | 71 | 74 | 506 | 4650 | 157 | 5.22 |
| 2-HV-13-10 | 3/6 | 1021 | 2 | 2035 | 29.78 | 26.65 | 29.65 | 0.65 | 73 | 73 | 336 | 4520 | 101 | 3.27 |
| 2-HV-13-11 | 3/6 | 1120 | 4 | 2041 | 29.77 | 26.65 | 29.64 | 0.10 | 73 | 73 | 167 | 4675 | 49 | 1.64 |
| 2-HV-13-12 | 3/6 | 1220 | 23 | 1984 | 29.76 | 26.55 | 29.63 | 1.45 | 72 | 73 | 280 | 4700 | 89 | 3.01 |
| 2-HV-13-13 | 3/6 | 1320 | 21 | 2080 | 29.75 | 26.45 | 29.61 | 5.75 | 74 | 72 | 354 | 4580 | 131 | 4.29 |
| 3-HV-13-14 | 3/6 | 1420 | 24 | 2053 | 29.73 | 26.40 | 29.61 | 0.50 | 74 | 72 | 540 | 4835 | 161 | 5.58 |
| 3-HV-13-15 | 3/6 | 1520 | 25 | 2076 | 29.73 | 26.50 | 29.61 | 4.55 | 74 | 73 | 235 | 4815 | 82 | 2.83 |
| 3-HV-13-16 | 3/6 | 1621 | 14 | 2124 | 29.71 | 26.40 | 29.60 | 1.45 | 75 | 73 | 330 | 4840 | 99 | 3.43 |
| 4-HV-13-17 | 3/7 | 0921 | 2 | 2035 | 29.65 | 26.50 | 29.84 | 1.45 | 73 | 64 | 118 | 4685 | 35 | 1.20 |
| 4-HV-13-18 | 3/7 | 1021 | 4 | 2041 | 29.63 | 26.45 | 29.84 | 0.35 | 73 | 64 | 103 | 3480 | 29 | 0.74 |
| 4-HV-13-19 | 3/7 | 1121 | 23 | 1984 | 29.61 | 26.55 | 29.84 | 0.65 | 72 | 65 | 466 | 4690 | 140 | 4.70 |
| 4-HV-13-20 | 3/7 | 1220 | 21 | 2080 | 29.61 | 26.50 | 29.84 | 1.75 | 72 | 65 | 522 | 4765 | 156 | 5.33 |
| 5-HV-13-21 | 3/7 | 1320 | 24 | 2053 | 29.60 | 26.45 | 29.84 | 0.90 | 73 | 65 | 200 | 4655 | 58 | 1.96 |
| 5-HV-13-22 | 3/7 | 1420 | 25 | 2076 | 29.58 | 26.40 | 29.83 | 2.25 | 76 | 65 | 265 | 4630 | 81 | 2.70 |
| 5-HV-13-23 | 3/7 | 1524 | 14 | 2124 | 29.56 | 26.45 | 29.82 | 2.15 | 77 | 65 | 208 | 4430 | 62 | 1.97 |
| 5-HV-13-24 | 3/7 | 1620 | 16 | 2071 | 29.53 | 26.50 | 29.82 | 2.60 | 75 | 65 | 420 | 4530 | 130 | 4.23 |
| 5-HV-13-25 | 3/7 | 1654 | 18 | 2078 | 29.54 | 26.45 | 29.82 | 3.70 | 77 | 65 | 290 | 4530 | 94 | 3.05 |
| 6-HV-13-26 | 3/11 | 1420 | 2 | 2035 | 29.65 | 27.00 | 29.51 | 0.50 | 74 | 77 | 135 | 3265 | 40 | 0.94 |
| 6-HV-13-27 | 3/11 | 1450 | 4 | 2041 | 29.65 | 26.85 | 29.51 | 0.25 | 73 | 77 | 30 | 3320 | 8 | 0.21 |

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-HV-13-28 | 3/11 | 1520 | 23 | 1984 | 29.62 | 26.65 | 29.53 | 0.0 | 75 | 78 | 38 | 3320 | 11 | 0.27 |
| 6-HV-13-29 | 3/11 | 1521 | 19 | 2116 | 29.62 | 26.70 | 29.53 | 0.0 | 77 | 78 | 340 | 3320 | 96 | 2.29 |
| 6-HV-13-30 | 3/11 | 1620 | 9 | 2053 | 29.61 | 26.65 | 29.55 | 3.80 | 73 | 79 | 122 | 4175 | 41 | 1.25 |
| 6-HV-13-31 | 3/11 | 1645 | 25 | 2076 | 29.61 | 26.70 | 29.55 | 4.50 | 75 | 77 | 68 | 4175 | 23 | 0.71 |
| 6-HV-13-32 | 3/11 | 1721 | 14 | 2124 | 29.60 | 26.60 | 29.54 | 1.60 | 75 | 76 | 78 | 4150 | 23 | 0.70 |
| 6-HV-13-33 | 3/11 | 1750 | 16 | 2071 | 29.60 | 26.60 | 29.50 | 0.50 | 75 | 77 | 90 | 4150 | 26 | 0.79 |
| 7-HV-13-34 | 3/12 | 1028 | 2 | 2035 | 29.53 | 26.45 | 29.47 | 0.45 | 77 | 76 | 180 | 3275 | 54 | 1.27 |
| 7-HV-13-35 | 3/12 | 1120 | 4 | 2041 | 29.53 | 26.50 | 29.47 | 0.65 | 78 | 73 | 165 | 3275 | 49 | 1.16 |
| 7-HV-13-36 | 3/12 | 1220 | 23 | 1984 | 29.55 | 26.50 | 29.46 | 0.75 | 78 | 71 | 210 | 3280 | 65 | 1.53 |
| 8-HV-13-38 | 3/12 | 1430 | 26 | 2055 | 29.55 | 26.45 | 29.41 | 0.40 | 78 | 71 | 158 | 4030 | 46 | 1.35 |
| 8-HV-13-39 | 3/12 | 1520 | 25 | 2076 | 29.54 | 26.55 | 29.33 | 1.60 | 77 | 75 | 159 | 4030 | 49 | 1.42 |
| 8-HV-13-40 | 3/12 | 1620 | 14 | 2124 | 29.50 | 26.45 | 29.35 | 1.05 | 77 | 70 | 295 | 4005 | 86 | 2.48 |
| 6-HV-13-41 | 3/12 | 1720 | 16 | 2071 | 29.48 | 26.40 | 29.33 | 0.05 | 76 | 70 | 351 | 4005 | 101 | 2.92 |
| 9-HV-13-42 | 3/13 | 1049 | 2 | 2035 | 29.44 | 26.40 | 29.59 | 1.60 | 70 | 59 | 140 | 2010 | 42 | 0.61 |
| 9-HV-13-43 | 3/13 | 1135 | 4 | 2041 | 29.43 | 26.30 | 29.59 | 3.00 | 68 | 59 | 114 | 4140 | 36 | 1.09 |
| 9-HV-13-44 | 3/13 | 1200 | 23 | 1984 | 29.41 | 26.55 | 29.62 | 1.85 | 68 | 59 | 206 | 4760 | 64 | 2.19 |
| 9-HV-13-45 | 3/13 | 1325 | 6 | 2073 | 29.39 | 26.35 | 29.65 | 3.25 | 73 | 59 | 354 | 4770 | 112 | 3.83 |
| 10HV-13-46 | 3/13 | 1535 | 26 | 2055 | 29.33 | 26.30 | 29.70 | 1.45 | 73 | 61 | 197 | 4975 | 58 | 2.09 |
| 10HV-13-47 | 3/13 | 1635 | 25 | 2076 | 29.32 | 26.30 | 29.60 | 3.40 | 69 | 61 | 316 | 5050 | 101 | 3.67 |
| 10HV-13-48 | 3/13 | 1735 | 14 | 2124 | 29.35 | 26.25 | 29.70 | 1.85 | 70 | 60 | 158 | 5125 | 46 | 1.70 |

## OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10HV-13-49 | 3/13 | 1850 | 16 | 2071 | 29.26 | 26.20 | 29.70 | 1.75 | 72 | 60 | 308 | 5025 | 92 | 3.31 |
| 11HV-13-50 | 3/14 | 0750 | 2 | 2035 | 29.59 | 26.50 | 29.79 | 1.85 | 60 | 51 | 225 | 4455 | 67 | 2.15 |
| 11HV-13-51 | 3/14 | 0850 | 4 | 2041 | 29.62 | 26.55 | 29.79 | 4.10 | 60 | 51 | 281 | 4455 | 92 | 2.94 |
| 11HV-13-52 | 3/14 | 0951 | 23 | 1984 | 29.63 | 26.70 | 29.79 | 2.95 | 60 | 54 | 634 | 4430 | 204 | 6.46 |
| 11HV-13-53 | 3/14 | 1050 | 6 | 2073 | 29.66 | 26.50 | 29.79 | 0.20 | 59 | 54 | 820 | 4455 | 228 | 7.28 |
| 9-HV-23-01 | 3/13 | 1045 | 27 | 2092 | 29.44 | 26.20 | 29.56 | 0.75 | 70 | 59 | 7150 | 3040 | 2059 | 44.72 |
| 9-HV-23-02 | 3/13 | 1130 | 2 | 2035 | 29.43 | 26.40 | 29.59 | 1.90 | 68 | 59 | 5150 | 5000 | 1582 | 56.52 |
| 9-HV-23-03 | 3/13 | 1217 | 28 | 2064 | 29.41 | 26.45 | 29.63 | 2.20 | 70 | 59 | 10250 | 5825 | 3127 | 130.13 |
| 9-HV-23-04 | 3/13 | 1315 | 29 | 2089 | 29.39 | 26.35 | 29.63 | 1.10 | 73 | 59 | 13150 | 5825 | 3802 | 158.23 |
| 10HV-23-05 | 3/13 | 1530 | 10 | 2050 | 29.32 | 26.25 | 29.70 | 1.90 | 73 | 59 | 8250 | 5975 | 2506 | 106.96 |
| 10HV-23-06 | 3/13 | 1630 | 11 | 2052 | 29.32 | 26.35 | 29.70 | 0.90 | 73 | 59 | 10150 | 6075 | 2949 | 128.00 |
| 10HV-23-07 | 3/13 | 1730 | 12 | 2067 | 29.36 | 26.40 | 29.70 | 1.05 | 70 | 58 | 12000 | 6150 | 3475 | 152.67 |
| 10HV-23-08 | 3/13 | 1845 | 17 | 2073 | 29.26 | 26.20 | 29.70 | 1.05 | 72 | 58 | 11650 | 6050 | 3375 | 145.87 |
| 11HV-23-09 | 3/14 | 0745 | 27 | 2092 | 29.59 | 26.45 | 29.79 | 0.45 | 60 | 51 | 11000 | 5475 | 3045 | 119.12 |
| 11HV-23-10 | 3/14 | 0845 | 4 | 2041 | 29.62 | 26.35 | 29.79 | 3.20 | 60 | 51 | 11500 | 5475 | 3666 | 143.40 |
| 11HV-23-11 | 3/14 | 0945 | 28 | 2064 | 29.63 | 26.50 | 29.79 | 4.00 | 60 | 54 | 7750 | 5475 | 2531 | 98.99 |
| 11HV-23-12 | 3/14 | 1045 | 7 | 2099 | 29.66 | 26.60 | 29.79 | 0.40 | 59 | 55 | 10250 | 5475 | 2840 | 111.07 |
| CAL GAS 1 | 3/6 | | 6 | 2073 | 29.76 | 26.75 | 29.53 | 8.78 | 75 | 74 | 6250 | 1 | 2700 | 0.02 |
| CAL GAS 2 | 3/6 | | 7 | 2099 | 29.76 | 26.65 | 29.80 | 2.85 | 75 | 66 | 13350 | 1 | 4167 | 0.03 |
| CAL GAS 3 | 3/6 | | 8 | 2058 | 29.76 | 26.50 | 29.80 | 2.35 | 63 | 68 | 12750 | 1 | 4030 | 0.03 |

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

| RUN ID | DATE | TIME | NO. | FLASK VOL ML | PRESSURES -- IN.HG INL BARO | FLASK VAC | FNL BARO | FNL FLAS | TEMP F INL | FNL | N MASS UG | FLOW RATE SCFM | NOX PPM | NOX RATE LB/HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAL GAS 4 | 3/7 | | 10 | 2050 | 29.76 | 26.60 | 29.80 | 0.0 | 74 | 68 | 142 | 1 | 40 | 0.00 |
| CAL GAS 5 | 3/7 | | 11 | 2052 | 29.75 | 26.65 | 29.80 | 0.0 | 74 | 68 | 138 | 1 | 39 | 0.00 |
| CAL GAS 6 | 3/7 | | 12 | 2067 | 29.75 | 26.60 | 29.80 | 1.60 | 74 | 68 | 142 | 1 | 43 | 0.00 |

# APPENDIX C

## EPA REFERENCE METHOD NO. 7

tilled water and add these washings to the same storage container.

4.3 Sample analysis. Transfer the contents of the storage container to a 50 ml. volumetric flask. Dilute to the mark with deionized, distilled water. Pipette a 10 ml aliquot of this solution into a 125 ml. Erlenmeyer flask. Add 40 ml. of isopropanol and two to four drops of thorin indicator. Titrate to a pink endpoint using 0.01 *N* barium perchlorate. Run a blank with each series of samples.

5. *Calibration.*

5.1 Use standard methods and equipment which have been approved by the Administrator to calibrate the rotameter, pitot tube, dry gas meter, and probe heater.

5.2 Standardize the barium perchlorate against 25 ml. of standard sulfuric acid containing 100 ml. of isopropanol.

6. *Calculations.*

6.1 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (70° F. and 29.92 inches Hg) by using equation 6-1.

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right) = 17.71 \frac{°R}{in.\ Hg}\left(\frac{V_m P_{bar}}{T_m}\right) \quad \text{equation 6-1}$$

where:

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

$V_m$ = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

$T_{std}$ = Absolute temperature at standard conditions, 530° R.

$T_m$ = Average dry gas meter temperature, °R.

$P_{bar}$ = Barometric pressure at the orifice meter, inches Hg.

$P_{std}$ = Absolute pressure at standard conditions, 29.92 inches Hg.

6.2 Sulfur dioxide concentration.

$$C_{SO_2} = \left(7.05\times10^{-5}\frac{lb.-l.}{g.-ml.}\right)\frac{(V_t - V_{tb})N\left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}} \quad \text{equation 6-2}$$

where:

$C_{SO_2}$ = Concentration of sulfur dioxide at standard conditions, dry basis, lb./cu. ft.

$7.05\times10^{-5}$ = Conversion factor, including the number of grams per gram equivalent of sulfur dioxide (32 g./g.-eq.), 453.6 g./lb., and 1,000 ml./l., lb.-l./g.-ml.

$V_t$ = Volume of barium perchlorate titrant used for the sample, ml.

$V_{tb}$ = Volume of barium perchlorate titrant used for the blank, ml.

$N$ = Normality of barium perchlorate titrant, g.-eq./l.

$V_{soln}$ = Total solution volume of sulfur dioxide, 50 ml.

$V_a$ = Volume of sample aliquot titrated, ml.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft., see Equation 6-1.

7. *References.*

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METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measure colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable for the measurement of nitrogen oxides from stationary sources only when specified by the test procedures for determining compliance with New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 7-1.

2.1.1 Probe—Pyrex[1] glass, heated, with filter to remove particulate matter. Heating is unnecessary if the probe remains dry during the purging period.

2.1.2 Collection flask—Two-liter, Pyrex,[1] round bottom with short neck and 24/40 standard taper opening, protected against implosion or breakage.

2.1.3 Flask valve—T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature gauge—Dial-type thermometer, or equivalent, capable of measuring 2° F. intervals from 25° to 125° F.

2.1.5 Vacuum line—Tubing capable of withstanding a vacuum of 3 inches Hg absolute pressure, with "T" connection and T-bore stopcock, or equivalent.

2.1.6 Pressure gauge—U-tube manometer, 36 inches, with 0.1-inch divisions, or equivalent.

[1] Trade name.

valve to its "vent" position and turn off the pump. Check the manometer for any fluctuation in the mercury level. If there is a visible change over the span of one minute, check for leaks. Record the initial volume, temperature, and barometric pressure. Turn the flask valve to its "purge" position, and then do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and flask valve area, heat the probe and purge until the condensation disappears. Then turn the pump valve to its "vent" position. Turn the flask valve to its "sample" position and allow sample to enter the flask for about 15 seconds. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for 5 minutes.

4.2 Sample recovery.

4.2.1 Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer, open the valve from the flask to the manometer, and record the flask pressure and temperature along with the barometric pressure. Transfer the flask contents to a container for shipment or to a 250 ml. beaker for analysis. Rinse the flask with two portions of distilled water (approximately 10 ml.) and add rinse water to the sample. For a blank use 25 ml. of absorbing solution and the same volume of distilled water as used in rinsing the flask. Prior to shipping or analysis, add sodium hydroxide (1*N*) dropwise into both the sample and the blank until alkaline to litmus paper (about 25 to 35 drops in each).

4.3 Analysis.

4.3.1 If the sample has been shipped in a container, transfer the contents to a 250 ml. beaker using a small amount of distilled water. Evaporate the solution to dryness on a steam bath and then cool. Add 2 ml. phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a glass rod. Make sure the solution contacts all the residue. Add 1 ml. distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Cool, add 20 ml. distilled water, mix well by stirring, and add concentrated ammonium hydroxide dropwise with constant stirring until alkaline to litmus paper. Transfer the solution to a 100 ml. volumetric flask and wash the beaker three times with 4 to 5 ml. portions of distilled water. Dilute to the mark and mix thoroughly. If the sample contains solids, transfer a portion of the solution to a clean, dry centrifuge tube, and centrifuge, or filter a portion of the solution. Measure the absorbance of each sample at 420 nm. using the blank solution as a zero. Dilute the sample and the blank with a suitable amount of distilled water if absorbance falls outside the range of calibration.

5. *Calibration.*

5.1 Flask volume. Assemble the flask and flask valve and fill with water to the stopcock. Measure the volume of water to ±10 ml. Number and record the volume on the flask.

5.2 Spectrophotometer. Add 0.0 to 16.0 ml. of standard solution to a series of beakers. To each beaker add 25 ml. of absorbing solution and add sodium hydroxide (1*N*) dropwise until alkaline to litmus paper (about 25 to 35 drops). Follow the analysis procedure of section 4.3 to collect enough data to draw a calibration curve of concentration in µg. $NO_2$ per sample versus absorbance.

6. *Calculations.*

6.1 Sample volume.

$$V_{sc}=\frac{T_{std}(V_f-V_a)}{P_{std}}\left(\frac{P_f}{T_f}-\frac{P_i}{T_i}\right)=\left(17.71\,\frac{°R}{\text{in. Hg}}\right)(V_f-25\text{ ml.})\left(\frac{P_f}{T_f}-\frac{P_i}{T_i}\right)\quad\text{Equation 7-1}$$

where:

$V_{sc}$ = Sample volume at standard conditions (dry basis), ml.

$T_{std}$ = Absolute temperature at standard conditions, 530° R.

$P_{std}$ = Pressure at standard conditions, 29.92 inches Hg.

$V_f$ = Volume of flask and valve, ml.

$V_a$ = Volume of absorbing solution, 25 ml.

$P_f$ = Final absolute pressure of flask, inches Hg.

$P_i$ = Initial absolute pressure of flask, inches Hg.

$T_f$ = Final absolute temperature of flask, °R.

$T_i$ = Initial absolute temperature of flask, °R.

6.2 Sample concentration. Read µg. $NO_2$ for each sample from the plot of µg. $NO_2$ versus absorbance.

$$C=\left(\frac{m}{V_{sc}}\right)\left(\frac{\frac{1\text{ lb.}}{\text{cu. ft.}}}{1.6\times10^{8}\frac{\mu g.}{\text{ml.}}}\right)=\left(6.2\times10^{-5}\frac{\text{lb./s.c.f.}}{\mu g./\text{ml.}}\right)\left(\frac{m}{V_{sc}}\right)\quad\text{equation 7-2}$$

where:

C = Concentration of $NO_x$ as $NO_2$ (dry basis), lb./s.c.f.

m = Mass of $NO_2$ in gas sample, µg.

$V_{sc}$ = Sample volume at standard conditions (dry basis), ml.

7. *References.*

Standard Methods of Chemical Analysis. 6th ed. New York, D. Van Nostrand Co., Inc., 1962, vol. 1, p. 329–330.

Standard Method of Test for Oxides of Nitrogen in Gaseous Combustion Products

2.1.7 Pump—Capable of producing a vacuum of 3 inches Hg absolute pressure.
2.1.8 Squeeze bulb—One way.
2.2 Sample recovery.
2.2.1 Pipette or dropper.
2.2.2 Glass storage containers—Cushioned for shipping.

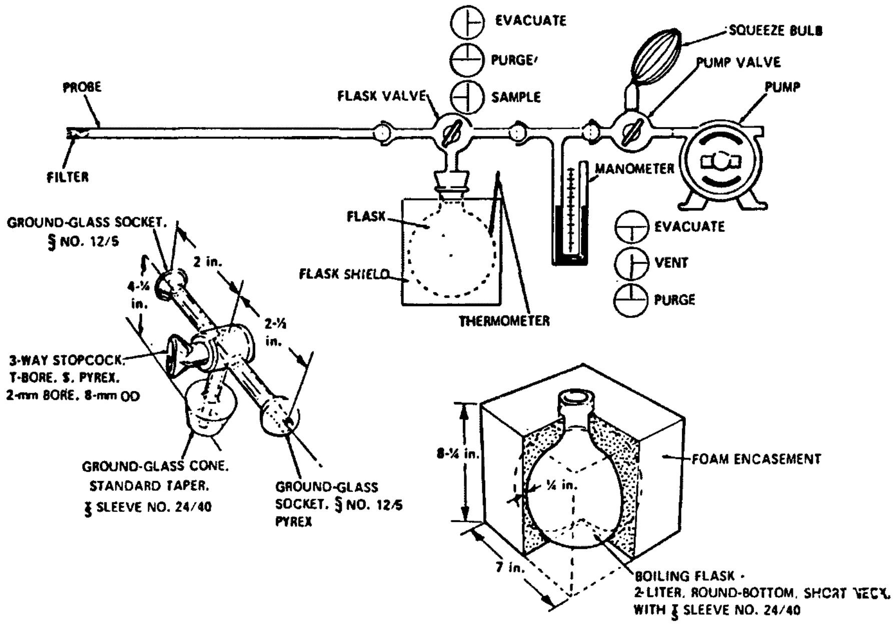


Figure 7-1. Sampling train, flask valve, and flask.

2.2.3. Glass wash bottle.
2.3 Analysis.
2.3.1 Steam bath.
2.3.2 Beakers or casseroles—250 ml., one for each sample and standard (blank).
2.3.3 Volumetric pipettes—1, 2, and 10 ml.
2.3.4 Transfer pipette—10 ml. with 0.1 ml. divisions.
2.3.5 Volumetric flask—100 ml., one for each sample, and 1,000 ml. for the standard (blank).
2.3.6 Spectrophotometer—To measure absorbance at 420 nm.
2.3.7 Graduated cylinder—100 ml. with 1.0 ml. divisions.
2.3.8 Analytical balance—To measure to 0.1 mg.
3. *Reagents.*
3.1 Sampling.
3.1.1 Absorbing solution—Add 2.8 ml. of concentrated $H_2SO_4$ to 1 liter of distilled water. Mix well and add 6 ml. of 3 percent hydrogen peroxide. Prepare a fresh solution weekly and do not expose to extreme heat or direct sunlight.
3.2 Sample recovery.
3.2.1 Sodium hydroxide (1*N*)—Dissolve 40 g. NaOH in distilled water and dilute to 1 liter.
3.2.2 Red litmus paper.
3.2.3 Water—Deionized, distilled.
3.3 Analysis.
3.3.1 Fuming sulfuric acid—15 to 18% by weight free sulfur trioxide.
3.3.2 Phenol—White solid reagent grade.
3.3.3 Sulfuric acid—Concentrated reagent grade.
3.3.4 Standard solution—Dissolve 0.5495 g. potassium nitrate ($KNO_3$) in distilled water and dilute to 1 liter. For the working standard solution, dilute 10 ml. of the resulting solution to 100 ml. with distilled water. One ml. of the working standard solution is equivalent to 25 μg. nitrogen dioxide.
3.3.5 Water—Deionized, distilled.
3.3.6 Phenoldisulfonic acid solution—Dissolve 25 g. of pure white phenol in 150 ml. concentrated sulfuric acid on a steam bath. Cool, add 75 ml. fuming sulfuric acid, and heat at 100° C. for 2 hours. Store in a dark, stoppered bottle.
4. *Procedure.*
4.1 Sampling.
4.1.1 Pipette 25 ml. of absorbing solution into a sample flask. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to at least 3 inches Hg absolute pressure. Turn the pump

(Phenoldisulfonic Acid Procedure), In: 1968 Book of ASTM Standards, Part 23, Philadelphia, Pa. 1968, ASTM Designation D-1608-60, p. 725-729.

Jacob, M. B., The Chemical Analysis of Air Pollutants, New York, N.Y., Interscience Publishers, Inc., 1960, vol. 10, p. 351-356.

METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A gas sample is extracted from a sampling point in the stack and the acid mist including sulfur trioxide is separated from sulfur dioxide. Both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable to determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources only when specified by the test procedures for determining compliance with the New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 8-1. Many of the design specifications of this sampling train are described in APTD-0581.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex[1] glass with a heating system to prevent visible condensation during sampling.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter holder—Pyrex[1] glass.

2.1.5 Impingers—Four as shown in Figure 8-1. The first and third are of the Greenburg-Smith design with standard tip. The second and fourth are of the Greenburg-Smith design, modified by replacing the standard tip with a ½-inch ID glass tube extending to one-half inch from the bottom of the impinger flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5° F., dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inch Hg.

[1] Trade name.

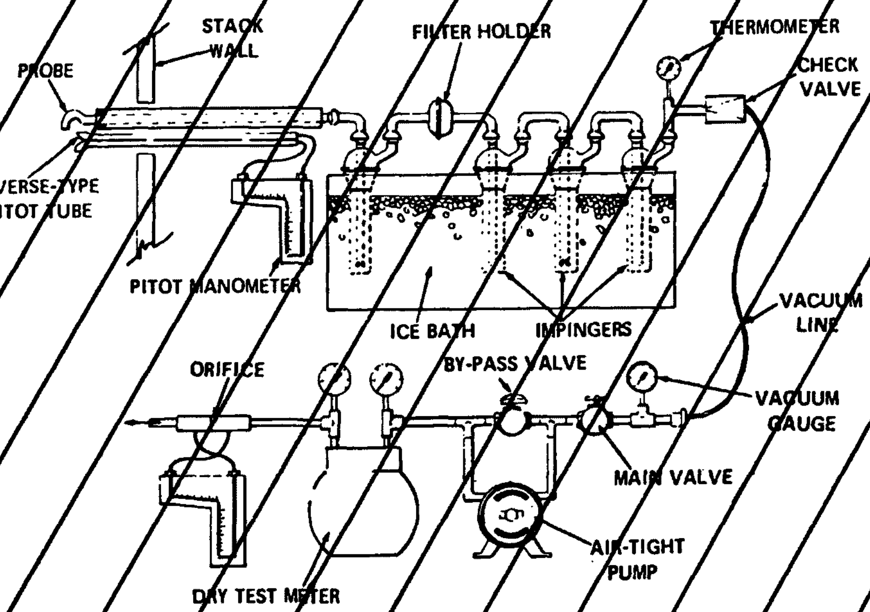


Figure 8-1. Sulfuric acid mist sampling train.

# APPENDIX D

## FIELD DATA LOG FOR DUPONT 411 PHOTOMETRIC ANALYZER

## $NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75 Zero Gas <0.1ppm Cylinder Pressure 1500

Instrument Ser. No. 0142 Zero Gas 3980 ppm $NO_2$ Cylinder Pressure 700

Location Hercules, Bessemer Ala Inlet Oxygen ____ Cylinder Pressure 2500

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1230 | $E_1$ | 220 | C 1000 F 500 | | | | | Test 50 |
| | $E_2$ | " | " | | | | | Test 45 |
| | Might | " | " | | | | | Test 12 |
| | Rlight | " | " | | | | | |
| | Mdark | " | " | | | | | |
| | Rdark | " | " | | | | | |
| | M-R | 250 | C 834 F 500 | | 025 | | | |
| 1500 | Zero | 222 | C 850 F 500 | 400 | 000 | | | |
| 1505 | 3980 ppm Span | " | " | 400 | 3960 to 4000 | | | cell temp 115° F |
| 1715 | Zero | " | C 850 F 502 | 400 | | | | adjust fine zero |
| | 3980 Span | " | " | 400 | 3980 | 79.5 | | adjust recorder span |
| 1730 | Sample | " | " | 400 | 500 | | | Leave on overnight |
| C | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75 | Zero Gas < 0.1 ppm $NO_x$ | Cylinder Pressure 1500

Instrument Ser. No. 0142 | Span ~~Zero~~ Gas 3980 ppm $NO_2$ | Cylinder Pressure 690

Location Hercules Bessemer Ala Inlet | Oxygen 2 | Cylinder Pressure 2300

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0830 | Sample | 222 | C 850 F 502 | 200 | 2700 | | | Analyzer Operated During Night |
| 0845 | Zero | " | " | 500 | 140 | | | |
| 0855 | Zero | " | C 850 F484 | 500 | 000 | | | adjust fine zero |
| 0905 | Span | " | " | 500 | 4000 | 80 | | cell temp 113 °C |
| 0915 | Sample | " | " | 400 | Aprox 1700 | | | 5000 ppm full scale |
| 0945 | NOx | " | " | 0 | 1900 | | | |
| 0950 | Sample | " | " | 400 | | | | PDS NOx Sample. Water in line |
| 1000 | No Sample | " | " | 0 | | | | Change sample. shut off flow line, dry trap |
| 1115 | Zero | " | " | 400 ~~018~~ | -018 | | | |
| 1125 | Zero | " | C 850 F 512 | | | | | |
| 1135 | | " | " | 0 | | | | Plant Shut Down |
| 1215 | Zero | " | " | 400 | +060 | | | |
| 1225 | Zero | " | C 850 F515 | 400 | 000 | 20 | | adjust zero |
| 1226 | Sample | " | " | 400 | approx 1600 | | | change range From 20 mv to 50 mv |
| 1245 | NOx | " | " | 0 | 1850 | | | cell temp 116 °F |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75 Zero Gas 500 ppm NOx Cylinder Pressure 1500

Instrument Ser. No. C142 ~~Zero~~ Span Gas 3980 ppm $NO_2$ Cylinder Pressure 700

Location Hercules Bessemer Ala ~~Sample~~ Inlet Oxygen ______ Cylinder Pressure 2300

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1255 | Sample | 222 | C 350<br>F 515 | 400 | 1400 to 1300 | | | |
| 1315 | NOx | " | " | 0 | 1940 | | | PDS Sample 1315 |
| 1320 | Sample | " | " | 400 | 1300 | | | |
| 1330 | NOx | " | " | 0 | 1970 | | | |
| 1335 | Sample | " | " | 400 | 1340 | | | |
| 1345 | NOx | " | " | 0 | 2030 | | | PDS Sample 1345<br>cell temp 118°F |
| 1350 | Sample | " | " | 400 | 1350 | | | |
| 1400 | NOx | " | " | 0 | 2010 | | | |
| 1405 | Sample | " | " | 400 | 1340 | | | sieve on B 1412 |
| 1415 | NOx | " | " | 0 | 2100 | | | PDS Sample 1415 |
| 1420 | Sample | " | " | 400 | 1340 | | | |
| 1430 | NOx | " | " | 0 | 2050 | | | |
| 1435 | Sample | " | " | 400 | 1290 | | | |
| 1445 | NOx | " | " | 0 | 1970 | | | PDS Sample 1445<br>cell temp 121°F |
| 1450 | Sample | " | " | 400 | 1350<br>1700 | | | |

# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75 Zero Gas ______ Cylinder Pressure ______

Instrument Ser. No. 0142 Zero Gas ______ Cylinder Pressure ______

Location Hercules, Bessemer Ala ~~Sample~~ Inlet Oxygen ______ Cylinder Pressure ______

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1500 | Zero | 222 | C850 F515 | 400 | -010 | 20 | | |
| 1504 | Zero ~~Sample~~ | // | C850 F517 | 400 | 000 | 20 | | adjust fine zero |
| 1505 | Sample ~~NOx~~ | // | // | 400 | 1740 | | | |
| 1508 | NOx | // | // | 0 | 2800 | | | |
| 1512 | Sample | // | // | 400 | 1650 | | | |
| 1516 | NOx | // | // | 0 | 2550 | | | PDS sample 1516 |
| 1520 | Sample | // | // | 400 | 1730 | | | |
| 1530 | NOx | // | // | 0 | 1660 | | | |
| 1535 | Sample | // | // | 400 | 1780 | | | |
| 1545 | NOx | // | // | 0 | 2590 | | | cell temp 121°F PDS Sample 1545 |
| 1550 | Sample | // | // | 400 | 1780 | | | |
| 1600 | NOx | // | // | 0 | 2680 | | | |
| 1605 | Sample | // | // | 400 | 1770 | | | |
| 1615 | NOx | // | // | 0 | 2610 | | | |
| 1620 | Sample | // | // | 400 | 1750 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1630 | NOx | 222 | C 850<br>F 517 | 0 | 2600 | | | |
| 1635 | Sample | " | " | 400 | 2000 | | | |
| 1645 | NOx | " | " | 0 | 2910 | | | PDS Sample 1645 cell temp 122°F |
| 1650 | Sample | " | " | 400 | 2000 to 1850 | | | |
| 1700 | NOx | " | " | 0 | 2750 | | | |
| 1707 | Sample | " | " | 400 | 1750 | | | |
| 1715 | NOx | " | " | 0 | 2610 | | | |
| 1720 | Sample | " | " | 400 | 1750 | | | |
| 1730 | NOx | " | " | 0 | 2620 | | | |
| 1735 | Sample | " | " | 400 | 1770 | | | |
| 1745 | NOx | " | " | 0 | 2680 | | | PDS Sample 1745 cell temp 120° F |
| 1752 | Sample | " | " | 400 | 1820 | | | |
| 1800 | NOx | " | " | 0 | 2650 | | | |
| 1805 | Zero | " | " | 600 | 000 | 20 | | |
| 1820 | 3980 ppm Span | " | " | 400 | 3960<br>4020 | 995 | | cell temp 118° F |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/5/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1830 | Sample | 222 | C 850<br>F 517 | | | | | |
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NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/6/75 — Zero Gas <0.1 ppm NO$_x$ — Cylinder Pressure 1475

Instrument Ser. No. 0142 — ~~Zero~~ Span Gas 3980 ppm NO$_2$ — Cylinder Pressure 675

Location Hercules, Bessemer Ala Inlet — Oxygen ______ — Cylinder Pressure 2350

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0825 | Sample | 222 | C850 F517 | 300 | 1380 | | | Instrument Operated During Night. Recorder ok |
| 0830 | Sample | // | // | // | 1380 | | | Cell Temp 115°F Set chart 0830 120mm/hr |
| 0833 | zero | // | // | 400 | 020 | 20.5% | | |
| 0837 | zero | // | C850 F513 | 400 | 000 | 20. | | adjust fine zero |
| 0850 | zero | // | // | 400 | 030 | | | |
| 0851 | zero | // | C850 F510 | 400 | 000 | 20 | | adjust fine zero |
| 0855 | 3980 ppm Span | // | // | 400 | 3950 | 98.5 | | |
| 0900 | // | // | // | 400 | 3950 | 99. | | adjust Recorder to 99 |
| 0903 | Sample | // | // | 400 | 1500 to 1680 | | | |
| 0915 | NOx | // | // | 0 | 2280 | | | |
| 0920 | Sample | // | // | 400 | 1590 | | | |
| 0930 | NOx | // | // | 0 | 2310 | | | |
| 0935 | Sample | // | // | 400 | 1680 | | | |
| 0945 | NOx | // | // | 0 | 2450 | | | |
| 0950 | Sample | // | // | 400 | 1750 to 1700 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1000 | NOx | 222 | C 850 F 510 | 0 | 2410 | | | |
| 1005 | Sample | " | " | 400 | 1750 to 1660 | | | |
| 1015 | NOx | " | " | 0 | 2430 | | | PDS Sample 1015 |
| 1020 | Sample | " | " | 400 | 1810 | | | |
| 1030 | NOx | " | " | 0 | 2700 | | | cell temp 117 °F |
| 1035 | Sample | " | " | 400 | 1910 to 1980 | | | |
| 1045 | NOx | " | " | 0 | 2760 | | | |
| 1050 | Sample | " | " | 400 | 2000 to 2180 | | | |
| 1100 | NOx | " | " | 0 | 3000 | | | |
| 1105 | Sample | " | " | 400 | 2120 to 2220 | | | |
| 1115 | NOx | " | " | 0 | 3190 | | | PDS Sample 1115 |
| 1120 | Sample | " | " | 400 | 2300 to 2310 | | | |
| 1130 | NOx | " | " | 0 | 3360 | | | |
| 1135 | Sample | " | " | 400 | 2400 to 2460 | | | |
| 1145 | NOx | " | " | 0 | 3400 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1150 | Sample | 222 | C850<br>F510 | 400 | 2410<br>2320 to | | | |
| 1200 | NOx | // | // | 0 | 3230 | | | |
| 1205 | Sample | // | // | 400 | 2230<br>2190 | | | |
| 1215 | NOx | // | // | 0 | 3120 | | | PDS Sample 1215 |
| 1220 | zero ~~Sample~~ | // | // | 400 | 000 | | | |
| 1225 | Sample | // | // | 400 | 2340<br>2370 to | | | |
| 1230 | NOx | // | // | 0 | 3370 | | | cell temp 119° F |
| 1235 | Sample | // | // | 400 | 2320<br>2300 to | | | |
| 1245 | NOx | // | // | 0 | 3300 | | | |
| 1250 | Sample | // | // | 400 | 2360<br>2280 to | | | |
| 1300 | NOx | // | // | 0 | 3330 | | | |
| 1305 | Sample | // | // | 400 | 2290<br>2390 to | | | |
| 1315 | NOx | // | // | 0 | 3440 | | | PDS Sample 1316 |
| 1320 | Sample | // | // | 400 | 2280<br>2150 to | | | |
| 1330 | NOx | // | // | 0 | 2975 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1335 | Sample | 222 | C 850 F 510 | 400 | 2120 to 2100 | | | |
| 1345 | NOx | " | " | 0 | 2920 | | | |
| 1350 | Sample | " | " | 400 | 2180 to 2230 | | | |
| 1400 | NOx | " | " | 0 | 3110 | | | |
| 1405 | Sample | " | " | 400 | 2150 to 2070 | | | |
| 1415 | NOx | " | " | 0 | 2870 | | | PDS Sample 1415 |
| 1420 | Sample | " | " | 400 | 2040 to 2000 | | | |
| 1430 | NOx | " | " | 0 | 2770 | | | cell temp 122°F |
| 1435 | Sample | " | " | 400 | 2000 | | | |
| 1445 | NOx | " | " | 0 | 2750 | | | |
| 1450 | Sample | " | " | 400 | 1970 to 2040 | | | |
| 1500 | NOx ~~Sample~~ | " | " | 0 | 2890 | | | |
| 1505 | Sample | " | " | 400 | 2200 to 2390 | | | |
| 1515 | NOx | " | " | 0 | 3270 | | | PDS Sample 1515 |
| 1520 | Sample | " | " | 400 | 2470 to 2550 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1530 | NOx | 222 | C850 F510 | 0 | 3460 | | | |
| 1535 | Sample | " | " | 400 | 2560 to 2470 | | | |
| 1545 | NOx | " | " | 0 | 3290 | | | |
| 1550 | Sample | " | " | 400 | 2500 to 2530 | | | |
| 1600 | NOx | " | " | 0 | 3370 | | | |
| 1605 | Sample | " | " | 400 | 2450 to 2440 | | | |
| 1616 | NOx | " | " | 0 | 3300 | | | PDS · Sample 1616 |
| 1620 | Sample | " | " | 400 | 2380 to 2290 | | | |
| 1632 | NOx | " | " | 0 | 3070 | | | |
| 1636 | Sample | " | " | 400 | 2250 to 2220 | | | |
| 1645 | NOx | " | " | 0 | 3000 | | | |
| 1650 | Sample | " | " | 400 | 2220 to 2180 | | | cell temp 125 °F |
| 1700 | NOx | " | " | 0 | 2940 | | | |
| 1706 | Sample | " | " | 400 | 2150 to 1770 | | | |
| 1715 | NOx | " | " | 0 | 2320 | | | PDS Sample 1715 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

Page 6 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1720 | Sample | 222 | C850 F510 | 400 | 1400 to 1460 | | | Upset condition |
| 1730 | NOx | " | " | 0 | 1770 | | | " |
| 1735 | Sample | " | " | 400 | 1275 to 0610 | | | " |
| 1745 | NOx | " | " | 0 | 1070 | | | " |
| 1750 | Sample | " | " | 400 | 1100 to 1420 | | | " |
| 1800 | NOx | " | " | 0 | 2120 | | | cell temp 122 |
| 18~~28~~ | zero ~~Sample~~ | " | " | 400 | -110 | 17.75 | | |
| 1836 | zero | " | C850 ~~F5~~ F524 | 400 | 000 | 20 | | adjust fine zero |
| 1843 | 3980 Span | " | " | 400 | 3950 | 99 | | cell temp 120°F |
| 1850 | Sample | " | " | 400 | | | | |
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NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/7/75 | Zero Gas <0.1 ppm NOx Cylinder Pressure 1450

Instrument Ser. No. 0142 | Span ~~Zero~~ Gas 3980 ppm NO$_2$ Cylinder Pressure 700

Location Hercules, Bessemer, Ala Inlet | ~~Oxygen~~ ______ Cylinder Pressure 2350

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0840 | Sample | 222 | C850 F524 | 550 | 1700 | | | Instrument Operated During Night, Recorder OK |
| 0850 | Zero | 〃 | 〃 | 400 | 060 | 21 + | | Increase Recorder Chart Speed to 120mm/hr |
| 0900 | Zero | 〃 | C850 F518 | 400 | 000 | 20 | | Adjust fine zero |
| 0903 | 3980 ppm Span | 〃 | 〃 | 400 | 4000 | 99.5 | | cell temp 116 °F |
| 0910 | Sample | 〃 | 〃 | 400 | 1670 | | | |
| 0915 | NOx | 〃 | 〃 | 0 | 2800 | | | PDS Sample 0915 |
| 0920 | Sample | 〃 | 〃 | 400 | 1550 1470 | | | |
| 0930 | NOx | 〃 | 〃 | 0 | 2440 | | | |
| 0935 | Sample | 〃 | 〃 | 400 | 1510 1550 | | | |
| 0945 | NOx | 〃 | 〃 | 0 | 2710 | | | |
| 0950 | Sample | 〃 | 〃 | 400 | 1630 1790 | | | |
| 1000 | NOx | 〃 | 〃 | 0 | 3020 | | | |
| 1005 | Sample | 〃 | 〃 | 400 | 1600 to 1110 | | | |
| 1015 | NOx | 〃 | 〃 | 0 | 1620 | | | PDS Sample 1015 |
| 1020 | Sample | 〃 | 〃 | 400 | 1220 to 940 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/7/75

Page 2 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1030 | NOx | 222 | C 850<br>F 518 | 0 | 1360 | | | |
| 1035 | Sample | // | // | 400 | 1500<br>2080 | | | |
| 1045 | NOx | // | // | 0 | 3900 | | | |
| 1051 | Sample | // | // | 400 | 2210<br>2240 | | | |
| 1100 | NOx | // | // | 0 | 4060 | | | attenuate to 100mv range on recorder for NOx reading |
| 1106 | Sample | // | // | 400 | 2290 to<br>2310 | | | place recorder back on ~~mv~~ 50mv range |
| 1115 | NOx | // | // | 0 | 4150 | | | PDS Sample 1115 / attenuate to 100mv range on recorder |
| 1120 | Sample | // | // | 400 | 2340 to<br>2350 | | | place recorder back on 50mv range |
| 1130 | NOx | // | // | 0 | 4000 | | | ~~attenuate to 100mv range on recorder~~ not necessary |
| 1135 | Sample | // | // | 400 | 2200 to<br>2060 | | | |
| 1145 | NOx | // | // | 0 | 3400 | | | |
| 1150 | Sample | // | // | 400 | 2110 to<br>2170 | | | |
| 1200 | NOx | // | // | 0 | 3690 | | | |
| 1205 | Sample | // | // | 400 | 2240 to<br>2340 | | | |
| 1215 | NOx | // | // | 0 | 3940 | | | PDS Sample 1215 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

Page 3 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1220 | Sample | 222 | C850 F518 | 400 | 2310 to 2140 | | | |
| 1230 | NOx | " | " | 0 | 3330 | | | cell temp 116°F |
| 1236 | Sample | " | " | 400 | 2140 to 2100 | | | |
| 1245 | NOx | " | " | 0 | 3300 | | | |
| 1250 | Sample | " | " | 400 | 2120 to 2160 | | | |
| 1300 | NOx | " | " | 0 | 3350 | | | |
| 1305 | Sample | " | " | 400 | | | | Change chart paper |
| 1310 | " | " | " | 400 | 2150 to 1810 | | | New chart paper |
| 1315 | NOx | " | " | 0 | 2490 | | | PDS Sample 1315 |
| 1320 | zero ~~Sample~~ | " | " | 400 | 050 | 21 | | |
| 1325 | zero | " | C850 F514 | 400 | 000 | 20 | | adjust fine zero |
| 1330 | sample | " | " | 400 | 1490 to 1530 | | | cell temp 118°F |
| 1345 | NOx | " | " | 0 | 2090 | | | |
| 1350 | Sample | " | " | 400 | 1560 to 1550 | | | |
| 1400 | NOx | " | " | 0 | 280 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1405 | Sample | 222 | C850 F514 | 400 | 1490 to 1470 | | | |
| 1415 | NOx | " | " | 0 | 2040 | | | PDS Sample 1415 |
| 1420 | Sample | " | " | 400 | 1550 to 1600 | | | |
| 1430 | NOx | " | " | 0 | 2240 | | | |
| 1435 | Sample | " | " | 400 | 1680 to 1700 | | | cell temp 120°F |
| 1445 | NOx | " | " | 0 | 2300 | | | |
| 1450 | Sample | " | " | 400 | 1700 to 1660 | | | |
| 1500 | NOx | " | " | 0 | 2240 | | | |
| 1505 | Sample | " | " | 400 | 1650 to 1650 | | | |
| 1515 | NOx | " | " | 0 | 2210 | | | PDS Sample 1515 |
| 1520 | Sample | " | " | 400 | 1650 to 1650 | | | |
| 1530 | NOx | " | " | 0 | 2190 | | | |
| 1535 | Sample | " | " | 400 | 1590 1570 | | | cell temp 126°F |
| 1545 | NOx | " | " | 0 | 2120 | | | |
| 1552 | Sample | " | " | 400 | 1470 to 1400 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1600 | NOx | 222 | C850 F514 | 0 | 1890 | | | |
| 1605 | Sample | // | // | 400 | 1500 to 1560 | | | |
| 1615 | NOx | // | // | 0 | 2240 | | | PDS Sample 1615 |
| 1623 | Sample | // | // | 400 | 1570 to 1580 | | | |
| 1630 | NOx | // | // | 0 | 2140 | | | |
| 1635 | Sample | // | // | 400 | 1600 to 1590 | | | |
| 1645 | NOx | // | // | 0 | 2190 | | | |
| 1650 | Sample | // | // | 400 | 1630 to 1630 | | | |
| 1700 | NOx | // | // | 0 | 2200 | | | PDS NOx Sample ~~[illegible]~~ 1658 |
| 1705 | Zero | // | // | 400 | -080 | 18.2 | | |
| 1710 | Zero | // | C850 F528 | // | 000 | 20 | | adjust fine zero |
| 1715 | 3980 Span | // | C850 F528 | 400 | 3980 | 99.2 | | |
| | | | | | to 4000 | to 99.8 | | cell temp 120 |
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$NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/10/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala Inlet

Zero Gas <0.1 ppm $NO_x$ Cylinder Pressure 1350

~~Zero~~ Span Gas 3980 ppm $NO_2$ Cylinder Pressure 630

~~Oxygen~~ 2 Cylinder Pressure 2250

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0830 | Zero | 222 | C850 F528 | 400 | 030 | 26 | | |
| 0835 | Zero | " | C850 F486 | 400 | 000 | 20 | | adjust fine zero |
| 0845 | Span | " | " | " | 4000 | 100 | | cell temp 110° F |
| 0855 | Zero | " | " | 100 | [illegible] | decreasing | | |
| 1355 | Zero | " | " | 400 | -170 | 17.25 | | cell temp 120° F |
| 1400 | Zero | " | C850 F505 | 400 | 000 | 20 | | adjust fine zero |
| 1415 | " | " | " | " | " | | | Change light source |
| 1430 | Zero | " | C850 F550 | 400 | 000 | 30 | | adjust fine zero |
| 1440 | Span | " | " | 400 | 3960 | 99.5 | | adjust to 99.5 cell temp 115 |
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## $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/11/75
Instrument Ser. No. 0142
Location Hercules, Bessemer Ala Inlet

Zero Gas <0.1 ppm $NO_x$ Cylinder Pressure 1310
~~Zero~~ Span Gas 3980 ppm $NO_2$ Cylinder Pressure 650
Oxygen ______ Cylinder Pressure 2310

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0805 | Zero | 222 | C850 F550 | 400 | -40 | 19 | | |
| 0820 | Zero | " | C850 F556 | 400 | 000 | 20 | | adjust fine zero |
| 0825 | " | " | " | 025 | 000 | 20 | | |
| 1300 | " | " | " | 400 | -100 | 17.8 | | |
| 1320 | " | " | C850 F571 | 400 | 000 | 20 | | adjust fine zero |
| 1325 | Span | " | " | 400 | 3980 | 99.75 | | cell temp [redacted] 115°F |
| 1350 | Zero | " | " | 400 | 000 | 20 | | |
| 1355 | Sample | " | " | 400 | 675 to 600 | | | |
| 1415 | $NO_x$ | " | " | 0 | 1060 | | | PDS Sample 1415 |
| 1420 | Sample | " | " | 400 | 510 to 480 | | | |
| 1430 | $NO_x$ | " | " | 0 | 760 | | | |
| 1435 | Sample | " | " | 400 | 470 to 480 | | | |
| 1445 | $NO_x$ | " | " | 0 | 730 | | | PDS Sample 1445 |
| 1450 | Sample | " | " | 400 | 490 to 500 | | | |
| 1500 | $NO_x$ | " | " | 0 | 760 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/11/75

Page 2 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1505 | Sample | 222 | C850 F571 | 400 | 510 to 540 | | | |
| 1515 | NOx | " | " | 0 | 760 | | | PDS Sample 1515 |
| 1520 | Sample | " | " | 400 | 470 to 560 | | | |
| 1530 | NOx | " | " | 0 | 870 | | | |
| 1535 | Sample | " | " | 400 | 630 to 680 | | | |
| 1545 | NOx | " | " | 0 | 1060 | | | PDS Sample 1545 |
| 1550 | Sample | " | " | 400 | 720 to 850 | | | |
| 1600 | NOx | " | " | 0 | 1280 | | | |
| 1605 | Sample | " | " | 400 | 880 to 910 | | | |
| 1615 | NOx | " | " | 0 | 1340 | | | PDS Sample 1615 |
| 1620 | Sample | " | " | 400 | 900 to 880 | | | |
| 1630 | NOx | " | " | 0 | 1290 | | | |
| 1635 | Sample | " | " | 400 | 870 to 870 | | | |
| 1445 | NOx | " | " | 0 | 1280 | | | PDS Sample 1645 |
| 1450 | Sample | " | " | 400 | 0850 to 0850 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/11/75

Page 3 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1700 | NOx | 222 | C850 F571 | 0 | 1240 | | | ~~PDS Sample~~ |
| 1705 | Sample | // | // | 400 | 0840 to 0850 | | | |
| 1715 | NOx | // | // | 0 | 1260 | | | PDS Sample 1715 |
| 1720 | Sample | // | // | 400 | 0860 to 0870 | | | |
| 1730 | NOx | // | // | 0 | 1270 | | | |
| 1735 | Sample | // | // | 400 | 0860 to 0860 | | | |
| 1745 | NOx | // | // | 0 | 1250 | | | PDS Sample 1745 |
| 1750 | Sample | // | // | 400 | 760 | | | |
| 1755 | Zero | // | // | 400 | 0130 | 22.8 | | |
| 1755 | Zero | // | C850 F553 | 400 | 000 | 20 | | |
| 1804 | 3980 Span | // | // | 400 | 3930 | 99 | | cell temp 120°F |
| 1810 | Sample | // | // | 400 | | | | |
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# NO$_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/12/75
Instrument Ser. No. 0142
Location Hercules, Bessemer Ala Inlet

~~Zero~~ Zero Gas <0.1ppm — Cylinder Pressure 1300
Span Gas 3980 ppm — Cylinder Pressure 600
Oxygen — Cylinder Pressure 2300

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0810 | Sample | 222 | C850 F553 | 400 | 760 | | | |
| 0815 | Zero | // | // | // | -190 | 15.9 | | |
| 0825 | // | // | // | // | 000 | 20 | | adjust Fine zero |
| 0840 | Span | // | // | 400 | 3890 | 98 | | cell temp 125°C |
| 0850 | // | // | // | 400 | 3890 | 98 | | adjust recorder span |
| 0855 | // | // | // | 400 | 3900 | 98 | | equivalent to 3970 ppm at 115° |
| 0856 | zero | // | [redacted] // | 400 | -030 | 19.2 | | ~~adjust fine zero~~ |
| 0900 | Zero | // | C850 F582 | 400 | 000 | 20 | | adjust fine zero |
| 0903 | Span | // | // | 400 | 3950 | 99.0 | | cell temp 120°C |
| 0910 | zero | // | // | 400 | 020 | 20.5 | | |
| 0920 | Zero | // | C850 F578 | 400 | 000 | 20 | | adjust fine zero |
| 0925 | Span | // | // | 400 | 3930 | 98.7 | | cell temp 120° |
| 0930 | Sample | // | // | | 1480 to 1550 | | | |
| 1022 | NOx | // | // | 0 | 2110 | | | PDS Sample 1023 |
| 1027 | Sample | // | // | 400 | 1470 1550 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/12/75

Page 2 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1045 | NOx | 222 | C850 F578 | 0 | 2170 | | | |
| 1050 | Sample | // | // | 400 | 1550 to 1620 | | | |
| 1100 | NOx | // | // | 0 | 2260 | | | |
| 1105 | Sample | // | // | 400 | 1700 to 1890 | | | |
| 1120 | NOx | // | // | 0 | 2660 | | | PDS Sample 1120 |
| 1125 | Sample | // | // | 400 | 1970 to 1950 | | | cell temp 122 °F |
| 1130 | NOx | // | // | 0 | 2720 | | | |
| 1135 | Sample | // | // | 400 | 1990 to 2000 | | | |
| 1145 | NOx | // | // | 0 | 2760 | | | |
| 1150 | Sample | // | // | 400 | 1820 to 1810 | | | |
| 1200 | NOx | // | // | 0 | 2490 | | | |
| 1205 | Sample | // | // | 400 | 1740 to 1660 | | | |
| 1215 | NOx | // | // | 0 | 2290 | | | PDS Sample 1215 |
| 1220 | Sample | // | // | 400 | 1700 to 1670 | | | cell temp 124 °F |
| 1230 | NOx | // | // | 0 | 2290 | | | |

## $NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

Page 3 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1235 | Sample | 222 | C850 F578 | 400 | 1650 to 1640 | | | cell temp 126°F |
| 1245 | NOx | " | " | 0 | 2270 | | | |
| 1251 | Sample | " | " | 400 | 1650 to 1690 | | | |
| 1300 | NOx | " | " | 0 | 2360 | | | |
| 1305 | Sample | " | " | 400 | 1730 to 1660 | | | |
| 1316 | NOx | " | " | 0 | 2290 | | | |
| 1321 | Sample | " | " | 400 | 1600 to 1580 | | | P.D.S Sample 1326 |
| 1330 | NOx | " | " | 0 | 2200 | | | |
| 1335 | Sample | " | " | 400 | 1590 to 1570 | | | cell temp 122°F |
| 1345 | NOx | " | " | 0 | 2180 | | | increased production rate |
| 1350 | Sample | " | " | 400 | 1650 to 1970 | | | |
| 1400 | NOx | " | " | 0 | 2740 | | | |
| 1405 | Sample | " | " | 400 | 1970 to 1930 | | | |
| 1415 | zero | " | " | 400 | 000 | 20 | | |
| 1420 | Sample | " | " | 400 | 1800 to 1760 | | | |

## $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/12/75

Page 4 of C142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1430 | NOx | 222 | C850 F578 | 0 | 2380 | | | PDS Sample 1430 |
| 1435 | Sample | // | // | 400 | 1650 to 1670 | | | cell temp 120°F |
| 1445 | NOx | // | // | 0 | 2350 | | | |
| 1450 | Sample | // | // | 400 | 1720 to 1720 | | | |
| 1500 | NOx | // | // | 0 | 2380 | | | |
| 1505 | Sample | // | // | 400 | 1890 to 1670 | | | |
| 1516 | NOx | // | // | 0 | 2300 | | | PDS Sample 1516 |
| 1521 | Sample | // | // | 400 | 1700 to 1730 | | | |
| 1530 | NOx | // | // | 0 | 2380 | | | |
| 1535 | Sample | // | // | 400 | 1760 to 1790 | | | cell temp 120°F |
| 1545 | NOx | // | // | 0 | 2450 | | | |
| 1550 | Sample | // | // | 400 | 1800 to 1850 | | | |
| 1600 | NOx | // | // | 0 | 2540 | | | |
| 1605 | Sample | // | // | 400 | 1860 | | | |
| 1615 | NOx | // | // | 0 | 2530 | | | PDS sample 1615 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

Page 5 of 0142 Inlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1620 | Sample | 222 | C850 F578 | 400 | 1850 to 1650 | | | |
| 1630 | NOx | " | " | 0 | 2200 | | | cell temp 121°F |
| 1635 | Sample | " | " | 400 | 1570 to 1560 | | | |
| 1645 | NOx | " | " | 0 | 2090 | | | |
| 1650 | Sample | " | " | 400 | 1550 1540 | | | |
| 1700 | NOx | " | " | 0 | 2080 | | | |
| 1705 | Sample | " | " | 400 | 1550 to 1520 | | | |
| 1716 | NOx | " | " | 0 | 2080 | | | |
| 1721 | Sample | " | " | 400 | 1500 to 1560 | | | |
| 1730 | NOx | " | " | 0 | 2240 | | | |
| 1735 | Sample | " | " | 400 | 1750 to 1820 | | | cell temp 123°F |
| 1745 | NOx | " | " | 0 | 2640 | | | PDS Sample 1745 |
| 1750 | Sample | " | " | 400 | 1800 to 1530 | | | |
| 1800 | NOx | " | " | 0 | 2200 | | | |
| 1805 | Sample | " | " | 400 | 1640 to 1720 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/12/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1810 | Zero | 222 | C850 F578 | 400 | 050 | 21 | | |
| 1830 | zero | 222 | C850 F572 | 400 | 000 | 20 | | adjust fine zero |
| 1833 | Span | " | " | 400 | 3950 | | | cell temp 120°F |
| 1845 | Sample | | | | | | | Change Port to HV23 Inlet to Demister |
| | | | | | | | | |
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## $NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/13/75

Instrument Ser. No. 0142

Location Hercules Bessemer Ala

HV-23 Inlet to Demister

Zero Gas <0.1 ppm $NO_x$ Cylinder Pressure 1200

~~Zero~~ Span Gas 3980 ppm $NO_2$ Cylinder Pressure

Oxygen Cylinder Pressure

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0815 | Sample | 222 | C850 F572 | 300 | 2440 | | | cell temp 110° F |
| 0816 | zero | // | // | 400 | 320 | 26 | | |
| 0830 | zero | // | C850 F530 | 000 | 000 | 20 | | adjust fine zero |
| 0845 | Span | // | // | 400 | 3970 | 99 | | cell temp 113° F |
| 0900 | zero | // | // | 400 | 000 | 20 | | |
| 0915 | zero | // | // | 400 | -010 | 19.8 | | |
| 0930 | zero | // | C850 F531 | 400 | 000 | 20 | | adjust fine zero |
| 0940 | Sample | // | // | 400 | 1400 to 1260 | | | |
| 1017 | Sample | // | // | 400 | 1260 to 1270 | | | sieve switched 1017 |
| 1030 | NOx | // | // | 0 | 1910 | | | |
| 1035 | Sample | // | // | 400 | 1250 to 1200 | | | |
| 1045 | NOx | // | // | 0 | 1810 | | | bypass opened 1040 PDS sample 1045 |
| 1050 | Sample | // | // | 400 | 1250 to 1160 | | | |
| 1100 | NOx | // | // | 0 | 1770 | | | |
| 1105 | Sample | // | // | 400 | 1320 to 1450 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 2 of 0142 HV-23 Inlet to Demister

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1115 | NOx | 222 | C850 F531 | 0 | 2060 | | | |
| 1120 | Sample | " | " | 400 | 1420 to 1360 | | | |
| 1130 | NOx | " | " | 0 | 1850 | | | PDS Sample 1130 |
| 1135 | Sample | " | " | 400 | 1230+ 1000+ | | | |
| 1145 | NOx | " | " | 0 | 1440 | | | |
| 1150 | Sample | " | " | 400 | 1380 to 1840 | | | |
| 1200 | NOx | " | " | 0 | 2940 | | | |
| 1205 | Sample | " | " | 400 | 1850 to 1890 | | | |
| 1217 | NOx | " | " | 0 | 3040 | | | PDS Sample 1217 |
| 1222 | Sample | " | " | 400 | 1970 to 2100 | | | cell temp 114°F |
| 1230 | NOx | " | " | 0 | 3370 | | | |
| 1235 | Zero | " | " | 400 | 040 | 20.9 | | |
| 1238 | zero | " | C850 F527 | 400 | 000 | 20 | | adjust Fine zero |
| 1240 | Sample | " | " | 400 | 2250 to 2260 | | | |
| 1245 | NOx | " | " | 0 | 3420 | | | |

## $NO_x$ FIELD DATA

**DUPONT 411 PHOTOMETRIC ANALYZER.**

**(Continued)**

DATE 3/13/75

Page 3 of 0142 HV-23 Inlet to Demister

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1250 | Sample | 222 | C850 F527 | 400 | 2380 to 2470 | | | |
| 1300 | NOx | // | // | 0 | 3800 | | | |
| 1305 | Sample | // | // | 400 | 2510 to 2590 | | | |
| 1315 | NOx | // | // | 0 | 3850 | | | |
| 1320 | Sample | // | // | 400 | 2640 to | | | |
| 1330 | NOx | // | // | 0 | 4030 | | | switch recorder to 100 mv scale for NOx reading |
| 1335 | Sample | // | // | 400 | 2690 to 2590 | | | cell temp 117°F |
| 1345 | NOx | // | // | 0 | 3930 | | | |
| 1350 | Sample | // | // | 400 | 2500 to | | | |
| ~~1400~~ | ~~NOx~~ | ~~//~~ | ~~//~~ | ~~0~~ | | | | 1357 Sondyne shut off and turned on. Bypass valve ~~opened.~~ |
| 1415 | NOx | // | // | 0 | 3570 | | | |
| 1420 | Sample | // | // | 400 | 2570 to 1120 | | | cell temp 119°F |
| 1500 | NOx | // | // | 0 | 2090 | | | |
| 1505 | Sample | // | // | 400 | 1150 to 1970 | | | |
| 1515 | NOx | // | // | 0 | 3020 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 4 of 0142 HV-23 Inlet to Demister

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1520 | Sample | 222 | C850 F527 | 400 | 1840 to 1860 | | | |
| 1530 | NOx | // | // | 0 | 2890 | | | PDS sample 1530 |
| 1535 | Sample | // | // | 400 | 1730 | | | cell temp 121°F |
| 1545 | NOx | // | // | 0 | 2770 | | | |
| 1550 | Sample | // | // | 400 | 1840 to 1790 | | | |
| 1600 | NOx | // | // | 0 | 2810 | | | |
| 1005 | Sample | // | // | 400 | 1820 to 1930 | | | |
| 1615 | NOx | // | // | 0 | 3020 | | | |
| 1620 | Sample | // | // | 400 | 1800 to 1920 | | | |
| 1630 | NOx | // | // | 0 | 2860 | | | |
| 1635 | Sample | // | // | 400 | 1800 to 1690 | | | cell temp 121°F |
| 1645 | NOx | // | // | 0 | 2830 | | | |
| 1650 | Sample | // | // | 400 | 1760 to 1830 | | | |
| 1700 | NOx | // | // | 0 | 3040 | | | |
| 1705 | Sample | // | // | 400 | 1890 to 1890 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/13/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1715 | NO$_x$ | 222 | CB 50 FS 27 | 0 | 3050 | | | |
| 1720 | Sample | // | // | 400 | 1950 to 1850 | | | |
| 1730 | NOx | // | // | 0 | 2930 | | | |
| 1735 | Sample | // | // | 400 | 1850 to 1920 | | | cell temp 121°F |
| 1745 | NOx | // | // | 0 | 3060 | | | |
| 1750 | Sample | // | // | 400 | 1860 to 1900 | | | |
| 1800 | NOx | // | // | 0 | 3040 | | | |
| 1805 | Sample | // | // | 400 | 1980 to 2010 | | | |
| 1815 | NOx | // | // | 0 | 3210 | | | |
| 1820 | Sample | // | // | 400 | 2050 to 2090 | | | |
| 1830 | NOx | // | // | 0 | 3320 | | | |
| 1835 | Sample | // | // | 400 | 2150 to 2240 | | | |
| 1848 | NO$_x$ | // | // | 0 | 3440 | | | cell temp 120°F |
| 1853 | Sample | // | // | 400 | 2210 to 2290 | | | |
| 1900 | NOx | // | // | 0 | 3420 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 6 of 0142 HV-23 Demister Inlet ~~Outlet~~

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1905 | zero | 222 | C850 F527 | 400 | -180 | 16 | | |
| 1910 | " | " | C850 F550 | 400 | 000 | 20 | | adjust fine zero |
| 1913 | Span | " | " | 400 | 3920 | 98.25 | | cell temp 120°F |
| 1920 | Sample | " | " | 400 | | | | |
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NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/14/75 | Zero Gas <0.1 ppm NOx | Cylinder Pressure 1150

Instrument Ser. No. 0142 | Zero Gas 3980 ppm NO2 | Cylinder Pressure 550

Location Hercules, Bessemer Ala HV-23 Inlet to Demister | Oxygen ______ | Cylinder Pressure 2200

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0630 | Sample | 222 | C850 F550 | 400 | | | | |
| 0635 | zero | " | " | " | 018 | 23.7 | | |
| 0642 | zero | " | C850 F527 | " | 000 | 20 | | adjust fine zero |
| 0645 | Span | " | " | 400 | 4040 | slightly >100 | | cell temp 107°C |
| 0651 | Sample | " | " | 400 | 1960 to 2180 | | | sieve switched to A on absorb 0711 |
| 0711 | Sample | " | " | 400 | 2180 to 2200 | | | |
| 0715 | NOx | " | " | 0 | 3400 | | | |
| 0720 | Sample | " | " | 400 | 2100 to 2120 | | | |
| 0730 | NOx | " | " | 0 | 3410 | | | |
| 0735 | Sample | " | " | 400 | 2180 to 2180 | | | |
| 0745 | NOx | " | " | 0 | 3320 | | | PDS Sample 0745 |
| 0750 | Sample | " | " | 400 | 2210 to 2220 | | | |
| 0800 | NOx | " | " | 0 | 3290 | | | |
| 0805 | Sample | " | " | 400 | 2210 to 2170 | | | |
| 0815 | NOx | " | " | 0 | 3190 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/14/75

Page 2 of 0142 HV-23 Inlet to Demister

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0820 | Sample | 222 | C850 F527 | 400 | 2150 to 2150 | | | |
| 0830 | NOx | 11 | 11 | 0 | 3180 | | | |
| 0835 | Sample | 11 | 11 | 400 | 2160 to 2140 | | | |
| 0845 | NOx | 11 | 11 | 0 | 3170 | | | 0845 PDS Sample 110 °F cell temp |
| 0850 | Sample | 11 | 11 | 400 | 2140 2140 to | | | |
| 0900 | NOx | 11 | 11 | 0 | 3160 | | | |
| 0905 | zero | 11 | 11 | 400 | 050 | 21 | | |
| 0910 | zero | 11 | C850 F520 | 11 | 000 | 20 | | adjust fine zero |
| 0915 | Sample | 11 | 11 | 400 | 2075 2010 to | | | |
| 0930 | NOx | 11 | 11 | 0 | 3090 | | | |
| 0935 | Sample | , | 11 | 400 | 2030 to 2010 | | | |
| 0945 | NOx | 11 | 11 | 0 | 3090 | | | PDS Sample 0945. cell temp 108 °F |
| 0950 | Sample | 11 | 11 | 400 | 1930 to 1980 | | | |
| 1000 | NOx | 11 | 11 | 0 | 3070 | | | |
| 1005 | Sample | 11 | 11 | 400 | 1970 to 2030 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/14/75

Page 3 of 0142 HV-23 Inlet to Demister

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1015 | NOx | 222 | C850 F520 | 0 | 3050 | | | |
| 1020 | Sample | " | " | 400 | 2030 2010 to | | | |
| 1030 | NOx | " | " | 0 | 3000 | | | |
| 1035 | Sample | " | " | 400 | 1990, 1970 to | | | |
| 1045 | NOx | " | " | 0 | 2980 | | | PDS Sample 1045 cell temp 107°F |
| 1050 | Sample | " | " | 400 | 1970 to 1960 | | | |
| 1100 | NOx | " | " | 0 | 2960 | | | |
| 1105 | Sample | " | " | 400 | 1960 to 1920 | | | |
| 1115 | zero | " | " | 400 | 000 | | | |
| 1122 | Span | " | " | 400 | 4030 | 100 + | | cell temp 108°F |
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# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala. Outlet

Zero Gas < 0.1 ppm $NO_x$ Cylinder Pressure 1500

Span ~~Zero~~ Gas 35 ppm $NO_2$ Cylinder Pressure 2100

Oxygen ______ Cylinder Pressure 2500

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 11:45 | $E_1$ | 795 | C 1000 F 500 | | | | | Test 49.5 |
| | $E_2$ | " | " | | | | | Test 47. |
| | M light | " | " | | | | | Test 21. |
| | R light | " | " | | | | | Test 17.5 |
| | M dark | " | " | | | | | Test 35. |
| | R dark | " | " | | | | | Test 33. |
| ~~12:15~~ | ~~Zero~~ | | | | | | | |
| | M-R | 250 | C 806 F 500 | | 025 | | | Screen In 023 |
| 1215 | Zero | 795 | C 800 F 496 | 400 | 000 | | | adjust to 000. Cal ~~Filter in, Meter 470~~ |
| 1230 | Span | 795 | " | 400 | 032 | | | |
| 1430 | Span | 795 | " | 400 | 032 | | | |
| 1445 | Zero | 795 | " | 400 | 008 | | | |
| 1450 | Zero | 795 | C800 F490 | 400 | 000 | | | Adjust fine zero |
| 1510 | 3980 ppm Span | 795 | C 800 F490 | 400 | 4000 to 3960 | 79-80 | | cell temp 108°F |
| 1700 | Zero | " | " | 400 | 000 | | | zero stabil |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75      Zero Gas < 0.1 ppm NOx   Cylinder Pressure 1500

Instrument Ser. No. 0166      ~~Zero~~ Span Gas 35 ppm NO2   Cylinder Pressure 2100

Location Hercules, Bessemer Ala Outlet      Oxygen ______   Cylinder Pressure 2500

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1730 | Sample | 795 | C 800<br>F 490 | 400 | 800 | | | Sample, recorder 1000 ppm full scale |
| 0830 | Sample | 795 | C 800<br>F 490 | 400 | 100 | | | see new sheet for 3/5/75 |
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NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NOx Cylinder Pressure 1500

Span Gas 35 ppm $NO_2$ Cylinder Pressure 1800

Oxygen Cylinder Pressure 2300

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0830 | Sample | 795 | C 800 F 490 | 400 | 100 | | | Instrument Operated During Night. |
| 0845 | Zero | " | " | 300 | 050 | | | |
| 0855 | Zero | 795 | C 800 F 474 | 300 | 000 | | | adjust fine zero cal filter in Meter 471 |
| 0905 | Span | " | " | 500 | 032 | | | cell temp 108°F |
| 0915 | Zero | " | " | 500 | 000 | | | |
| 0920 | Span | 795 | " | 500 | 30 | | | |
| 0925 | Sample | 795 | " | 500 | Aprox 20-25 | | | 100 ppm full scale |
| 0950 | NOx | 795 | " | 0 | 029 | | | |
| 0955 | Sample | 795 | " | 500 | | | | |
| 1045 | Zero | 795 | " | 500 | -048 | | | |
| 1050 | Zero | 795 | C 803 F 474 | 500 | 000 | 50 | | Set zero at 50% of chart |
| 1100 | Zero | 795 | C 803 F 477 | 500 | 000 | 50 | | adjust fine zero |
| 1110 | Sample | 795 | " | 500 | 65-70 | | | |
| 1135 | | " | " | 0 | | | | Plant Shut Down |
| 1215 | Zero | 795 | " | 500 | 005 | | | |

Page 2 of C166 Outlet

# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas < 0.1 ppm NO Cylinder Pressure 1500

Span ~~Zero Gas~~ 35 ppm $NO_2$ Cylinder Pressure 1900

Oxygen ______ Cylinder Pressure ______

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1220 | Zero | 795 | C 803 F 473 | | 000 | 50 | | adjust zero |
| 1235 | Sample | " | " | 400 | 100 | | | |
| 1245 | NOx | " | " | 0 | 100 | | | PDS Sample 1258 |
| 1255 | Sample | " | " | 400 | 98 to 113 | | | cell temp 109°F |
| 1320 | NOx | " | " | 0 | 113 | | | PDS Sample 1320 |
| 1325 | Sample | " | " | 400 | 135 | | | |
| 1335 | NOx | " | " | 0 | 135 | | | |
| 1340 | Zero | " | " | 400 | 000 | | | |
| 1343 | Sample | " | " | 400 | 154 | | | |
| 1350 | NOx | " | " | 0 | 154 | | | PDS Sample 1350 cell temp 110°F |
| 1355 | Sample | " | " | 400 | 166 | | | |
| 1405 | NOx | " | " | 0 | 166 | | | |
| 1410 | Sample | " | " | 400 | 166 to 85 | | | sieve on B 1412 |
| 1420 | NOx | " | " | 0 | 85 | | | PDS Sample 1420 |
| 1425 | Sample | " | " | 400 | 114 to 90 | | | |

Page 3 of F 0166 Outlet

# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75 | Zero Gas <0.1 ppm $NO_x$ | Cylinder Pressure 1500

Instrument Ser. No. 0166 | Span ~~Zero~~ Gas 35 ppm $NO_2$ | Cylinder Pressure 1900

Location Hercules, Bessemer Ala Outlet | Oxygen ____ | Cylinder Pressure ____

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1435 | NOx | 795 | C 803 F 473 | 0 | 085 | | | |
| 1440 | Sample | // | // | 400 | 073 | | | |
| 1445 | Zero | // | // | 400 | 007 | | | cell temp 110 |
| 1448 | Zero | // | C 803 F 469 | 400 | 000 | 50 | | adjust Fine zero |
| 1450 | Sample | // | // | 400 | 065 | | | |
| 1454 | NOx | // | // | 0 | 066 | | | PDS Sample 1459 |
| 1457 ~~1501~~ | Sample | // | // | 400 | 075 | | | |
| 1501 | NOx | // | // | 0 | 076 | | | |
| 1507 | Sample | // | // | 400 | 086 | | | |
| 1520 | NOx | // | // | 0 | 086 | | | PDS Sample 1520 |
| 1525 | Sample | // | // | 400 | 082 to 093 | | | |
| 1535 | NOx | // | // | 0 | 094 | | | |
| 1540 | Sample | // | // | 400 | 098 to 101 | | | |
| 1550 | NOx | // | // | 0 | 103 | | | cell temp 111°F PDS Sample 1550 |
| 1555 | Sample | // | // | 400 | 106 to 114 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/5/75

Page 4 of C166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1605 | NOx | 895 | C 803 F 469 | 0 | 115 | | | |
| 1610 | Zero | " | " | 400 | 015 | | | |
| 1615 | Zero | " | C 803 F 463 | 400 | 000 | 50 | | adjust fine zero |
| 1618 | Sample | " | " | 400 | 111 | | | |
| 1623 | NOx | " | " | 0 | 113 | | | |
| 1628 | Sample | " | " | 400 | 120 | | | |
| 1635 | NOx | " | " | 0 | 122 | | | |
| 1640 | Sample | " | " | 400 | 126 to 139 | | | |
| 1650 | NOx | " | " | 0 | 138 | | | PDS sample 1550 1660, cell temp 109°F |
| 1655 | Sample | " | " | 400 | 146 to 149 | | | |
| 1705 | NOx | " | " | 0 | 151 to 151 | | | |
| 1710 | Sample | " | " | 400 | 152 to 164 | | | |
| 1720 | NOx | " | " | 0 | 165 | | | |
| 1725 | Zero | " | " | 400 | 006 | | | |
| 1730 | Zero | " | C 803 F 461 | 400 | 000 | 50 | | adjust fine zero |

## $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

Page 5 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1732 | Sample | 795 | C 803 F 461 | 400 | 171 to 173 | | | |
| 1737 | NOx | " | " | 0 | 178 | | | |
| 1742 | Sample | " | " | 400 | 182 to 189 | | | cell temp 107° F |
| 1750 | NOx | " | " | 0 | 194 | | | PDS Sample 1750 |
| 1755 | Sample | " | " | 400 | peak 194 096 | | | sieve switched P |
| 1805 | Zero | " | " | 400 | 017 | | | |
| 1810 | Zero | " | C 803 F 454 | 400 | 000 | 50 | | adjust fine zero |
| 1815 | Zero | " | C 803 F 454 | 400 | 000 | 30 | | adjust recorder zero to 30% of chart |
| 1820 | 35 ppm Span | " | " | 400 | 032 to 033 | 36 to 37 | | cell temp 105 °F |
| 1830 | Sample | " | " | 400 | | | | |
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-115-

# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/6/75
Instrument Ser. No. 0166
Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO Cylinder Pressure 1475
Zero Gas 35 ppm $NO_2$ Cylinder Pressure 1800
Oxygen ______ Cylinder Pressure 2350

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0820 | Sample | 795 | C 803 F 454 | 300 | 010 | | | Instrument Operated During Night. Recorder Stopped |
| 0830 | Sample | // | // | // | | set Chart 0830 120mm/hr | | Inking at 0520 AM Cell Temp 110°F |
| 0833 | Zero | // | // | 400 | 075 | 16 | | |
| 0845 | Zero | // | C 803 F 478 | 400 | 000 | 30 | | adjust fine zero |
| 0853 | 35ppm Span | // | // | 400 | 033 | 36.5 | | |
| 0900 | Sample | // | // | 400 | 105 to 121 | | | |
| 0920 | NOx | // | // | 0 | 124 | | | |
| 0925 | Sample | // | // | 400 | 124 to 134 | | | |
| 0935 | NOx | // | // | 0 | 135 | | | |
| 0940 | Sample | // | // | 400 | 141 to 146 | | | |
| 0950 | NOx | // | // | 0 | 148 | | | |
| 0955 | Sample | // | // | 400 | 150 to 155 | | | |
| 1005 | NOx | // | // | 0 | 159 | | | sieve switched to A |
| 1010 | Sample | // | // | 400 | 111 to | | | |
| 1020 | NOx | // | // | 0 | 112 | | | PPS Sample 1021 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1025 | Zero | 795 | C803 F454 | 400 | 023 | 34.8 | | cell temp 109°F |
| 1035 | Zero | 795 | C803 F470 | 400 | 000 | 30 | | adjust fine zero |
| 1040 | Sample | // | // | 400 | 052 | | | |
| 1050 | NOx | // | // | 0 | 054 | | | |
| 1055 | Sample | // | // | 400 | 057 to 063 | | | |
| 1105 | NOx | // | // | 0 | 066 | | | |
| 1110 | Sample | // | // | 400 | 073 to 085 | | | |
| 1120 | NOx | // | // | 0 | 086 | | | pos sample 1120 |
| 1125 | Sample | // | // | 400 | 099 to 113 | | | |
| 1135 | NOx | // | // | 0 | 113 | | | |
| 1140 | Zero | // | // | 400 | 025 | | | |
| 1145 | Zero | // | C 803 F 460 | 400 | 000 | 30 | | adjust fine zero |
| 1150 | Sample | // | // | 400 | 111 to 130 | | | |
| 1205 | NOx | // | // | 0 | 132 | | | |
| 1210 | Sample | // | // | 400 | 135 to 147 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

Page 3 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1220 | NOx | 795 | C803 F460 | 0 | 147 | | | PDS Sample 1220 |
| 1225 | Sample | " | " | 400 | 160 to 178 | | | cell temp 109°F |
| 1235 | NOx | " | " | 0 | turned wrong valve | | | |
| 1236 | Sample | " | " | 400 | 185 to 193 | | | |
| 1242 | NOx | " | " | 0 | 190 | | | |
| 1245 | Sample | " | " | 400 | 205 to 209 | | | |
| 1250 | NOx | " | " | 0 | 212 | | | |
| 1255 | zero ~~Sample~~ | " | " | 400 | 005 | 31 | | |
| 1255 | Zero | " | C803 F458 | 400 | 000 | 30 | | adjust Fine zero |
| 1258 | Sample | " | " | 400 | 225 to 237 | | | |
| 1306 | NOx | " | " | 0 | 239 | | | |
| 1311 | Sample | " | " | 400 | 250 to 264 | | | |
| 1320 | NOx | " | " | 0 | 265 | | | PDS Sample 1320 |
| 1325 | Sample | " | " | 400 | 270 to 268 | | | |
| 1335 | NOx | " | " | 0 | 268 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

Page 4 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1340 | Sample | 795 | C803 F458 | 400 | 272 to 275 | | | |
| 1350 | NOx | // | // | 0 | 274 | | | |
| 1355 | Sample | // | // | 400 | 278 to 283 | | | |
| 1405 | NOx | // | // | 0 | 284 | | | sieve switched 1408 |
| 1410 | Sample | // | // | 400 | 159 to 177 | | | |
| 1420 | NOx | // | // | 0 | 176 | | | PDS Sample 1420 |
| 1425 | Zero | // | // | 400 | -012 | 27.8 | | cell temp 108°F |
| 1430 | Zero | // | C803 F462 | 400 | 000 | 30 | | adjust fine zero |
| 1435 | Sample | // | // | 400 | 112 to 084 | | | |
| 1450 | NOx | // | // | 0 | 083 | | | |
| 1455 | Sample | // | // | 400 | 080 to 077 | | | |
| 1505 | NOx | // | // | 0 | 079 | | | |
| 1510 | Sample | // | // | 400 | 081 to 085 | | | |
| 1520 | NOx | // | // | 0 | 087 | | | PDS Sample 1520 |
| 1525 | Zero | // | // | 400 | -008 | 28.5 | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1530 | Zero | 795 | C803 F466 | 400 | 000 | 30 | | adjust fine zero |
| 1535 | Sample | // | // | 400 | 109 to 115 | | | |
| 1550 | NOx | // | // | 0 | 116 | | | |
| 1555 | Sample | // | // | 400 | 120 to 128 | | | |
| 1605 | NOx | // | // | 0 | 127 | | | |
| 1610 | Sample | // | // | 400 | 134 to 141 | | | |
| 1620 | NOx | // | // | 0 | 141 | | | PDS Sample 1621 |
| 1625 | Sample | // | // | 400 | 149 to 154 | | | |
| 1635 | NOx | // | // | 0 | 156 | | | |
| 1640 | Zero | // | // | 400 | -002 | 29.5 | | |
| 1646 | Zero | // | C803 F468 | 400 | 000 | 30 | | adjust fine zero |
| 1650 | Sample | // | // | 400 | 172 to 182 | | | cell temp 108°F |
| 1705 | NOx | // | // | 0 | 187 | | | |
| 1710 | Sample | // | // | 400 | 179 to 172 | | | |
| 1720 | NOx | // | // | 0 | 170 | | | Upset Condition |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1723 | Sample | 795 | C803 F468 | 400 | 170 to 302 | | | Upset Condition |
| 1735 | NOx | 7 / | " | 0 | 284 | | | " |
| 1740 | Sample | " | " | 200 | 150 | | | " |
| 1750 | Sample | " | " | 200 | 150 | | | " |
| 1755 | Sample | " | " | 300 | 146 | | | |
| 1810 | Sample | " | " | 300 | 165 | | | 1812 |
| 1828 | Zero | " | " | 400 | +25 | 35 | | |
| 1835 | Zero | " | C 803 F 458 | 400 | 000 | 30 | | adjust fine zero |
| 1843 | 35ppm Span | " | " | 400 | 032 | | | cell temp 106°F |
| 1850 | Sample | " | " | 400 | | | | |
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## $NO_x$ FIELD DATA

### DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/7/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm $NO_x$ Cylinder Pressure 1450

~~Zero~~ Span Gas 35 ppm $NO_2$ Cylinder Pressure 1800

Oxygen ______ Cylinder Pressure 2350

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0840 | Sample | 795 | C 803 F 458 | 200 | 048 | | | Instrument Operated During Night. Recorder Stopped Inking |
| 0850 | Zero | // | // | 400 | -016 | 27 | | at 0500 3/7/75 Increase Record Chart Speed 120mm/hr |
| 0900 | Zero | // | C 803 F 463 | 400 | 000 | 30 | | adjust fine zero |
| 0904 | Span | // | // | 400 | 034 | 37 — | | cell temp 105°F |
| 0910 | Sample | // | // | 400 | 083 to 070 | | | |
| 0925 | // | // | // | // | 070 to 077 | | | PDS Sample 0921 |
| 0940 | // | // | // | // | 077 093 | | | |
| 0955 | Zero | // | // | 400 | 028 | 35.75 | | |
| 1000 | Zero | // | C803 F452 | 400 | 000 | 30 | | adjust fine zero |
| 1005 | Sample | // | // | 400 | 068 to 059 | | | |
| 1020 | // | // | // | 400 | 059 to 056 | | | PDS Sample 1021 |
| 1030 | // | // | // | 400 | 056 to 097 | | | |
| 1050 | // | // | // | 400 | 097 to 130 | | | |
| 1105 | // | // | // | 400 | 130 to 163 | | | |
| 1120 | $NO_x$ | // | // | 0 | 170 | | | PDS Sample 1121 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1125 | Zero | 795 | C803 F452 | 400 | 016 | 33.3 | | |
| 1130 | Zero | // | C803 F447 | 400 | 000 | 30 | | adjust fine zero |
| 1135 | Sample | // | // | 400 | 177 181 to | | | |
| 1205 | // | // | // | 350 | 203 to 229 | | | |
| 1220 | NOx | // | // | 0 | 236 | | | PDS Sample 1220 |
| 1225 | Sample | // | // | 400 | 234 238 to | | | cell temp 105°F |
| 1240 | // | // | // | // | 238 245 to | | | |
| 1255 | // | // | // | // | 245 to 122 | | | sieve switched to 1255 |
| 1304 | // | // | // | // | 122 228 to | | | |
| 1312 | // | // | // | // | 228 041 to | | | |
| 1335 | ~~Zero~~ // | // | // | // | 041 ~~to~~ | | | PDS Sample 1320 |
| 1336 | Zero | // | // | 400 | -012 | 27.5 | | |
| 1341 | Zero | // | C803 F451 | 400 | 000 | 30 | | adjust fine zero |
| 1345 | Sample | // | // | 400 | 048 049 to | | | |
| 1400 | // | // | // | // | 049 to 053 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

Page 3 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1415 | Sample | 795 | C 803 F451 | 400 | 053 | | | |
| 1420 | NOx | // | // | 0 | 053 | | | PDS Sample 1420 |
| 1425 | Sample | // | // | 400 | 060 066 to | | | cell temp 110°F |
| 1440 | zero | // | // | 400 | -020 | 26 | | |
| 1450 | zero | // | C 803 F458 | 400 | 000 | 30 | | adjust fine zero |
| 1456 | Sample | // | // | 400 | 087 to 086 | | | |
| 1510 | // | // | // | 400 | 086 to 085 | | | |
| 1523 | NOx | // | // | 0 | 083 | | | PDS Sample 1523 |
| 1528 | Sample | // | // | 400 | 086 to 090 | | | |
| 1538 | zero | // | // | 400 | -020 | 26 | | cell temp 111°F |
| 1541 | Zero | // | C 803 F465 | 400 | 000 | 30 | | adjust fine zero |
| 1544 | Sample | // | // | 400 | 110 to 114 | | | |
| 1600 | // | // | // | // | 114 to 126 | | | |
| 1620 | NOx | // | // | 0 | 125 | | | PDS Sample 1620 |
| 1626 | Sample | // | // | 400 | 127 to 132 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

Page 4 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1640 | Sample | 795 | C803 F465 | 400 | 132 to 136 | | | |
| 1655 | " | " | " | " | 136 to 138 | | | PDS Sample 1654 |
| 1658 | " | " | " | " | 138 | | | sieve switch 1658 |
| 1702 | " | " | " | " | 069 | | | |
| 1714 | " | " | " | " | 115 | | | |
| 1722 | Zero | " | " | 400 | -006 | 28.8 | | |
| 1727 | Zero | " | C803 F467 | 400 | 000 | 30 | | adjust fine zero |
| 1730 | Span | " | " | 400 | 031 | 36. | | |
| 1735 | 3980 Span | " | " | 400 | 3950 | | | Placed Analyzer on Range Two |
| | | | | | | | | cell temp 110°F |
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## $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/10/75

Instrument Ser. No. 0166

Location Hercules Bessemer Ala Outlet

Zero Gas <0.1 ppm NOx Cylinder Pressure 13

~~Zero~~ Span Gas 35 ppm $NO_2$ Cylinder Pressure 1700

Oxygen ______ Cylinder Pressure 2250

| TIME | MODE | SPAN SETTING (Indicate Adjustments) | ZERO SETTING (Indicate Adjustments) | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0835 | Zero | 795 | C803 F467 | 400 | 142 | 58 | | |
| 0840 | Zero | 795 | C790 F466 | 400 | 000 | 30 | | adjust coarse and fine zero |
| 0845 | 35ppm Span | " | " | " | 030 | 36 | | cell temp 100°F |
| 0855 | Zero | " | " | 100 | | decreasing | | |
| 1355 | Zero | " | " | 400 | -63 | 17.75 | | cell temp 110°F |
| 1400 | Zero | " | C790 F487 | " | 000 | 30 | | adjust fine zero |
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# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/11/75 — Zero Gas <0.1 ppm $NO_x$ — Cylinder Pressure 1310

Instrument Ser. No. 0166 6 — ~~Zero~~ Span Gas 35 ppm $NO_2$ — Cylinder Pressure 1650

Location Hercules, Bessemer Ala Outlet — Oxygen ____ — Cylinder Pressure 2310

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0805 | Zero | 795 | C 790 F 487 | 400 | +16 | 33.25 | | |
| 0820 | Zero | " | C 790 F 481 | 400 | 000 | 30 | | adjust fine zero |
| 0825 | " | " | " | 025 | 000 | 30 | | |
| 1300 | " | " | " | 400 | -046 | 21 | | |
| 1320 | " | " | C 790 F 497 | 400 | 000 | 30 | | adjust fine zero |
| 1325 | Span | " | " | " | 080 | 36 | | cell temperature 110°F |
| 1350 | zero | " | " | 400 | +008 | 29.9 | | |
| 1355 | " | " | C 790 F 494 | 400 | 000 | 30 | | adjust fine zero |
| 1356 | Sample | " | " | " | 017 to 023 | | | |
| 1420 | NOx | " | " | 0 | 029 | | | PDS Sample 1420 |
| 1425 | Zero | " | " | 400 | 019 | 34 | | |
| 1430 | " | " | C 790 F 480 | " | 000 | 30 | | adjust fine zero |
| 1435 | Sample | " | " | 400 | 008 to 014 | | | |
| 1450 | NOx | " | " | 0 | 014 | | | PDS Sample 1450 |
| 1455 | Zero ~~Sample~~ | " | " | 400 | 009 to 011 | | | |

$NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/11/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1500 | Zero | 795 | C 790 F 486 | 400 | 000 | 30 | | adjust fine zero |
| 1505 | Sample | // | // | 400 | 008 to 015 | | | |
| 1520 | NOx | // | // | 0 | 015 | | | PDS Sample 1520 |
| 1525 | Zero | // | // | 400 | 008 | | | |
| 1530 | Zero | // | C 790 F 482 | // | 000 | 30 | | adjust fine zero |
| 1535 | Sample | // | C 790 F 482 | 400 | 011 to 015 | | | |
| 1550 | NOx | // | // | 0 | 016 | | | PDS Sample 1550 |
| 1555 | Zero | // | // | 400 | 004 | 30.8 | | |
| 1600 | Zero | // | C 790 F 480 | // | 000 | 30 | | adjust fine zero |
| 1605 | Sample | // | // | 400 | 016 to 021 | | | |
| 1620 | NOx | // | // | 0 | 023 | | | PDS Sample 1620 |
| 1625 | Zero | // | // | 400 | 007 | | | |
| 1630 | Zero | // | C 790 F 477 | 400 | 000 | 30 | | |
| 1635 | Sample | // | // | 400 | 019 to 023 | | | |
| 1650 | NOx | // | // | 0 | 023 | | | PDS Sample 1650 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/~~12~~ 11/75

Page 3 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1655 | ~~Sample~~ zero | 795 | C790 F477 | 400 | 000 | 30 | | |
| 1700 | Sample | " | " | 400 | 023 to 024 | | | |
| 1720 | NOx | " | " | 0 | 024 | | | PDS Sample 1720 |
| 1725 | ~~Sample~~ zero | " | " | 400 | -003 | | | |
| 1730 | Zero | " | C790 F479 | " | 000 | 30 | | adjust Fine zero |
| 1735 | Sample | " | " | 400 | 026 to 025 | | | |
| 1750 | NOx | " | " | 0 | 025 | | | PDS Sample 1750 |
| 1755 | Zero | " | " | 400 | -003 | 29.3 | | |
| 1800 | zero | " | C790 F480 | 400 | 000 | 30 | | adjust fine zero |
| 1804 | Span | " | " | 400 | 029 | 34.8 | | cell temp 108°F |
| 1810 | Sample | " | " | 400 | | | | |
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# $NO_x$ FIELD DATA

## DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/12/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala, Outlet

Zero Gas <0.1ppm $NO_x$ Cylinder Pressure 1300

Zero Gas 35ppm $NO_x$ Cylinder Pressure 1650

Oxygen ______ Cylinder Pressure 2300

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0810 | Sample | 795 | C 790 F 460 | 400 | -26 | | | |
| 0815 | Zero | // | // | 400 | -76 | 15 | | |
| 0825 | // | // | C790 F503 | 400 | 000 | 30 | | adjust fine zero |
| 0840 | Span | // | // | 400 | 030 to 037 | | | cell temp 112 °F |
| 0845 | zero | // | // | 400 | 007 to 033 | | | |
| 0930 | Zero | // | C790 F491 | 400 | 000 | 30 | | adjust fine zero |
| 0935 | Sample | // | // | 400 | 072 to 083 | | | sieved switched 1002 B on absorb |
| 1002 | Sample | // | // | 400 | 083 053 to 077 | | | |
| 1027 | NOx | // | // | 0 | 077 | | | PDS Sample 1028 |
| 1032 | zero | // | // | 400 | 010 | 32 | | |
| 1037 | zero | // | C790 F488 | 400 | 000 | 30 | | adjust fine zero |
| 1040 | Sample | // | // | 400 | 046 to 049 | | | |
| 1122 | NOx | // | // | 0 | 049 | | | PDS Sample 1120 |
| 1127 | zero | // | // | 400 | 000 | 30 | | cell temp 113°F |
| 1130 | Sample | // | // | 400 | 052 to 050 | | | |

$NO_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1220 | NOx | 795 | C790 F488 | 0 | 050 | | | PDS sample 1220 |
| 1225 | Zero | " | " | 400 | -008 | 28.25 | | cell temp 114°F |
| 1230 | zero | " | C790 F490 | 400 | 000 | 30 | | adjust fine zero |
| 1235 | Sample | " | " | 400 | 063 to 067 | | | |
| 1320 | NOx | " | " | 0 | peak 066 | | | |
| 1325 | Zero | " | " | 400 | -010 | | | |
| 1330 | Zero | " | C790 F495 | 400 | 000 | 30 | | adjust fine zero |
| 1335 | Sample | " | " | 400 | 077 to 101 | | | 1345 increased production sieve switched 1404 to A absorb |
| 1404 | Sample | " | " | 400 | 055 to 093 to 059 | | | |
| 1435 | NOx | " | " | 0 | 060 | | | PDS Sample 1430 |
| 1440 | zero | " | " | 400 | 011 | 32.25 | | |
| 1445 | zero | " | C790 F491 | 400 | 000 | 30 | | adjust fine zero |
| 1450 | Sample | " | " | 400 | 045 to 054 | | | |
| 1520 | NOx | " | " | 0 | 053 | | | PDS Sample 1520 |
| 1525 | Zero | " | " | 400 | 003 to 005 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

Page 3 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1530 ~~ZERO~~ | zero | 795 | C790 F488 | 400 | 000 | 30 | | adjust fine zero |
| 1535 | Sample | " | " | " | 061 to 088 | | | |
| 1620 | NOx | " | " | 0 | 090 | | | PDS Sample 1620 |
| 1625 | zero ~~Sample~~ | " | " | 400 | 016 | 33.3 | | |
| 1633 | zero | " | C790 F483 | 400 | 000 | 30 | | adjust fine zero cell temp 108°C |
| 1638 | Sample | " | " | 400 | 077 to 096 | | | |
| 1720 | NOx | " | " | 0 | 095 | | | PDS Sample 1820 |
| 1725 | zero ~~Sample~~ | " | " | 400 | 004 | 30.8 | | |
| 1730 | zero | " | C790 F482 | " | 000 | 30 | | adjust fine zero |
| 1735 | Sample | " | " | 400 | 103 to 121 | | | cell temp 109°F |
| 1806 | Sample | " | " | 400 | 121 | | | sieve switched |
| 1810 | zero | " | " | 400 | 000 | 30 | | |
| 1833 | Span | " | " | 400 | 031 | 36.2 | | cell temp 108°F |
| 1845 | Sample | " | " | 400 | | | | |
| | | | | | | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/13/75 Zero Gas <0.1ppm NO$_x$ Cylinder Pressure 1200

Instrument Ser. No. 0166 ~~Zero~~ Span Gas 35 ppm Cylinder Pressure

Location Hercules, Bessemer Ala Outlet Oxygen Cylinder Pressure

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0815 | Sample | 795 | C790 F482 | 400 | 84 | | | cell temp 105°F |
| 0816 | zero | // | // | 400 | +32 | 36.4 | | |
| 0830 | // | // | C 790 F 469 | // | 000 | 30 | | adjust fine zero |
| 0845 | Span | // | // | 400 | 032 | 36.4 | | |
| 0900 | zero | // | // | 400 | 000 | 30 | | |
| 0907 | Span | // | // | 400 | 031 | 36.2 | | |
| 0925 | Sample | // | // | 400 | 057 070 | | | |
| 1010 | zero | // | // | 400 | 010 | 32 | | |
| 1013 | zero | // | C790 F466 | 400 | 000 | 30 | | adjust fine zero |
| 1016 | Sample | // | // | 400 | 041 to 054 | | | sieve switched 1017 to B on Adsorb |
| 1049 | NOx | // | // | 0 | 056 | | | Bypass opened 1040 PDS Sample 1049 |
| 1054 | Sample | // | // | 400 | 049 to 050 | | | |
| 1135 | NOx | // | // | 0 | 051 | | | PDS sample 1135 |
| 1140 | zero ~~sample~~ | // | // | 400 | 022 | 34.3 | | |
| 1145 | zero | // | C790 F458 | 400 | | | | adjust fine zero increased production 1141 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1150 | Sample | 795 | C 790 F 458 | 400 | 030 to 052 | | | |
| 1222 | NOx | " | " | 0 | 054 | | | |
| 1227 | Zero | " | " | 400 | -004 | | | cell temp 107°F |
| 1232 | zero | " | C 790 F 460 | 400 | 000 | 30 | | adjust fine zero |
| 1235 | Sample | " | " | 400 | 069 to 102 | | | |
| 1320 | NOx | " | " | 0 | 102 | | | |
| 1325 | zero | " | " | 400 | -07 | 26.7 | | cell temp 108°F PDS Sample 1325 |
| 1330 | zero | " | C 790 F 466 | " | 000 | 30 | | adjust fine zero |
| 1335 | Sample | " | " | 400 | 136 to 147 | | | cell temp 109°F |
| 1357 | Sample | " | " | 400 | 147 to 187 | | | Sundyne off and on Bypass valve opened |
| 1447 | zero | " | " | 400 | -012 | | | cell temp 109°F |
| 1450 | zero | " | C 790 F 470 | 400 | 000 | | | adjust Fine zero |
| 1452 | Sample | " | " | 400 | 202 to 187 | | | |
| 1503 | Sample | " | " | 400 | 045 | | | sieve switched to A on adsorb |
| 1535 | NOx | " | " | 0 | 044 | | | PDS Sample 1535 |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 3 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1540 | Zero | 795 | C 790 F 458 | 400 | 014 | 26.2 | | cell temp 110°F |
| 1545 | zero | // | C 790 F 476 | 400 | 000 | 30 | | adjust fine zero |
| 1550 | Sample | // | // | 400 | 051 to 093 | | | |
| 1635 | NOx | // | // | 0 | 102 to 104 | | | PDS Sample 1635 cell temp 109°F |
| 1640 | Zero | // | // | 400 | 016 | 33 | | |
| 1643 | zero | // | C 790 F 470 | // | 000 | 30 | | adjust fine zero |
| 1645 | Sample | // | // | 400 | 102 to 148 | | | |
| 1730 | zero | // | // | 400 | 005 | 31 | | |
| 1733 | zero | // | C 790 F 467 | // | 000 | 30 | | adjust fine zero |
| 1735 | Sample | // | // | 400 | 148 to 165 | | | cell temp 108°F |
| 1750 | NOx | // | // | 0 | 165 | | | PDS Sample 1735 |
| 1755 | Sample | // | // | 400 | 174 to 192 | | | |
| 1810 | zero | // | // | 400 | -005 | | | |
| 1813 | zero | // | C 790 F 470 | // | 000 | 30 | | adjust fine zero |
| 1815 | Sample | // | // | 400 | 208 to 255 | | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page ~~4~~ of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1845 | NOx | 795 | C790 F470 | 0 | 256 | | | cell temp 108°F |
| 1850 | Sample | // | // | 400 | 264 to 271 | | | PDS Sample 1850 |
| 1905 | zero | // | // | 400 | +03 | 30.5 | | sieve switched to B on adsorb |
| 1910 | // | // | C790 F469 | 400 | 000 | 30 | | adjust fine zero |
| 1913 | Span | // | // | 400 | 032 | 36.5 | | cell temp 106°F |
| 1920 | Sample | // | // | 400 | | | | |
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NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/14/75 | Zero Gas <0.1 ppm NOx | Cylinder Pressure 1150

Instrument Ser. No. 0166 | ~~Zero~~ Span Gas 35 ppm NO2 | Cylinder Pressure 1600

Location Hercules, Bessemer Ala Outlet | Oxygen | Cylinder Pressure 2200

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 0630 | Sample | 795 | C790 F469 | 400 | | | | |
| 0635 | Zero | " | " | " | 102 | 50.5 | | |
| 0643 | zero | " | C790 F433 | " | 000 | 30 | | adjust fine zero |
| 0645 ~~Span~~ | Span | " | " | 400 | 031 | 36 | | cell temp 98°C |
| 0651 | Sample | " | " | 400 | 155 to 192 | | | |
| 0711 | Sample | " | " | 400 | 80 to 116 to 67 | | | Sieve switch to A on Adsorb 0711 |
| 0750 | NOx | " | " | 0 | 068 | | | |
| 0755 | zero | " | " | 400 | 008 | | | PDS Sample 0755 |
| 0758 | zero | " | C790 F429 | 400 | 000 | 30 | | adjust fine zero |
| 0802 | Sample | " | " | 400 | 056 to 099 | | | |
| 0848 | NOx | " | " | 0 | 099 | | | cell temp 102°F |
| 0853 | Zero | " | " | 400 | 000 | 30 | | |
| 0858 | Sample | " | " | 400 | 114 to 163 | | | |
| 0951 | NOx | " | " | 0 | 163 | | | PDS Sample 0951 |
| 0956 | Zero | " | " | 400 | 000 | 30 | | |

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/14/75

Page 2 of 0166 Outlet

| TIME | MODE | (Indicate Adjustments) SPAN SETTING | ZERO SETTING | FLOW (cc/min) | METER CONC. (ppm) | AVERAGE RECORDER % OF CHART | CONC. FROM CHART (ppm) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1000 | Sample | 795 | C790 F429 | 400 | 183 to 235 | | | |
| 1051 | NOx | // | // | 0 | 235 | | | PDS sample 1051 cell temp 101° F |
| 1056 | Zero | // | // | 400 | -001 | | | |
| 1058 | Zero | // | C790 F430 | // | 000 | 30 | | adjust Fine zero |
| 1100 | Sample | // | // | 400 | 241 to 249 | | | |
| 1114 | Sample | // | // | 400 | 249 | | | sieve switched 1114 |
| 1115 | zero | // | // | 400 | +003 | 30.75 | | |
| 1122 | zero | // | C790 F429 | 400 | 000 | 30 | | adjust fine zero |
| 1127 | Span | // | // | 400 | 032 | | | cell temp 100 |
| | | | | | | | | |
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# APPENDIX E

# FIELD DATA FOR EPA METHOD NO. 7 TESTS

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. CAL. GAS.

Hercules Inc. Bessemer, Ala. 3980 ppm

| | | 1 | 2 | 3 |
|---|---|---|---|---|
| | Time | | | |
| | Flask Number | 6 | 7 | 8 |
| $V_f$ | Volume of Flask and Valve, ml | 2073 | 2099 | 2058 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2048 | 2074 | 2033 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.76 | 29.76 | 29.76 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.75 | 26.65 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.01 | 3.11 | 3.26 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.53 | 29.80 | 29.80 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -8.78 | -2.85 | -2.35 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 20.75 | 26.95 | 27.45 |
| $T_i$ | Initial Flask Temperature, °F | 75 | 75 | 63 |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | 535 | 523 |
| $T_f$ | Final Flask Temperature, °F | 74 | 66 | 68 |
| $T_{fr}$ | Final Flask Temperature, °R | 534 | 526 | 528 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | 1205 | 1668 | 1647 |
| M | Mass of $NO_2$ in Gas Sample, µg | 6,250 | 13,350 | 12,750 |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | 3.215 x [illegible] | 4.961 x [illegible] | [illegible] x $10^{-2}$ |
| | ppmv | 2705 | 4174 | 4037 |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

$$ppmv = \frac{(C)(387 \times 10^6)}{46}$$

# NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR 75

RUN NO. Cal Gas

Hercules, Inc. Bessemer, Ala.

| | | 4 | 5 | 6 |
|---|---|---|---|---|
| | Time | | | |
| | Flask Number | 10 | 11 | 12 |
| $V_f$ | Volume of Flask and Valve, ml | 2050 | 2052 | 2067 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2025 | 2027 | 2042 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.76 | 29.75 | 29.75 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.60 | 26.65 | 26.60 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.16 | 3.10 | 3.15 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.80 | 29.80 | 29.80 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | 0.00 | 0.00 | -1.60 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.80 | 29.80 | 28.20 |
| $T_i$ | Initial Flask Temperature, °F | 74 | 74 | 74 |
| $T_{ir}$ | Initial Flask Temperature, °R | 534 | 534 | 534 |
| $T_f$ | Final Flask Temperature, °F | 68 | 68 | 68 |
| $T_{fr}$ | Final Flask Temperature, °R | 528 | 528 | 528 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | 1812 | 1818 | 1718 |
| M | Mass of $NO_2$ in Gas Sample, μg | 142 | 138 | 142 |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | 4.859 x10⁻⁶ | 4.707 x10⁻⁶ | 5.124 x10⁻⁶ |
| | | 42.? | 39.6 | [illegible] |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

ppmv = $\frac{(C)(5.77 \times 10^{6})}{46}$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. inlet HV-12

Hercules, Inc. Bessemer, Ala.

| | | Run No.: HV-12-1 | HV-12-1 | HV-12-2 |
|---|---|---|---|---|
| | Time | CONTAMINATE | 1316 | 1345 |
| | Flask Number | *1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.75 | 29.75 | 29.74 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 2600 | 26.50 | 26.65 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 3.25 | 3.09 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.76 | 29.77 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | -0.50 | -4.90 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 29.26 | 24.87 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 75 | 74 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 535 | 535 |
| $T_f$ | Final Flask Temperature, °F | | 71 | 70 |
| $T_{fr}$ | Final Flask Temperature, °R | | 531 | 530 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

* $H_2O$ sucked back from bypass line

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar 75

RUN NO. inlet · HV-12

Hercules, Inc. Bessemer, Ala.

| | | Run No. - HV-12-3 | HV-12-4 | HV-12-5 |
|---|---|---|---|---|
| | Time | 1415 | 1446 | 1516 |
| | Flask Number | 7 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2053 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | 2028 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.72 | 29.71 | 29.71 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.60 | 26.60 | 26.70 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.12 | 3.11 | 3.01 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.78 | 29.77 | 29.73 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.05 | -0.60 | +0.20 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.73 | 29.17 | 29.93 |
| $T_i$ | Initial Flask Temperature, °F | 75 | 75 | 70 |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | 535 | 530 |
| $T_f$ | Final Flask Temperature, °F | 70 | 73 | 81 |
| $T_{fr}$ | Final Flask Temperature, °R | 530 | 533 | 541 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. inlet - HV-12

Hercules, Inc. Bessemer, Ala.

| | Run No. - | HV-12-6 | HV-12-7 | HV-12-8 |
|---|---|---|---|---|
| | Time | 1545 | 1645 | 1745 |
| | Flask Number | 13 | 15 | 1 |
| $V_f$ | Volume of Flask and Valve, ml | 2071 | 2064 | 2039 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2046 | 2039 | 2014 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.70 | 29.68 | 29.66 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.60 | 26.65 | 26.60 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.10 | 3.03 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.73 | 29.72 | 29.76 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | 0.00 | +0.05 | +0.85 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.73 | 29.77 | 30.61 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 68 | 71 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 528 | 531 |
| $T_f$ | Final Flask Temperature, °F | 76 | 75 | 71 |
| $T_{fr}$ | Final Flask Temperature, °R | 536 | 535 | 531 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. Inlet HU-12

Hercules, Inc. Bessemer, Ala.

| | Run No | HU 12-9 | HU 12-10 | HU-12[illegible] |
|---|---|---|---|---|
| | Time | 1015 | 1115 | 1215 |
| | Flask Number | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.78 | 29.77 | 29.76 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | 26.60 | 26.65 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.38 | 3.17 | 3.11 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.65 | 29.64 | 29.64 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +0.45 | -5.85 | -1.95 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 30.10 | 23.79 | 27.69 |
| $T_i$ | Initial Flask Temperature, °F | 75 | 73 | 73 |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | 533 | 533 |
| $T_f$ | Final Flask Temperature, °F | 74 | 73 | 73 |
| $T_{fr}$ | Final Flask Temperature, °R | 534 | 533 | 533 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06-MAR 75

RUN NO. Inlet HV-12

Hercules, Inc. Bessemer, Ala.

| | Run No.- | HV-12-12 | HV-12-13 | HV-12-14 |
|---|---|---|---|---|
| | Time | 1316 | 1415 | 1515 |
| | Flask Number | 7 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2053 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | 2028 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.75 | 29.73 | 29.73 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.35 | 26.40 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.25 | 3.38 | 3.33 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.63 | 29.61 | 29.60 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +0.05 | -1.75 | -1.05 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.68 | 27.86 | 28.55 |
| $T_i$ | Initial Flask Temperature, °F | 74 | 74 | 74 |
| $T_{ir}$ | Initial Flask Temperature, °R | 534 | 534 | 534 |
| $T_f$ | Final Flask Temperature, °F | 73 | 73 | 72 |
| $T_{fr}$ | Final Flask Temperature, °R | 533 | 533 | 532 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. Inlet HU12

Hercules, Inc Bessemer Ala.

| | | Run No. HU12-15 | HU-12-16 | |
|---|---|---|---|---|
| | Time | 1616 | 1715 | |
| | Flask Number | 13 | 15 | |
| $V_f$ | Volume of Flask and Valve, ml | 2071 | 2064 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2046 | 2039 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.71 | 29.70 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.45 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.21 | 3.25 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.61 | 29.58 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +0.45 | -6.10 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 30.06 | 23.48 | |
| $T_i$ | Initial Flask Temperature, °F | 75 | 73 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | 533 | |
| $T_f$ | Final Flask Temperature, °F | 73 | 74 | |
| $T_{fr}$ | Final Flask Temperature, °R | 533 | 534 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 7 MAR 75

RUN NO. HV-12 - Inlet

Hercules, Inc. Bessemer, Ala.

| | | Run No.: HV-12-17 | HV-12-18 | HV-12-19 |
|---|---|---|---|---|
| | Time | 915 | 1015 | 1115 |
| | Flask Number | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.65 | 29.63 | 29.61 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.55 | 26.25 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.20 | 3.08 | 3.36 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.83 | 29.84 | 29.84 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -2.10 | -0.90 | -4.85 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.73 | 28.94 | 24.99 |
| $T_i$ | Initial Flask Temperature, °F | 74 | 73 | 72 |
| $T_{ir}$ | Initial Flask Temperature, °R | 534 | 533 | 532 |
| $T_f$ | Final Flask Temperature, °F | 67 | 65 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 527 | 525 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[ \frac{M}{V_{sc}} \right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR

RUN NO. HV12 Inlet

Hercules, Inc. Bessemer Ala Run No -

| | | HV12-20 | HV-12-21 | HV12-22 |
|---|---|---|---|---|
| | Time | 1215 | 1316 | 1415 |
| | Flask Number | 7 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2053 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | 2028 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.61 | 29.60 | 29.58 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.35 | 26.50 | 26.25 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.26 | 3.10 | 3.33 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.85 | 29.84 | 29.82 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.75 | -3.55 | -4.10 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.10 | 26.29 | 25.72 |
| $T_i$ | Initial Flask Temperature, °F | 72 | 73 | 76 |
| $T_{ir}$ | Initial Flask Temperature, °R | 532 | 533 | 536 |
| $T_f$ | Final Flask Temperature, °F | 64 | 65 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 524 | 525 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR 75

RUN NO. HV 12 Inlet

Hercules Inc. Bessemer, Ala.

| | | Run No. HV12-23 | HV12-24 | HV12-25 |
|---|---|---|---|---|
| | Time | 1517 | 1615 | 1658 ~~1700~~ |
| | Flask Number | 13 | 15 | 6 (ES) |
| $V_f$ | Volume of Flask and Valve, ml | 2071 | 2064 | 2073 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2046 | 2039 | 2048 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.56 | 29.53 | 29.54 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.35 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.06 | 3.18 | 3.04 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.82 | 29.82 | 29.82 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.75 | -4.10 | -1.00 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.07 | 25.72 | 28.82 |
| $T_i$ | Initial Flask Temperature, °F | 77 | 75 | 78 |
| $T_{ir}$ | Initial Flask Temperature, °R | 537 | 535 | 538 |
| $T_f$ | Final Flask Temperature, °F | 65 | 65 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 525 | 525 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75  PLANT Hercules Inc.

RUN NO. Inlet Hl'12  LOCATION Bessemer, Ala.

| | | Run No | Hl'12-26 | Hl'12-27 | Hl'12-28 |
|---|---|---|---|---|---|
| | Time | | 1415 | 1445 | 1515 |
| | Flask Number | | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | | 29.65 | 29.65 | 29.62 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | | 27.35 | 27.10 | 26.75 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 2.30 | 2.55 | 2.87 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.61 | 29.51 | 29.50 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | +0.55 | -0.80 | +0.20 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 30.06 | 28.71 | 29.70 |
| $T_i$ | Initial Flask Temperature, °F | | 74 | 73 | 75 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 534 | 533 | 535 |
| $T_f$ | Final Flask Temperature, °F | | 78 | 78 | 78 |
| $T_{fr}$ | Final Flask Temperature, °R | | 538 | 538 | 538 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left|\frac{M}{V_{sc}}\right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 PLANT Hercules INC.

RUN NO. Inlet HV12 Location Bessemer Ala

1/13 outlet

| | | | HV12-29 | HV12-30 | HV12-31 |
|---|---|---|---|---|---|
| | Run No | | HV12-29 | HV12-30 | HV12-31 |
| | Time | | 1545 | 1615 | 1645 |
| | Flask Number | | 8 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2080 | ~~2116~~ | 2053 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | ~~25~~ | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2055 | ~~2091~~ | 2028 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.62 | ~~29.62~~ | 29.61 | 29.60 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.60 | ~~26.70~~ | 26.65 | 26.75 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 3.02 | 2.96 | 2.85 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.53 | 29.55 | 29.55 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | -7.50 | -3.80 | -2.25 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 22.03 | 25.75 | 27.30 |
| $T_i$ | Initial Flask Temperature, °F | 77 | ~~77~~ | 73 | 75 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 537 | 533 | 535 |
| $T_f$ | Final Flask Temperature, °F | | 78 | 79 | 77 |
| $T_{fr}$ | Final Flask Temperature, °R | | 538 | 539 | 537 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left|\frac{M}{V_{sc}}\right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 PLANT Hercules Inc.

RUN NO. Inlet HV 12 Location Bessemer, Ala.

| | Run No | HV12 32 | HV12 33 | ~~HV12 34~~ |
|---|---|---|---|---|
| | Time | 1715 | 1745 | |
| | Flask Number | 8 (E3) | 15 | |
| $V_f$ | Volume of Flask and Valve, ml | 2058 | 2064 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2033 | 2039 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.60 | 29.60 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.75 | 26.65 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 2.85 | 2.95 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.55 | 29.50 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +1.50 | -0.90 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 31.05 | 28.60 | |
| $T_i$ | Initial Flask Temperature, °F | 73 | 75 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 535 | |
| $T_f$ | Final Flask Temperature, °F | 77 | 76 | |
| $T_{fr}$ | Final Flask Temperature, °R | 537 | 536 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left| \frac{M}{V_{sc}} \right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75 PLANT Hercules Inc.

RUN NO. Inlet HV12 LOCATION Bessemer, Ala.

| | Run No | HV12-34 | HV12-35 | HV12-36 |
|---|---|---|---|---|
| | Time | 1023 | 1117 | 1215 |
| | Flask Number | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.53 | 29.53 | 29.55 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.55 | 26.45 | 26.45 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 2.98 | 3.08 | 3.10 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.46 | 29.47 | 29.46 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.65 | -1.05 | -2.05 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.81 | 28.42 | 27.41 |
| $T_i$ | Initial Flask Temperature, °F | 77 | 78 | 78 |
| $T_{ir}$ | Initial Flask Temperature, °R | 537 | 538 | 538 |
| $T_f$ | Final Flask Temperature, °F | 75 | 73 | 72 |
| $T_{fr}$ | Final Flask Temperature, °R | 535 | 533 | 532 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75 PLANT Hercules INC.

RUN NO. Inlet HV12 Location Bessemer Ala

| | | RUN No. HV12-31 | HV12-33 | HV12-39 |
|---|---|---|---|---|
| | Time | 1316 | 1430 | 1516 |
| | Flask Number | 7 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2063 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | 2038 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.55 | 29.54 | 29.54 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.35 | 26.40 | 26.20 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.20 | 3.14 | 3.34 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.42 | 29.42 | 29.33 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +0.05 | -0.45 | -0.20 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.47 | 28.97 | 29.13 |
| $T_i$ | Initial Flask Temperature, °F | 78 | 78 | 77 |
| $T_{ir}$ | Initial Flask Temperature, °R | 538 | 538 | 537 |
| $T_f$ | Final Flask Temperature, °F | 68 | 68 | 74 |
| $T_{fr}$ | Final Flask Temperature, °R | 528 | 528 | 534 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. HV12 Inlet

Hercules, Inc. Bessemer Ala. Run No.

| | | HV-12-40 | HV12-41 | |
|---|---|---|---|---|
| | Time | 1615 | 1715 | |
| | Flask Number | 8 (ES) | 15 | |
| $V_f$ | Volume of Flask and Valve, ml | 2058 | 2064 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2033 | 2039 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.50 | 29.48 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | 26.35 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.10 | 3.13 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.33 | 29.32 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | 0.00 | -0.40 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.33 | 28.92 | |
| $T_i$ | Initial Flask Temperature, °F | 77. | 76 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 537 | 536 | |
| $T_f$ | Final Flask Temperature, °F | 70 | 71 | |
| $T_{fr}$ | Final Flask Temperature, °R | 530 | 531 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 Mar 74

RUN NO. Inlet HV12

Hercules Inc Bessemer Ala.

| | Run No | HV12-42 | HV12-43 | HV12-44 |
|---|---|---|---|---|
| | Time | 1047 | 1132 | 1219 |
| | Flask Number | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.44 | 29.43 | 29.41 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.35 | 26.25 | 26.35 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.09 | 3.18 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.56 | 29.59 | 29.63 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -2.90 | -3.30 | -3.60 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 26.66 | 26.29 | 26.03 |
| $T_i$ | Initial Flask Temperature, °F | 70 | 68 | 70 |
| $T_{ir}$ | Initial Flask Temperature, °R | 530 | 528 | 530 |
| $T_f$ | Final Flask Temperature, °F | 59 | 58 | 59 |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 518 | 519 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. Inlet HV 12

Hercules Inc - Bessemer, Ala. Run No -

| | | HV1245 | 46 | 47 |
|---|---|---|---|---|
| | Time | 1317 | 1530 | 1632 |
| | Flask Number | 7 | 9 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2063 | 2069 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | 2038 | 2044 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.39 | 29.32 | 29.32 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.30 | 26.30 | 26.35 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.09 | 3.02 | 2.97 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.65 | 29.70 | 29.70 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -2.25 | -2.65 | -1.35 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.40 | 27.05 | 28.35 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 73 | 77 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 533 | 537 |
| $T_f$ | Final Flask Temperature, °F | 59 | 59 | 59 |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 519 | 519 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

# NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE Mar 75

RUN NO. Inlet - HV12

Hercules Inc. Bessemer, Ala. Run No.

| | | HV12-48 | 49 | |
|---|---|---|---|---|
| | Time | 1732 | 1847 | |
| | Flask Number | 8 (ES) | 15 | |
| $V_f$ | Volume of Flask and Valve, ml | 2058 | 2064 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2033 | 2039 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.35 | 29.26 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.30 | 26.25 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.05 | 3.01 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.70 | 29.70 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -2.25 | -1.85 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.45 | 27.85 | |
| $T_i$ | Initial Flask Temperature, °F | 70 | 72 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 530 | 532 | |
| $T_f$ | Final Flask Temperature, °F | 59 | 60 | |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 520 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. INLet HV12

Hercules, Inc. Bessemer Alg. Run No.

| | | 50 | 51 | 52 |
|---|---|---|---|---|
| | Time | 0747 | 0847 | 947 |
| | Flask Number | 1 | 3 | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2039 | 1965 | 1955 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2014 | 1940 | 1930 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.59 | 29.62 | 29.63 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.50 | 26.70 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.14 | 3.12 | 293 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | 29.79 | 29.79 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.65 | -0.75 | -0.35 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.14 | 29.04 | 29.44 |
| $T_i$ | Initial Flask Temperature, °F | 60 | 60 | 60 |
| $T_{ir}$ | Initial Flask Temperature, °R | 520 | 520 | 520 |
| $T_f$ | Final Flask Temperature, °F | 51 | 51 | 54 |
| $T_{fr}$ | Final Flask Temperature, °R | 511 | 511 | 514 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Inlet HV-12

Hercules, Inc. Bessemer Ala. Run No. 53

| | | | | |
|---|---|---|---|---|
| | Time | 1047 | | |
| | Flask Number | 7 | | |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.66 | | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.65 | | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.01 | | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.35 | | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 2844 | | |
| $T_i$ | Initial Flask Temperature, °F | 59 | | |
| $T_{ir}$ | Initial Flask Temperature, °R | 519 | | |
| $T_f$ | Final Flask Temperature, °F | 54 | | |
| $T_{fr}$ | Final Flask Temperature, °R | 514 | | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[ \frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar 75

RUN NO. outlet - HV-13

Hercules Inc. Bessemer, Ala.

| | | Run No.- HV-13-1 | HV-13-2 | HV-13-3 |
|---|---|---|---|---|
| | Time | 1258 | 1318 | 1350 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.75 | 29.75 | 29.74 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | 26.65 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.35 | 3.10 | 3.24 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.76 | 29.76 | 29.77 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +0.05 | - 1.50 | -0.05 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.81 | 28.26 | 29.72 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 75 | 73 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 535 | 533 |
| $T_f$ | Final Flask Temperature, °F | 71 | 70 | 70 |
| $T_{fr}$ | Final Flask Temperature, °R | 531 | 530 | 530 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

# NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. Outlet - HV-13

Hercules, Inc. Bessemer, Ala.

| | | Run No. - HV-13-4 | HV-13-5 | HV-13-6 |
|---|---|---|---|---|
| | Time | 1420 | 1454 | 1520 |
| | Flask Number | 8 | 10* | 12 |
| $V_f$ | Volume of Flask and Valve, ml | 2080 | 2053 | 2076 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2055 | 2028 | 2051 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.72 | 29.71 | 29.71 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.55 | 26.60 | 26.55 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.17 | 3.11 | 3.16 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.78 | 29.77 | 29.73 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | 0.00 | +1.25 | +0.45 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.78 | 31.02 | 30.18 |
| $T_i$ | Initial Flask Temperature, °F | 75 | 75 | 73 |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | 535 | 533 |
| $T_f$ | Final Flask Temperature, °F | 73 | 73 | 73 |
| $T_{fr}$ | Final Flask Temperature, °R | 533 | 533 | 533 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

* E.S. STOPCOCK No. 9 must be calibrated

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 MAR 75

RUN NO. HV-13 Outlet

Hercules INC. Bessemer, Ala.

| | | HV13-7 | HV13-8 | HV13-9 |
|---|---|---|---|---|
| | Time | 1550 | 1650 | 1750 |
| | Flask Number | 14 | 16* | 18 |
| $V_f$ | Volume of Flask and Valve, ml | 2124 | 2071 | 2078 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2099 | 2046 | 2053 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.70 | 29.68 | 29.66 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.55 | 26.55 | 26.60 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | +3.15 | 3.13 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.72 | 29.72 | 29.70 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | +1.20 | +1.40 | +2.00 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 30.92 | 31.12 | 31.70 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 70 | 71 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 530 | 531 |
| $T_f$ | Final Flask Temperature, °F | 74 | 74 | 74 |
| $T_{fr}$ | Final Flask Temperature, °R | 534 | 534 | 534 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left|\frac{M}{V_{sc}}\right|$$

# NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. Outlet - HV-13-

Hercules Inc. Bessemer, Ala.

| | | Run No. HV-13-10 | HV-13-11 | HV-13-12 |
|---|---|---|---|---|
| | Time | 1021 | 1120 | 1220 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.78 | 29.77 | 29.76 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.65 | 26.65 | 26.55 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.13 | 3.12 | 3.21 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.65 | 29.64 | 29.63 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.65 | -0.10 | -1.45 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.00 | 29.54 | 28.18 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 73 | 72 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 533 | 532 |
| $T_f$ | Final Flask Temperature, °F | 73 | 73 | 73 |
| $T_{fr}$ | Final Flask Temperature, °R | 533 | 533 | 533 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. HV-13 - Outlet

Hercules, Inc. Bessemer, Ala.

| | | Run No. HV13-13 | HV-13-14 | HV 13-15 |
|---|---|---|---|---|
| | Time | 1320 | 1420 | 1520 |
| | Flask Number | 8 | 10 | 12 |
| $V_f$ | Volume of Flask and Valve, ml | 2080 | 2053 | 2076 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2055 | 2028 | 2051 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.75 | 29.73 | 29.73 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.40 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.30 | 3.33 | 3.23 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.61 | 29.61 | 29.61 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -5.75 | +0.50 | -4.55 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 23.86 | 30.11 | 25.06 |
| $T_i$ | Initial Flask Temperature, °F | 74 | 74 | 74 |
| $T_{ir}$ | Initial Flask Temperature, °R | 534 | 534 | 534 |
| $T_f$ | Final Flask Temperature, °F | 72 | 72 | 73 |
| $T_{fr}$ | Final Flask Temperature, °R | 532 | 532 | 533 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

# NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. Outlet HU13

Hercules, Inc Bessemer Ala. Run No.

| | | HU13 16 | HU13 17 | |
|---|---|---|---|---|
| | Time | 1621 | | |
| | Flask Number | 14 | 16 | |
| $V_f$ | Volume of Flask and Valve, ml | 2124 | 2071 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2099 | 2046 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.71 | 29.70 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | 26.55 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.31 | | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.60 | | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.45 | | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.15 | | |
| $T_i$ | Initial Flask Temperature, °F | 75 | 73 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 535 | | |
| $T_f$ | Final Flask Temperature, °F | 73 | | |
| $T_{fr}$ | Final Flask Temperature, °R | 533 | | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 7 MAR 75

RUN NO. HV-13 Outlet

| Hercules, Inc. Bessemer Ala. Run No. | | HV-13-17 | HV-13-18 | HV-13-19 |
|---|---|---|---|---|
| | Time | 0921 | 1021 | 1121 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.65 | 29.63 | 29.61 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.45 | 26.55 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.15 | 3.18 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.84 | 29.84 | 29.84 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.45 | -0.35 | -0.65 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.39 | 29.49 | 29.19 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 73 | 72 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 533 | 532 |
| $T_f$ | Final Flask Temperature, °F | 64 | 64 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 524 | 524 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR

RUN NO. HV13 - Outlet

Hercules Inc. Bessemer Ala. Run No.

| | | HV13-20 | HV13-21 | HV13-22 |
|---|---|---|---|---|
| | Time | 1220 | 1320 | 1420 |
| | Flask Number | 08 | 10 | 12 |
| $V_f$ | Volume of Flask and Valve, ml | 2080 | 2053 | 2076 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2055 | 2028 | 2051 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.61 | 29.60 | 29.58 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.45 | 26.40 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.11 | 3.15 | 3.18 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 2984 | 29.84 | 29.83 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.75 | -0.90 | -2.25 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 2309 | 28.94 | 2733 |
| $T_i$ | Initial Flask Temperature, °F | 72 | 73 | 76 |
| $T_{ir}$ | Initial Flask Temperature, °R | 532 | 533 | 536 |
| $T_f$ | Final Flask Temperature, °F | 65 | 65 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 525 | 525 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 Mar 75

RUN NO. HV-13 Outlet

Hercules Inc. Bessemer Ala. Run No.-

| | | HV13-23 | HV13-24 * | HV13-25 |
|---|---|---|---|---|
| | Time | 1524 | 1620 | 1654 |
| | Flask Number | 14 | 16 | 18 |
| $V_f$ | Volume of Flask and Valve, ml | 2124 | 2071 | 2078 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 50 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2099 | 2021 | 2053 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.56 | 29.53 | 29.54 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.50 | 26.45 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.11 | 3.03 | 3.09 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.82 | 29.82 | 29.82 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -2.15 | -2.60 | -3.70 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.67 | 27.22 | 26.12 |
| $T_i$ | Initial Flask Temperature, °F | 77 | 75 | 77 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 535 | 537 |
| $T_f$ | Final Flask Temperature, °F | 65 | 65 | 65 |
| $T_{fr}$ | Final Flask Temperature, °R | 525 | 525 | 525 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

* HV13-24 was charged with 50ml POS

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 Plant Hercules Inc.

RUN NO. Outlet HU13 Location Bessemer, Ala

| | | Run No. | HU13-26 | HU13-27 | HU13-28 |
|---|---|---|---|---|---|
| | Time | | 1420 | 1450 | 1520 |
| | Flask Number | | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | | 29.65 | 29.65 | 29.62 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | | 27.00 | 26.85 | 26.65 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 2.65 | 2.80 | 2.97 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.51 | 29.51 | 29.53 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | +0.50 | +0.25 | 0.00 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 30.01 | 29.76 | 29.53 |
| $T_i$ | Initial Flask Temperature, °F | | 74 | 73 | 75 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 534 | 533 | 535 |
| $T_f$ | Final Flask Temperature, °F | | 77 | 77 | 78 |
| $T_{fr}$ | Final Flask Temperature, °R | | 537 | 537 | 538 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[ \frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 Mar 75 Plant Heaches Inc.

RUN NO. HV13 Outlet Location Bosseemer, Ala.

Run No -

| | | | HV13-29 | Inlet 12 HV13-30 | HV13-31 |
|---|---|---|---|---|---|
| | Time | | ~~1521~~ 1551 | 1620 | |
| | Flask Number | 7 | ~~8~~ | 10 | 12 |
| $V_f$ | Volume of Flask and Valve, ml | 2116 | 2080 | 2055 | 2076 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | ~~25~~ | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2091 | — | 2030 | 2051 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.62 | ~~29.62~~ | 29.61 | 29.60 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.70 | ~~26.60~~ | 26.65 | 26.70 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 2.92 | 2.96 | 2.90 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.53 | 29.53 | 29.55 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | 0.00 | +0.70 | -4.50 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 29.53 | 30.23 | 25.05 |
| $T_i$ | Initial Flask Temperature, °F | 77 | ~~77~~ | 74 | 75 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 537 | 534 | 535 |
| $T_f$ | Final Flask Temperature, °F | | 78 | 78 | 77 |
| $T_{fr}$ | Final Flask Temperature, °R | | 538 | 538 | 537 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 Mar ~~74~~ 75

RUN NO. Outlet HV13

| Hercules Inc. Bessemer, Ala. | | Run No | HV13-32 | HV13 33 | ~~HV13-34~~ |
|---|---|---|---|---|---|
| | Time | | 1721 | 1750 | |
| | Flask Number | | 14 | 16 | |
| $V_f$ | Volume of Flask and Valve, ml | | 2124 | 2071 | |
| $V_a$ | Volume of Absorbing Reagent, ml | | 25 | 25 | ~~25~~ |
| $V_n$ | Volume of Flask minus Reagent, ml | | 2099 | 2046 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | | 29.60 | 29.60 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | | 26.60 | 26.60 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 3.00 | 3.00 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.54 | 29.50 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | -1.60 | +0.50 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 27.94 | 30.00 | |
| $T_i$ | Initial Flask Temperature, °F | | 75 | 75 | |
| $T_{ir}$ | Initial Flask Temperature, °R | | 535 | 535 | |
| $T_f$ | Final Flask Temperature, °F | | 76 | 77 | |
| $T_{fr}$ | Final Flask Temperature, °R | | 536 | 537 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 Mar 75

RUN NO. Mutlet HV13

Hercules Inc. Bessemer Ala.

| | Run No. | HV13-34 | HV13-35 | HV13-36 |
|---|---|---|---|---|
| | Time | 1028 | 1120 | 1220 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.53 | 29.53 | 29.55 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.50 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.08 | 3.03 | 3.05 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.47 | 29.47 | 29.46 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.45 | -0.65 | -0.75 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.02 | 28.82 | 28.71 |
| $T_i$ | Initial Flask Temperature, °F | 77 | 78 | 78 |
| $T_{ir}$ | Initial Flask Temperature, °R | 537 | 538 | 538 |
| $T_f$ | Final Flask Temperature, °F | 76 | 73 | 71 |
| $T_{fr}$ | Final Flask Temperature, °R | 536 | 533 | 531 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[ \frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. Outlet-HU-13

Hercules Inc. Bessemer Ala.

| | | Run No. | HU13-37 | HU13-38 | HU13-39 |
|---|---|---|---|---|---|
| | Time | | 1320 | 1420 | 1520 |
| | Flask Number | | 8 | 10 | 12 |
| $V_f$ | Volume of Flask and Valve, ml | | 2080 | 2055 | 2076 |
| $V_a$ | Volume of Absorbing Reagent, ml | | ~~25~~ | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | | | 2030 | 2051 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | | 29.55 | 29.55 | 29.54 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | | 26.55 | 26.45 | 26.55 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | | 3.10 | 2.99 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | | 29.41 | 29.33 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | | -0.40 | -1.60 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | | 29.01 | 27.73 |
| $T_i$ | Initial Flask Temperature, °F | | 78 | 78 | 77 |
| $T_{ir}$ | Initial Flask Temperature, °R | | | 538 | 537 |
| $T_f$ | Final Flask Temperature, °F | | | 71 | 75 |
| $T_{fr}$ | Final Flask Temperature, °R | | | 531 | 535 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | | |

(Column HU13-37 is crossed out.)

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

HU13-37 Not Charged w/PDS

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. HV 13 · Outlet

Hercules, Inc. Bessemer, Ala.

| | | HV13-40 | HV13-41 | HV13 |
|---|---|---|---|---|
| | Time | 1620 | 1720 | |
| | Flask Number | 14 | 16 | |
| $V_f$ | Volume of Flask and Valve, ml | 2124 | 2071 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2099 | 2046 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.50 | 29.48 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.40 | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.05 | 3.08 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.35 | 29.33 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.05 | -0.05 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.30 | 29.28 | |
| $T_i$ | Initial Flask Temperature, °F | 77 | 76 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 537 | 536 | |
| $T_f$ | Final Flask Temperature, °F | 70 | 70 | |
| $T_{fr}$ | Final Flask Temperature, °R | 530 | 530 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. HV13 Outlet

Hercules, Inc. Bessemer Ala.

| | | Run No. HV13-42 | HV13-43 | 44 |
|---|---|---|---|---|
| | Time | 1049 | 1135 | 1200 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.44 | 29.43 | 29.41 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | 26.30 | 26.25 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.04 | 3.13 | 3.16 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.59 | 29.59 | 29.62 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.60 | -3.00 | -1.85 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.99 | 26.59 | 27.77 |
| $T_i$ | Initial Flask Temperature, °F | 70 | 68 | 68 |
| $T_{ir}$ | Initial Flask Temperature, °R | 530 | 528 | 528 |
| $T_f$ | Final Flask Temperature, °F | 59 | 59 | 59 |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 519 | 519 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 March

RUN NO. HV13 - Outlet

Hercules Inc - Bessemer, Ala

| | Run No. | X | HV13 45 | HV13 46 |
|---|---|---|---|---|
| | Time | | 1325 | 1535 |
| | Flask Number | 6 ES | 6 (ES) | 10 |
| $V_f$ | Volume of Flask and Valve, ml | ~~2080~~ | 2073 | 2055 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2055 | 2048 | 2030 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.39 | 29.39 | 29.~~32~~ 33 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.35 | 26.35 | 26.30 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | | 3.04 | 3.03 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | | 29.65 | 29.70 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | | -3.25 | -1.45 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | | 26.40 | 28.25 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 73 | 73 |
| $T_{ir}$ | Initial Flask Temperature, °R | | 533 | 533 |
| $T_f$ | Final Flask Temperature, °F | | 59 | 61 |
| $T_{fr}$ | Final Flask Temperature, °R | | 519 | 521 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. H/13 Outlet

Hercules Inc. · Bessemer, Ala.

| | Run No. | 47 | 48 | 49 |
|---|---|---|---|---|
| | Time | 1635 | 1735 | 1850 |
| | Flask Number | 12 | 14 | 16 |
| $V_f$ | Volume of Flask and Valve, ml | 2076 | 2124 | 2071 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2051 | 2099 | 2046 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.32 | 29.35 | 29.26 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.30 | 26.25 | 26.20 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.02 | 3.10 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | ~~29.59~~ 29.60 | 29.70 | 29.70 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | ~~-1.60~~ -3.40 | -1.85 | -1.75 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 26.20 | 27.85 | 27.95 |
| $T_i$ | Initial Flask Temperature, °F | ~~67~~ 69 | 70 | 72 |
| $T_{ir}$ | Initial Flask Temperature, °R | 529 | 530 | 532 |
| $T_f$ | Final Flask Temperature, °F | ~~59~~ 61 | 60 | 60 |
| $T_{fr}$ | Final Flask Temperature, °R | 521 | 520 | 520 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left|\frac{M}{V_{sc}}\right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Outlet 1 HV-13

| | Hercules, Inc. Bessemer, Ala. Run No. | 50 | 51 | 52 |
|---|---|---|---|---|
| | Time | 0750 | 0850 | 951 |
| | Flask Number | 2 | 4 | 6 |
| $V_f$ | Volume of Flask and Valve, ml | 2035 | 2041 | 1984 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2010 | 2016 | 1959 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.59 | 29.62 | 29.63 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | 26.55 | 26.70 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.09 | 3.07 | 2.93 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | 29.79 | 29.79 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.85 | -4.10 | -2.95 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 27.94 | 25.69 | 26.84 |
| $T_i$ | Initial Flask Temperature, °F | 60 | 60 | 60 |
| $T_{ir}$ | Initial Flask Temperature, °R | 520 | 520 | 520 |
| $T_f$ | Final Flask Temperature, °F | 51 | 51 | 54 |
| $T_{fr}$ | Final Flask Temperature, °R | 511 | 511 | 514 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Outlet HV13

| | | S3 | | |
|---|---|---|---|---|
| | Time | 1050 | | |
| | Flask Number | 6 (ES) | | |
| $V_f$ | Volume of Flask and Valve, ml | 2073 | | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2048 | | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.66 | | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.50 | | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.16 | | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.20 | | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.59 | | |
| $T_i$ | Initial Flask Temperature, °F | 59 | | |
| $T_{ir}$ | Initial Flask Temperature, °R | 519 | | |
| $T_f$ | Final Flask Temperature, °F | 54 | | |
| $T_{fr}$ | Final Flask Temperature, °R | 514 | | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\ (V_n) \left[ \frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5}) \left[ \frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. Inlet HV 23

Hercules Inc. Bessemer, Ala. Run No.

| | | HV23-1 | HV23-2 | HV23-3 |
|---|---|---|---|---|
| | Time | 1045 | 1130 | 1217 |
| | Flask Number | ES 1 | ES 2 | ES 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2092 | 2041 | ~~2075~~ 2064 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2067 | 2016 | ~~2050~~ |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.44 | 29.43 | 29.41 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.20 | 26.40 | 26.35 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.24 | 3.03 | 3.06 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.56 | 29.59 | 29.63 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.75 | -1.90 | -2.20 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.81 | 27.69 | 27.43 |
| $T_i$ | Initial Flask Temperature, °F | 70 | 68 | 70 |
| $T_{ir}$ | Initial Flask Temperature, °R | 530 | 528 | 530 |
| $T_f$ | Final Flask Temperature, °F | 59 | 59 | 59 |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 519 | 519 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

## NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 Mar 75

RUN NO. Inlet HV23

HV-23

Hercules, Inc. Bessemer, Ala. Run No.

| | | 4 | 5 | 6 |
|---|---|---|---|---|
| | Time | 1315 | 1530 | 1630 |
| | Flask Number | 7 | 10 | 11 |
| $V_f$ | Volume of Flask and Valve, ml | 2089 | 2050 | 2052 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2064 | 2025 | 2027 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.39 | 29.32 | 29.32 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.35 | 26.25 | 26.35 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.04 | 3.07 | 2.97 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.63 | 29.70 | 29.70 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.10 | -1.90 | -0.90 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.53 | 27.80 | 23.30 |
| $T_i$ | Initial Flask Temperature, °F | 73 | 73 | 73 |
| $T_{ir}$ | Initial Flask Temperature, °R | 533 | 533 | 533 |
| $T_f$ | Final Flask Temperature, °F | 59 | 59 | 59 |
| $T_{fr}$ | Final Flask Temperature, °R | 519 | 519 | 519 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. HV23 Inlet

Hercules Inc. Bessemer Ala.

| | Run No | HV23-7 | HV23-8 | HV23 |
|---|---|---|---|---|
| | Time | 1730 | 1845 | |
| | Flask Number | 12 | 17 (11) | |
| $V_f$ | Volume of Flask and Valve, ml | 2067 | 2073 | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2042 | 2048 | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.36 | 29.26 | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.40 | ~~26.20~~ | 26.20 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 2.96 | 3.06 | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.70 | 29.70 | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -1.05 | -1.05 | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 28.65 | 28.65 | |
| $T_i$ | Initial Flask Temperature, °F | 70 | 72 | |
| $T_{ir}$ | Initial Flask Temperature, °R | 530 | 532 | |
| $T_f$ | Final Flask Temperature, °F | 58 | 58 | |
| $T_{fr}$ | Final Flask Temperature, °R | 518 | 518 | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, µg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 Mar 75

RUN NO. INLet HV23

Hercules, Inc. Bessemer, Ala.

| | | | | |
|---|---|---|---|---|
| | Run No. | 9 | 10 | 11 |
| | Time | 0745 | 845 | 945 |
| | Flask Number | 1 (ES) | 2 (ES) | 5 |
| $V_f$ | Volume of Flask and Valve, ml | 2092 | 2041 | 2064 |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | 25 | 25 |
| $V_n$ | Volume of Flask minus Reagent, ml | 2067 | 2016 | 2039 |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.59 | 29.62 | 29.63 |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.45 | 26.35 | 26.50 |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.14 | 3.27 | 3.13 |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | 29.79 | 29.79 |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.45 | -3.20 | -4.00 |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.34 | 26.59 | 25.79 |
| $T_i$ | Initial Flask Temperature, °F | 60 | 60 | 60 |
| $T_{ir}$ | Initial Flask Temperature, °R | 520 | 520 | 520 |
| $T_f$ | Final Flask Temperature, °F | 51 | 51 | 54 |
| $T_{fr}$ | Final Flask Temperature, °R | 511 | 511 | 514 |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a$$

$$V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff}$$

$$C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 74

RUN NO. HV-23 Inlet

Hercules, Inc. Bessemer, Ala. Run No. 12

| | | | | |
|---|---|---|---|---|
| | Time | 1045 | | |
| | Flask Number | 7 | | |
| $V_f$ | Volume of Flask and Valve, ml | 2099 | | |
| $V_a$ | Volume of Absorbing Reagent, ml | 25 | | |
| $V_n$ | Volume of Flask minus Reagent, ml | 2074 | | |
| $P_{bi}$ | Initial Barometric Presure, in. Hg | 29.66 | | |
| $P_{fi}$ | Initial Flask Vacuum, in. Hg vac | 26.60 | | |
| $P_i$ | Initial Absolute Pressure in Flask, in. Hg | 3.06 | | |
| $P_{bf}$ | Final Barometric Pressure, in. Hg | 29.79 | | |
| $P_{ff}$ | Final Flask Vacuum in. Hg vac | -0.40 | | |
| $P_f$ | Final Absolute Pressure in Flask, in. Hg | 29.39 | | |
| $T_i$ | Initial Flask Temperature, °F | 59 | | |
| $T_{ir}$ | Initial Flask Temperature, °R | 519 | | |
| $T_f$ | Final Flask Temperature, °F | 55 | | |
| $T_{fr}$ | Final Flask Temperature, °R | 515 | | |
| $V_{sc}$ | Volume of Sample at Dry Std. Cond., ml | | | |
| M | Mass of $NO_2$ in Gas Sample, μg | | | |
| C | Concentration of $NO_x$ as $NO_2$, dry basis, lb/scf | | | |

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

# APPENDIX F

## LABORATORY REPORT FOR EPA METHOD NO. 7 TESTS AND ANALYTICAL REPORT FOR $NO_2$ CALIBRATION GASES

COMMONWEALTH LABORATORY
INCORPORATED
CHEMISTS BUILDING, 2209 EAST BROAD STREET
RICHMOND, VIRGINIA 23223

P. O. BOX 8025
AREA CODE 804
TELEPHONE: 648-8358

AIR AND WATER
SAMPLING, ANALYSIS

April 3, 1975

No. 75-102-04

# CERTIFICATE OF ANALYSIS

One hundred and twenty-nine (129) samples taken at Hercules, Inc.; Bessemer, Alabama; received March 18, 1975.

Attn: Mr. J. T. Chehaske

Job No. 1850, Task Order No. 2

Method: Federal Register, Vol. 36, No. 159, August 17, 1971, Method 7.

| SAMPLE IDENTIFICATION | TOTAL µg $NO_2$ |
|---|---|
| Cal Gas Blank | 0 |
| Cal Gas No. 1 | 6,250 |
| Cal Gas No. 2 | 13,350 |
| Gal Gas No. 3 | 12,750 |
| Cal Gas No. 4 | 142 |
| Cal Gas No. 5 | 138 |
| Cal Gas No. 6 | 142 |
| **HV-12 Inlet** | |
| Blank, March 05 | 0 |
| 1 | 7,550 |
| 2 | 6,550 |
| 3 | 8,900 |
| 4 | 7,650 |
| 5 | 10,500 |
| 6 | 10,500 |
| 7 | 10,650 |
| 8 | 7,200 |
| 9 | 6,850 |
| 10 | 7,250 |
| 11 | 9,900 |
| 12 | 11,850 |
| 13 | 8,350 |
| 14 | 10,150 |
| 15 | 9,100 |
| 16 | 6,900 |
| 17 | 6,850 |
| 18 | 5,900 |
| 19 | 11,200 |
| 20 | 14,000 |
| 21 | 8,600 |

(cont.)

HV-12 Inlet (continued)

| SAMPLE I.D. | TOTAL µg $NO_2$ |
|---|---|
| 22 | 8,200 |
| 23 | 9,000 |
| 24 | 6,850 |
| 25 | 9,800 |
| 26 | 3,650 |
| 27 | 2,300 |
| 28 | 3,650 |
| 29 | 4,600 |
| 30 | 2,800 |
| 31 | 3,450 |
| 32 | 5,150 |
| 33 | 4,750 |
| 34 | 4,750 |
| 35 | 9,000 |
| 36 | 8,550 |
| 37 | 9,500 |
| 38 | 8,150 |
| 39 | 9,550 |
| 40 | 9,600 |
| 41 | 8,150 |
| 42 | 3,750 |
| 43 | 5,500 |
| 44 | 9,750 |
| 45 | 11,000 |
| 46 | 7,200 |
| 47 | 5,550 |
| 48 | 9,350 |
| 49 | 10,450 |
| 50 | 11,000 |
| 51 | 9,500 |
| 52 | 13,150 |
| 53 | 9,550 |
| Blank March 11 | 0 |
| Blank March 15 | 0 |
| Blank March 13 | 0 |

| Outlet HV-13 | TOTAL μg $NO_2$ |
|---|---|
| 1 | 355 |
| 2 | 380 |
| 3 | 450 |
| 4 | 237 |
| 5 | 265 |
| 6 | 244 |
| 7 | 295 |
| 8 | 470 |
| 9 | 506 |
| 10 | 336 |
| 11 | 167 |
| 12 | 280 |
| 13 | 354 |
| 14 | 540 |
| 15 | 235 |
| 16 | 330 |
| | |
| Blank March 06 | 0 |
| 17 | 118 |
| 18 | 103 |
| 19 | 466 |
| 20 | 522 |
| 21 | 200 |
| 22 | 265 |
| 23 | 208 |
| 24 | 420 |
| 25 | 290 |
| 26 | 135 |
| 27 | 30 |
| 28 | 38 |
| 29 | 340 |
| 30 | 122 |
| 31 | 68 |
| 32 | 78 |
| 33 | 90 |
| 34 | 180 |
| 35 | 165 |
| 36 | 210 |
| 38 | 158 |
| 39 | 159 |
| 40 | 295 |
| 41 | 351 |
| 42 | 140 |
| 43 | 114 |

Outlet HV-13 (continued)

| | TOTAL µg $NO_2$ |
|---|---|
| Blank March 12 | 0 |
| 44 | 206 |
| 45 | 354 |
| 46 | 197 |
| 47 | 316 |
| 48 | 158 |
| 49 | 308 |
| 50 | 225 |
| 51 | 281 |
| 52 | 634 |
| 53 | 820 |
| HV-23 Demister Inlet | |
| 1 | 7,150 |
| 2 | 5,150 |
| 3 | 10,250 |
| 4 | 13,150 |
| 5 | 8,250 |
| 6 | 10,150 |
| 7 | 12,000 |
| 8 | 11,650 |
| 9 | 11,000 |
| 10 | 11,500 |
| 11 | 7,750 |
| 12 | 10,250 |

Respectfully submitted,

John A. Bingham

John A. Bingham
Chemist

AIRCO Industrial Gases

P.O. DRAWER NO. 272, UNION LANDING & RIVER ROADS, RIVERTON, NEW JERSEY 08077
TELEPHONE: 609-829-7878

Rare & Specialty Gases Department

April 16, 1975
RSG-75-86

Engineering Sciences, Inc.
7903 West Park Drive
McClean, Virginia 22101

Attention: Mr. John Greenberg

Dear Mr. Greenberg:

The following results on the initial analysis made on the two cylinders we sent you are from our laboratory analytical sheet and are the correct results. There were numerical errors on the tags you received. We are sorry if this caused you any problems in your work.

| | Cyl. No. | Test No. | $NO_2$ | NO | $N_2$ | Date |
|---|---|---|---|---|---|---|
| Initial Analysis | MM-2457 | U-0219 | 31.0 PPM | 1.5 PPM | Bal. | 1/28/' |
| Reanalysis | " | " | 32.0 PPM | 0.5 PPM | " | 4/14/' |
| Initial Analysis | MM-2510 | U-0218 | 3980 PPM | 20.0 PPM | " | 1/28/' |
| Reanalysis | " | " | 3910 PPM | 30.0 PPM | " | 4/14/' |

Very truly yours,
AIRCO INDUSTRIAL GASES

Frank Kramer

Frank Kramer
Chief Laboratory Analyst
Rare & Specialty Gases Dept.

FK/jh

RECEIVED
APR 24 1975
ENGINEERING SCIENCES, INC.

# APPENDIX G

# PROCESS DATA

# PURASIV-N PROCESS DATA

DATE 3/5/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 71 in. AT 1300 HRS.

| TIME | FEED GAS | | INLET GAS | | OUTLET GAS | | REGENERATION GAS | | | | | BED ΔP | WATER METER READING | BRINE TEMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PRESS. (PI-131) psig | TEMP. (T-3) °F | FLOW (FR-101) scfm | TEMP (TR-117) (#5) °F | PRESS. (PI-106) psig | TEMP. (TI-109) °F | FLOW (FRC-102) scfm | TEMPERATURE, °F IN (TR-122) (#10) | TEMPERATURE, °F TOP OF BED (#4&9) | TEMPERATURE, °F OUT (TR-123) (#11) | PRESS IN (PI-101) psig | in. WC | | °F |
| 0930 | 80 | | 6000 | 50 | 76 | | 1030 | 50 | | | 125 | 68 | – | 30 |
| 1030 | 80 | | 5900 | 50 | 76 | | 1030 | 430 | | | 125 | 67 | – | 30 |
| 1130 | 82 | | 5900 | 42 | 78 | | 1030 | 150 | | | 125 | 64 | – | 30 |
| 1230 | 82 | | 4850 | 38 | 78 | | 1025 | 42 | | | 124 | 44 | – | 29 |
| 1330 | 83 | | 5700 | 40 | 78 | | 1025 | 45 | | | 124 | 59 | – | 29 |
| 1430 | 82 | | 5950 | 42 | 78 | | 1025 | 370 | | | 122 | 57 | – | 29 |
| 1530 | 81 | | 5700 | 41 | 77 | | 1025 | 437 | | | 122 | 51 | – | 29 |
| 1630 | 83 | | 5700 | 43 | 79 | | 1025 | 48 | | | 123 | 51 | – | 30 |
| 1730 | 81 | | 5650 | 42 | 77 | | 1025 | 47 | | | 122 | 51 | – | 30 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850 DATE 3/5/75 SHT. 1

DETAIL HERCULES $HNO_3$ TESTING BY JTG OF 16

# NITRIC ACID PROCESS DATA

DATE 3/5/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X. D. R. RPM | INJECTION WATER gpm | ACID STRENGTH Tray #/% | X. R. D. FEED GAS % $O_2$ | PRODUCT STRENGTH % |
|---|---|---|---|---|---|---|---|---|---|
| 1430 | 79 | 116 | 112 | 78 | 170 | | | | |
| 1530 | 78 | 116 | 112 | 78 | 170 | | | | |
| 1630 | 78 | 116 | 112 | 78 | 170 | | | | |
| 1730 | 78 | 116 | 112 | 78 | 170 | | | | |
| 1830 | 80 | 115 | 111 | 76 | 170 | | | | |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850 DATE 3/5/75 SHT. 2

DETAIL HERCULES $HNO_3$ TESTING BY JTG OF 16

# PURASIV-N PROCESS DATA

DATE 3/6/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL ______________

| TIME | FEED GAS | | INLET GAS | | OUTLET GAS | | REGENERATION GAS | | | | | BED | WATER | BRINE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PRESS. (PI-131) psig | TEMP. (T-3) °F | FLOW (FR-101) scfm | TEMP (TR-117) (#3) °F | PRESS. (PI-106) psig | TEMP. (TI-107) °F | FLOW (FRC-102) scfm | TEMPERATURE, °F IN (TR-122) (#10) | TEMPERATURE, °F TOP OF BED (#4 & 9) | TEMPERATURE, °F OUT (TR-123) (#11) | PRESS IN (PI-101) psig | ΔP in. W.C. / bypass valve pos. | METER READING | TEMP °F (TI-111) |
| 0800 | 84 | 75 | 6050 | 47 | 79 | 75 | 1005 | 45 | 110 | 107 | 124 | 60.5 | – | 32 |
| 0900 | 84 | 76 | 5900 | 47 | 79 | 73 | 1045 | 45 | 365 | 205 | – | 56.0 | – | 32 |
| 1000 | 84 | 76 | 5950 | 45 | 78 | 75 | 1050 | 44 | 63 | 100 | 124 | 58.0 | – | 28 |
| 1100 | 84 | 76 | 5750 | 40 | 77 | 68 | 1055 | 432 | 58 | 63 | 124 | 60.5/c | – | 28 |
| 1200 | 82 | 78 | 5750 | 45 | 77 | 73 | 1040 | 55 | 192 | 132 | 123 | 60.5/c | – | 31 |
| 1300 | 80 | 80 | 5700 | 45 | 74 | 76 | 1025 | 51 | 370 | 222 | 120 | 60.5/c | – | 32 |
| 1400 | 85 | 81 | 5650 | 45 | 77 | 77 | 1050 | 50 | 65 | 115 | 125 | 56.0/c | – | 32 |
| 1500 | 85 | 81 | 5850 | 45 | 79 | 73 | 1040 | 443 | 95 | 75 | 125 | 54.0/18 | – | 32 |
| 1600 | 84 | 83 | 5850 | 47 | 78 | 73 | 1035 | 92 | 115 | 115 | 124 | 54/18 | – | 34 |
| 1700 | 85 | 82 | 5825 | 47 | 79 | 73 | 1025 | 50 | 355 | 178 | 125 | 54/18 | – | 34 |
| 1800 | 92 | 75 | 5600 | 42 | 84 | 62 | 1015 | 50 | 65 | 110 | 128 | 45/18 | – | 28 |
| 1900 | | | 580 | | | | 1045 | | | | | | | |
| 2000 | | | 580 | | | | 1045 | | | | | | | |
| 2100 | | | 580 | | | | 1045 | | | | | | | |
| 2200 | | | 650 | | | | 1060 | | | | | | | |
| 2300 | | | 820 | | | | 1050 | | | | | | | |
| M.N. | | | | | | | | | | | | | | |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-IAE JOB NO. 1850 DATE 3/6/75 SHT. 3

DETAIL HERCULES $HNO_3$ TESTING BY JJG OF 16

# NITRIC ACID PROCESS DATA

DATE 3/6/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X.D.R. RPM | INJECTION WATER gpm | ACID STRENGTH Tray#/% | X.R.D. FEED GAS %O₂ | PRODUCT STRENGTH % |
|---|---|---|---|---|---|---|---|---|---|
| 0800 | 82 | 118 | 114 | 78 | 170 | | 29/08.8, 26/12.2, 16/43.5, 4/59.87 | | 60.06 |
| 0900 | 81 | 118 | 114 | 78 | 170 | | | | |
| 1000 | 81 | 118 | 114 | 79 | 170 | | 29/10.6, 26/11.5; 16/47.4, 4/58.42 | | 59.68 |
| 1100 | 81 | 117 | 113 | 78 | 171 | | | | |
| 1200 | 80 | 115 | 111 | 76 | 170 | 2.70 | | | |
| 1300 | 80 | 114 | 110 | 75 | 170 | 2.65 | 29/10.6, 26/14.5, 16/49.0, 4/58.44 | 2.2 | 59.68 |
| 1400 | 78 | 117 | 113 | 80 | 168 | 2.65 | 29/13.1 | 2.7 | 59.42 |
| 1500 | 77 | 117 | 113 | 80 | 168 | 2.60 | | 2.9 | |
| 1600 | 77 | 116 | 112 | 80 | 168 | 2.55 | 29/15.4, 26/21.6, 16/57.1, 4/59.78 | 3.0 | 59.68 |
| 1700 | 77 | 116 | 112 | 80 | 168 | 2.55 | | 3.1 | |
| 1800 | 70 | 119 | 115 | 86 | 136 | 2.55 | | 2.6 | |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-ADE JOB NO. 1850 DATE 3/6/75 SHT. 4 OF 16

DETAIL HERCULES $HNO_3$ TESTING BY JJG

# PURASIV-N PROCESS DATA

DATE 3/7/75
PLANT Hercules Inc., Bessemer, Ala.
FUEL OIL TANK LEVEL 68" @ 1700

| | TIME | FEED GAS | | INLET GAS | | OUTLET GAS | | REGENERATION GAS | | | | | BED ΔP | WATER METER | BRINE TEMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRESS. (PI-131) psig | TEMP. (T-3) °F | FLOW (FR-101) scfm | TEMP (TR-117) (#3) °F | PRESS. (PI-106) psig | TEMP. (TI-109) °F | FLOW (FRC-102) scfm | TEMPERATURE, °F IN (TR-122) (#10) | TOP OF BED (#4 #9) | OUT (TR-123) (#11) | PRESS IN (PI-107) psig | in. W.C. / Bypass Valve press | READING | °F |
| | MN | | | 825 | | | | 1050 | | | | | | | |
| | 0100 | | | 830 | | | | 1040 | | | | | | | |
| | 0200 | | | 830 | | | | 1030 | | | | | | | |
| | 0300 | | | 780 | | | | 1030 | | | | | | | |
| | 0400 | | | 790 | | | | 1010 | | | | | | | |
| | 0500 | | | 0 | | | | 0 | | | | | | | |
| | 0600 | | | 0 | | | | 0 | | | | | | | |
| | 0700 | | | 0 | | | | 0 | | | | | | | |
| A | 0800 | | | 600 | | | | 1015 | | | | | 15 | | |
| B | 0900 | 83 | 75 | 5700 | 42 | 78 | 56 | 1015 ~~5700~~ | 250 | 55 | 62 | 124 | 50/18 | – | 30 |
| B | 1000 | – | – | 4500 | 42 | – | – | 1010 | 440 | 110 | 70 | – | 29/18 | – | – |
| B | 1100 | 80 | 80 | 5700 | 42 | 76 | 75 | 1010 | 55 | 220 | 145 | 121 | 51/18 | – | 34 |
| B | 1200 | 82 | 82 | 5750 | 45 | 77 | 75 | 1010 | 55 | 368 | 255 | 122 | 52/18 | – | 35 |
| A | 1300 | 82 | 82 | 5550 | 45 | 77 | 73 | 1010 | 200 | 57 | 77 | 122 | 55/18 | – | 35 |
| A | 1400 | 83 | 83 | 5700 | 45 | 78 | 71 | 1020 | 445 | 105 | 85 | 123 | 57/18 | – | 35 |
| | 1527 | 88 | 86 | 5500 | 48 | 80 | 73 | 1300 | 60 | 370 | 155 | 126 | 68/18 | – | 38 |
| | 1630 | 88 | 81 | 5600 | 45 | 81 | 61 | 1150 | 50 | 60 | 135 | 125 | 57/18 | – | 34 |
| | 1710 | 86 | 85 | 5850 | 50 | 80 | 65 | 1020 | 360 | 65 | 75 | 127 | 54/18 | – | 35 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850 DATE 3/7/75 SHT. 5 OF 16
DETAIL HERCULES $HNO_3$ TESTING BY JTG

# NITRIC ACID PROCESS DATA

DATE 3/7/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH.) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X. D. R. RPM | INJECTION WATER gpm | ACID STRENGTH Tray #/% | X.R.D. FEED GAS % $O_2$ | PRODUCT STRENGTH % |
|---|---|---|---|---|---|---|---|---|---|
| M.N. | 60 | 120 | 116 | 90 | 130 | 2.0 | 29/12.2, 26/17.0, 16/53.0, 4/60.2 | 3.7 | 59.70 |
| 0100 | 60 | 120 | 116 | 90 | 130 | 2.0 | | | |
| 0200 | 60 | 120 | 116 | 90 | 130 | 2.0 | | | |
| 0300 | 60 | 120 | 116 | 90 | 130 | 2.0 | 29/9.7, 26/13.[illegible], 16/48.[illegible], 4/58.97 | 3.7 | 60.53 |
| 0400 | 60 | 120 | 116 | 90 | 130 | 2.0 | | | |
| 0500 | 0 | | | | | | | | |
| 0600 | 50 | | | | | | | | |
| 0700 | 46 | | | | | | | | |
| 0800 | 50 | | | | | | | | |
| 0900 | 75 | 117 | 113 | 80 | 158 | 2.7 | 29/6.2, 26/8.8, 16/27.0, 4/57.84 | | 58.18 |
| 1000 | 73 → 0 → 35 in 5 min. | | | | | | | | |
| 1100 | 73 | 116 | 111 | 77 | 149 | 2.45 | | 0.9 | |
| 1200 | 73 | 116 | 111 | 77 | 149 | 2.45 | | 1.35 | |
| 1300 | 74 | 116 | 112 | 78 | 159 | 2.50 | 29/10.6, 26/14.5, 16/44.3, 4/58.32 | 1.70 | 57.76 |
| 1400 | 75 | 113 | 110 | 78 | 160 | 2.50 | | 4.35 | |
| 1527 | 74 | 114 | 111 | 82 | 160 | 2.45 | | 3.95 | |
| 1630 | 74 | 116 | 112 | 82 | 160 | 2.45 | 29/12.2, 26/[illegible], 16/[illegible], 4/[illegible] | 3.72 | |
| 1710 | 73 | 117 | 114 | 82 | 160 | 2.45 | | 4.30 | 57.76 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. L550

DETAIL HERCULES HNO3 TESTING

DATE 3/7/75

BY [illegible]

SHT. 6 OF 16

## PURASIV-N PROCESS DATA

DATE 3/10/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 66 1/2" @ 13:30

| TIME | FEED GAS | | INLET GAS | | OUTLET GAS | | REGENERATION GAS | | | | | BED ΔP in. W.C. | WATER METER READING | [illegible] TEMP °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PRESS. (PI-131) psig | TEMP. (T-3) °F | FLOW (FR-101) scfm | TEMP (TR-117) (#5) °F | PRESS. (PI-100) psig | TEMP. (TI-109) °F | FLOW (FRC-102) scfm | TEMPERATURE, °F: IN (TR-122) (#10) | TEMPERATURE, °F: TOP OF BED (#4 & 9) | TEMPERATURE, °F: OUT (TR-123) (#11) | PRESS IN (PI-101) psig | | | |

PURASIV NOT STARTED

## NITRIC ACID PROCESS DATA

DATE 3/10/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X.D.R. RPM | Injection Water gpm | Acid Strength Tiny*/% | X.R.D Feed Gas % O2 | Product Strength % |
|---|---|---|---|---|---|---|---|---|---|
| 1600 | 20 | 127 | 94 | 80 | 30 | 3.5 | – | – | – |
| 16:40 | 36 | 116 | 110 | 80 | 67 | 1.2 | - | 3.2 | – |

Plant continued to run until 07:00 on 3/11/75
Purasiv was not used

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850 DATE 3/19/75 SHT. 8
DETAIL HERCULES HNO3 TESTING BY RLR OF 16

## PURASIV-N PROCESS DATA

DATE 3/11/75
PLANT Hercules Inc., Bessemer, Ala.
FUEL OIL TANK LEVEL 67" @ 17:30

| TIME | FEED GAS PRESS. (PI-131) psig | FEED GAS TEMP. (T-3) °F | INLET GAS FLOW (FR-101) scfm | INLET GAS TEMP (TR-117) (#5) °F | OUTLET GAS PRESS. (PI-106) psig | OUTLET GAS TEMP. (TT-109) °F | REGENERATION GAS FLOW (FRC-102) scfm | REGENERATION GAS TEMPERATURE, °F IN (TR-122) (#10) | REGENERATION GAS TEMPERATURE, °F TOP OF BED (#4 & #9) | REGENERATION GAS TEMPERATURE, °F OUT (TR-123) (#11) | REGENERATION GAS PRESS IN (PI-107) psig | BED ΔP in. W.C. | WATER METER READING | BRINE TEMP °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1400 | 86 | 74 | 3200 | 40 | 75 | 66 | 1030 | 395 | 42 | 50 | 130 | 68/12 | 664 / 14:03 | 30 |
| 1445 | 97 | 74 | 4400 | 40 | 83 | 56 | 1040 | 412 | 40 | 58 | 130 | 52/18 | 5141 / 14:52 | 30 |
| 1530 | 90 | 77 | 5200 | 40 | 80 | 56 | 1030 | 418 | 41 | 98 | 126 | 70/18 | 8130 / 15:31 | 29 |
| 1615 | 90 | 79 | 5200 | 40 | 80 | 58 | 1030 | 47 | 45 | 185 | 125 | 70/10 | 11,565 / 16:15 | 30 |
| 1700 | 90 | 79 | 5200 | 40 | 80 | 62 | 1030 | 45 | 48 | 242 | 125 | 70/15 | 15,480 / 17:02 | 30 |
| B 1800 | 90 | 81 | 5400 | 40 | 80 | 57 | 1030 | 110 | 56 | 90 | 127 | 70/18 | 18,850 / 17:45 | 30 |
| 1900 | | | | | | | | | | | | | | |
| 2000 | 89 | 74 | 5400 | 50 | | | 1030 | 60 | | | | 70 | | 30 |
| 2100 | | | | | | | | | | | | | | |
| 2200 | 89 | 77 | 5300 | 50 | | | 1020 | 280 | | | | 70 | | 30 |
| 2300 | | | | | | | | | | | | | | |
| 2400 | 88 | 81 | 5100 | 45 | | | 1020 | 50 | | | | 72 | | 32 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-IPE JOB NO. 1850 DATE 3/11/75 SHT. 9
DETAIL HERCULES $HNO_3$ TESTING BY OF 16

# NITRIC ACID PROCESS DATA

DATE 3/11/75

PLANT Hercules, Inc., Bessemer, Ala.

| | TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X. D. R. RPM | Injection water gpm | Acid Strength Tray N / % | X. R. D. Feed Gas % $O_2$ | Product Strength % |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1300 | Light | -OFF | [Start | - UP] | | | | | |
| A | 1400 | 34 | 118 | 96 | 76 | 78 | 0.8 | | 2.55 | 1403/664 |
| | 1445 | 36 | 118 | 112 | 94 | 82 | 1.3 | | 3.42 | |
| | 1530 | 62 | 120 | 114 | 85 | 134 | 1.85 | | 4.0 | |
| | 1615 | 60 | 116 | 112 | 84 | 134 | 1.8 | 29/4.2<br>26/7.1<br>16/21.6<br>4/56.95 | 3.5 | 58.5 |
| | 1700 | 60 | 116 | 112 | 84 | 134 | 2.1 | | 3.7 | |
| B | 1800 | 60 | 116 | 112 | 84 | 134 | 2.1 | | 3.6 | |
| | 1900 | 60 | 118 | 114 | 84 | 134 | 2.2 | | | |
| | 2000 | 60 | 116 | 112 | 84 | 134 | 2.0 | 29/7.1<br>26/9.7<br>16/33.7<br>4/57.78 | | 58.18 |
| | 2100 | 60 | 116 | 112 | 84 | 134 | 2.0 | | | |
| | 2200 | 60 | 116 | 112 | 84 | 139 | 2.0 | | | |
| | 2300 | | 116 | 112 | 84 | 134 | 2.0 | | | |
| | 2400 | | 116 | 112 | 84 | 136 | 2.0 | 29/9.7<br>26/14.7<br>16/40.4<br>4/57.51 | | 58.98 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. L850 DATE 3/11/75 SHT. 10

DETAIL HERCULES $HNO_3$ TESTING BY OF 16

# PURASIV-N PROCESS DATA

| $H_2O$ meter Time | Reading |
|---|---|
| 09:00 | 98,030 |
| 14:11 | 129,610 |
| 17:00 | 138,830 |

DATE 3/12/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL ____________

| | TIME | FEED GAS PRESS. (PI-131) psig | FEED GAS TEMP. (T-3) °F | INLET GAS FLOW (FR-101) scfm | INLET GAS TEMP (TR-117) (#5) °F | OUTLET GAS PRESS. (PI-106) psig | OUTLET GAS TEMP. (TI-105) °F | REGENERATION GAS FLOW (FRC-102) scfm | REGENERATION GAS TEMPERATURE, °F IN (TR-122) (#10) | REGENERATION GAS TEMPERATURE, °F TOP OF BED (#44) | REGENERATION GAS TEMPERATURE, °F OUT (TR-123) (#11) | REGENERATION GAS PRESS IN (PI-107) psig | BED ΔP in. W.C. | WATER METER READING | BRINE TEMP °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1:00 | | | 5200 | 10.0 | | | 1020 | | | | | 70/ | | |
| B | 2:00 | 88 | 82 | 5200 | 40 | | | 1020 | 300 | | | | 70/ | | 32 |
| | 3:00 | | | 5200 | | | | 1020 | | | | | 70/ | | |
| | 4:00 | 88 | 82 | 5200 | 45 | | | 1020 | 60 | | | | 70/ | | 34 |
| | 5:00 | | | 5200 | | | | 1020 | | | | | 70/ | | – |
| A | 6:00 | 88 | 82 | 5200 | 45 | | | 1020 | 50 | | | | 70/ | | 34 |
| | 7:00 | | | 4200 | | | | 1020 | | | | | 52/ | | – |
| | 8:00 | 98 | 79 | 4200 | 42 | 84 | 67 | 1020 | 48 | 50 | 197 | 130 | 52/18 | | 32 |
| | 9:00 | 98 | 79 | 4200 | 41 | 84 | 68 | 1020 | 48 | 50 | 240 | 130 | 52/18 | | 32 |
| B | 10:00 | 99 | 80 | 4350 | 42 | 84 | 62 | 1030 | 160 | 50 | 90 | 132 | 50/18 | | 32 |
| | 11:00 | 98 | 81 | 4350 | 41 | 84 | 68 | 1030 | 428 | 35 | 62 | 132 | 50/18 | | 32 |
| | 12:00 | 98 | 83 | 4300 | 42 | 84 | 68 | 1030 | 65 | 35 | 108 | 132 | 50/18 | | 34 |
| | 13:00 | 98 | 85 | 4300 | 43 | 84 | 67 | 1030 | 50 | 35 | 250 | 132 | 50/18 | | 34 |
| A | 14:00 | 90 | 86 | 5250 | 47 | 80 | 64 | 1020 | 50 | 39 | 98 | 124 | 69/18 | | 36 |
| | 1600 | 90 | 81 | 5100 | 42 | 80 | 72 | 1020 | 438 | 48 | 62 | 126 | 70/18 | | 32 |
| | 16:00 | 90 | 83 | 5000 | 44 | 80 | 72 | 1020 | 68 | 48 | 108 | 126 | 70/18 | | 32 |
| | 17:00 | 90 | 85 | 5000 | 45 | 81 | 72 | 1030 | 50 | 52 | 250 | 126 | 70/18 | | 34 |
| B | 18:00 | 88 | 84 | 5050 | 45 | 80 | 73 | 1020 | 49 | 50 | 122 | 124 | 70/18 | | 34 |
| | 1900 | | | | | | | | | | | | | - | |
| | 2000 | 98 | 82 | 4300 | 45 | | | 1020 | 55 | | | | 44 | - | 31 |
| | 21:00 | | | | | | | | | | | | | - | |
| | 22:00 | 98 | 82 | 4200 | 45 | | | 1020 | 50 | | | | 44 | - | 32 |
| | 2300 | | | | | | | | | | | | | - | |
| | 2400 | 98 | 85 | 4300 | 50 | | | 1020 | 70 | | | | 44 | - | 34 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850 DATE 3/12/75 SHT. 11

DETAIL HERCULES $HNO_3$ TESTING BY R&R OF 16

# NITRIC ACID PROCESS DATA

DATE 3/12/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X. D. R. RPM | Injection Water gpm | Acid Strength Tray#/% | X.P.O Feed w/o % $O_2$ | Product Strength % |
|---|---|---|---|---|---|---|---|---|---|
| 1:00 | 60 | 114 | 110 | 83 | 136 | 2.0 | | | |
| 2:00 | 60 | 116 | 112 | 84 | 136 | 2.0 | | | |
| 3:00 | 60 | 116 | 112 | 84 | 136 | 2.0 | 29/13.1 16/52.2<br>26/17.8 4/59.03 | | 59.02 |
| 4:00 | 60 | 114 | 110 | 84 | 136 | 2.0 | | | |
| 5:00 | 60 | 114 | 110 | 83 | 136 | 2.0 | 29/16.2 26/20.9<br>16/54.7 4/59.24 | | 59.28 |
| 6:00 | 60 | 114 | 110 | 83 | 136 | 2.0 | | | |
| 7:00 | 40 | 114 | 110 | 83 | 88 | 2.0 | 29/17.0 26/27.[illegible]<br>16/55.6 4/59.24 | | 59.48 |
| 8:00 | 36 | 116 | 114 | 94 | 88 | 1.9 | | 3.15 | |
| 9:00 | 36 | 116 | 114 | 94 | 88 | 1.8 | | 3.1 | |
| 10:00 | 36 | 117 | 114 | 98 | 88 | 1.8 | 29/9.7 26/15.9<br>16/53.2 4/60.07 | 2.8 | 60.25 |
| 11:00 | 36 | 118 | 116 | 96 | 88 | 1.8 | | 2.2 | |
| 12:00 | 36 | 116 | 114 | 94 | 89 | 1.8 | | 2.1 | |
| 13:00 | 36 | 116 | 114 | 94 | 88 | 1.8 | 29/10.6 26/15.4<br>16/51.9 4/[illegible] | 2.1 | 59.97 |
| 14:00 | 62 | 116 | 112 | 84 | 140 | 2.2 | | 2.8 | |
| 15:00 | 58 | 116 | 112 | 84 | 140 | 2.2 | | 2.9 | |
| 16:00 | 58 | 116 | 112 | 84 | 140 | 2.3 | 29/13.1 26/13.6<br>16/51.95 ~~4/~~ 60.84 | 2.8 | 59.97 |
| 17:00 | 58 | 116 | 112 | 84 | 138 | 2.3 | | 3.5 | |
| 18:00 | 57 | 114 | 110 | 83 | 128 | 2.3 | | 3.2 | |
| 14:00 | 58 | 116 | 112 | 83 | 132 | 2.0 | | | |
| 20:00 | 58 | 116 | 112 | 83 | 132 | 2.0 | 29/11.4 26/15.4<br>16/49 4/59.30 | | 59.70 |
| 21:00 | 58 | 116 | 111 | 82 | 132 | 2.0 | | | |
| 22:00 | 58 | 115 | 111 | 82 | 132 | 2.0 | | | |
| 23:00 | 56 | 115 | 111 | 82 | 132 | 2.0 | | | |
| 24:00 | 57 | 114 | 110 | 83 | 128 | 2.0 | 29/12.2 26/17.0<br>16/44.8 4/59.3[illegible] | | 58.78 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1550 DATE 3/12/75 SHT. 12

DETAIL HERCULES $HNO_3$ TESTING BY RLR OF 13

# PURASIV-N PROCESS DATA

DATE 3/13/75
PLANT Hercules Inc., Bessemer, Ala.
FUEL OIL TANK LEVEL ________

| | TIME | FEED GAS | | INLET GAS | | OUTLET GAS | | REGENERATION GAS | | | | | | BED | WATER | BRINE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRESS. (PI-131) psig | TEMP. (T-3) °F | FLOW (FR-101) scfm | TEMP (TR-117) (#5) °F | PRESS. (PI-100) psig | TEMP. (TI-109) °F | FLOW (FRC-104) scfm | TEMPERATURE, °F IN (TR-122) (#10) | TOP OF BED (#4 4'9) | OUT (TR-125) (#11) | PRESS IN (PI-101) psig | ΔP in. W.C. | METER READING | TEMP °F |
| | 1:00 | | | | | | | | | | | | | – | |
| | 2:00 | 88 | 86 | 4900 | 50 | | | 1020 | 50 | | | | 70 | – | 35 |
| | 3:00 | | | | | | | | | | | | | – | |
| | 4:00 | 88 | 84 | 5100 | 45 | | | 1020 | 440 | | | | 68 | – | 35 |
| | 5:00 | | | 5100 | | | | 1020 | | | | | | – | |
| | 6:00 | 88 | 82 | 5100 | 48 | | | 1020 | 70 | | | | 68 | – | 34 |
| | 7:00 | | | | | | | | | | | | | | |
| | 8:00 | 96 | 75 | 4200 | 50 | 83 | 68 | 1030 | 50 | 45 | 112 | 130 | 52/18 | | 30 |
| | 9:00 | 100 | 76 | 4200 | 39 | 86 | 64 | 1030 | 44 | 48 | 218 | 132 | 52/18 | | 30 |
| B | 10:00 | 100 | 76 | 4200 | 40 | 84 | 63 | 1030 | 42 | 42 | 102 | 132 | 52/18 | | 30 |
| B | 11:00 | 100 | 78 | 3000 | 40 | 85 | 66 | 1030 | 99 | 38 | 129 | 132 | 38/1 | | 29 |
| | 12:00 | 86 | 80 | 5800 | 42 | 80 | 58 | 1040 | 415 | 38 | 58 | 125 | 77/18 | | 30 |
| | 13:00 | 84 | 81 | 5800 | 48 | 78 | 72 | 1030 | 60 | 44 | 102 | 124 | 76/14 | | 38 |
| * | 14:00 | No | Data | Taken : | System | | Fluctuating | | * | * | * | * | | | |
| A | 15:00 | 86 | 80 | 6200 | 47 | 78 | 68 | 1030 | 130 | 60 | 80 | 126 | 60/15 | | 33 |
| | 16:00 | 86 | 78 | 6050 | 42 | 78 | 68 | 1030 | 408 | 47 | 66 | 126 | 60/18 | | 32 |
| | 17:00 | 85 | 80 | 6150 | 44 | 75 | 65 | 1030 | 60 | 49 | 102 | 125 | 62/14 | | 33 |
| | 18:00 | 82 | 78 | 6050 | 46 | 78 | 62 | 1030 | 48 | 52 | 194 | 124 | 60/18 | | 34 |
| B | 19:00 | 82 | 81 | 6050 | 48 | 74 | 63 | 1030 | 50 | 50 | 102 | 122 | 60/18 | | 35 |
| | 20:00 | 84 | 86 | 6300 | 50 | | | 1020 | 440 | | | | 58 | | 31 |
| | 21:00 | | | | | | | | | | | | | | |
| | 22:00 | 83 | 86 | 6300 | 50 | | | 1020 | 50 | | | | 56 | | 38 |
| | 23:00 | | | | | | | | | | | | | | |
| | 24:00 | 84 | 76 | 6200 | 50 | | | 1020 | 430 | | | | 60 | | 32 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-IDE JOB NO. LB550 DATE 3/13/75 SHT. 13
DETAIL HERCULES HNO3 TESTING BY RKR OF 16

H2O meter

# NITRIC ACID PROCESS DATA

| Time | Reading |
|---|---|
| 09:00 | 222,850 |
| 13:00 | 241,800 |
| 18:00 | 267,590 |

DATE 3/13/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X.D.R. RPM | Injection water gpm | Acid Strength Tray*/% | XRD Feed Gas % O2 | Product Strength % |
|---|---|---|---|---|---|---|---|---|---|
| 1:00 | 57 | 114 | 110 | 83 | 132 | 2.0 | | | |
| 2:00 | 58 | 114 | 110 | 83 | 132 | 2.0 | | | - |
| 3:00 | 57 | 115 | 111 | 83 | 130 | 2.0 | 29/14.5 24/16.6 16/55.6 4/59.51 | | 59.97 |
| 4:00 | 55 | 115 | 111 | 83 | 130 | 2.0 | | | |
| 5:00 | 56 | 115 | 111 | 83 | 130 | 2.0 | 29/15.4 24/19.3 16/56.4 4/60.03 | | 60.53 |
| 6:00 | 56 | 114 | 110 | 83 | 130 | 2.0 | | | |
| 7:00 | 36 | 114 | 110 | 83 | 82 | 2.0 | 29/13.8 24/21.6 16/23.9 4/59.68 | | 60.20 |
| 8:00 | 35 | 115 | 112 | 93 | 82 | 1.8 | | 1.9 | |
| 9:00 | 33 | 120 | 118 | 100 | 82 | 1.7 | | 3.2 | - |
| 10:00 | 35 | 116 | 112 | 96 | 82 | 1.8 | 29/11.4 24/17.0 16/51.4 4/60.73 | 3.5 | 60.22 |
| 11:00 | 35 | 118 | 115 | 98 | 82 | 1.7 | | 3.1 | - .. |
| 12:00 | 76 | 116 | 112 | 80 | 158 | 2.6 | | 3.1 | |
| 13:00 | 73 | 116 | 112 | 80 | 158 | 2.5 | 29/11.4 24/17.0 16/? 4/? | 2.8 | 59.42 |
| * 14:00 | Production | | Rate | Changing | * | * | | | |
| 15:00 | 78 | 118 | 114 | 80 | 161 | 2.7 | | 4.2 | |
| 16:00 | 80 | 121 | 118 | 80 | 164 | 2.6 | 29/14.5 24/20.1 16/53.26 4/58.71 | 2.8 | 58.11 |
| 17:00 | 80 | 120 | 116 | 78 | 164 | 2.7 | | 3.1 | |
| 18:00 | 80 | 118 | 114 | 77 | 164 | 2.7 | | 3.0 | |
| 19:00 | 82 | 118 | 113 | 77 | 164 | 2.6 | | 3.0 | |
| 20:00 | 82 | 118 | 114 | 76 | 164 | 3.0 | 29/19.3 24/25.6 16/56.86 4/[illegible] | | 59.14 |
| 21:00 | 82 | 118 | 114 | 76 | 164 | 3.0 | | | |
| 22:00 | 82 | 118 | 114 | 76 | 164 | 3.0 | | | |
| 23:00 | 82 | 118 | 114 | 76 | 168 | 3.0 | | [illegible] | |
| 24:00 | 82 | 120 | 116 | 80 | 168 | 2.8 | 29/20.9 24/26.2 16/56.4 4/58.71 | [illegible] | 59.95 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850 DATE 3/13 SHT. 14

DETAIL HERCULES $HNO_3$ TESTING BY RLR OF 16

# NITRIC ACID PROCESS DATA

DATE 3/14/75

PLANT Hercules, Inc., Bessemer, Ala.

| TIME | AIR FLOW (x 4500 = CFH) | AIR RECEIVER PRESS. psig | SYSTEM PRESS psig | BACK PRESS psig | X. D. R. RPM | Injection water gpm | Acid Strength Tray #/% | XRD Feed Gro %O₂ | Product Strength |
|---|---|---|---|---|---|---|---|---|---|
| 1:00 | 83 | 120 | 114 | 80 | 168 | 2.8 | - | Instrument out of order | |
| 2:00 | 83 | 120 | 116 | 80 | 168 | 2.8 | | | |
| 3:00 | 84 | 121 | 116 | 80 | 168 | 2.8 | 29/14.5 24/19.3 11/559 4/58.71 | | 59.83 |
| 4:00 | 84 | 121 | 116 | 80 | 168 | 2.8 | | | |
| 5:00 | 85 | 121 | 117 | 80 | 168 | 2.8 | 29/15.4 24/20.1 11/539 4/59.88 | | 59.83 |
| 6:00 | 85 | 121 | 117 | 80 | 168 | 2.8 | | | |
| 7:00 | 85 | 121 | 117 | 80 | 168 | 2.8 | | | |
| 8:00 | 80 | 118 | 114 | 77 | 168 | 2.6 | | | |
| 9:00 | 80 | 118 | 114 | 78 | 168 | 2.6 | | | |
| 10:00 | 80 | 116 | 112 | 76 | 168 | 2.6 | | | |
| 11:00 | 80 | 116 | 112 | 76 | 168 | 2.6 | | | |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. L850

DETAIL HERCULES $HNO_3$ TESTING

DATE 3/14/75

BY RGR

SHT. 15 OF 16

# PURASIV-N PROCESS DATA

DATE 3/14/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 63 1/2" @ 10:00 AM 3/14/75

Water Meter

| Time | Reading (QN) |
|---|---|
| 07:13 | 331,655 |
| 11:00 | 347,375 |

| TIME | FEED GAS PRESS. (PI-131) psig | FEED GAS TEMP. (T-3) °F | INLET GAS FLOW (FR-101) scfm | INLET GAS TEMP (TR-117) (#5) °F | OUTLET GAS PRESS. (PI-106) psig | OUTLET GAS TEMP. (TT-105) °F | REGENERATION GAS FLOW (FRC-102) scfm | REGENERATION GAS TEMPERATURE, °F IN (TR-124) (#10) | REGENERATION GAS TEMPERATURE, °F TOP OF BED (#4 & 9) | REGENERATION GAS TEMPERATURE, °F OUT (TR-125) (#11) | REGENERATION GAS PRESS IN (PI-107) psig | BED ΔP in. W.C. | WATER METER READING | [illegible] TEMP °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1:00 | – | | | | | | | | | | | | | |
| 2:00 | 84 | 74 | 6100 | 45 | | | 1020 | 50 | | | | 60 | | 32 |
| 3:00 | – | | | | | | | | | | | | | |
| 4:00 | 84 | 72 | 6300 | 40 | | | 1020 | 400 | | | | 60 | | 30 |
| 5:00 | | | | | | | | | | | | | | |
| 6:00 | 84 | 70 | 6200 | 45 | | | 1030 | 50 | | | | 60 | | 30 |
| A 7:00 | 80 | 68 | 5900 | 44 | 75 | 55 | 1030 | 45 | 42 | 74 | 120 | 58/18 | | 31 |
| 8:00 | 83 | 67 | 5500 | 44 | 78 | 69 | 1030 | 408 | 48 | 55 | 123 | 60/18 | | 32 |
| 9:00 | 84 | 66 | 5500 | 45 | 80 | 71 | 1030 | 411 | 49 | 102 | 124 | 60/18 | | 32 |
| 10:00 | 82 | 67 | 5450 | 44 | 80 | 69 | 1030 | 48 | 51 | 160 | 122 | 60/18 | | 31 |
| 11:00 | 82 | 68 | 5500 | 44 | 78 | 67 | 1030 | 47 | 49 | 114 | 122 | 60/18 | | 32 |

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850 DATE 3/14/75 SHT. 16

DETAIL HERCULES HNO3 TESTING BY RKR OF 16

0. Compressor #3 off line - output being used by other parts of plant
1. Unit was shut down during the night - pilot flame failure
2. Unit restarted about 7:20 - run at partial load until 0930
3. Switched to adsorber A @ 0930. Brought flow rate thru system up to ~ 6000 scfm.
4. 1135 Acid plant shut down - Purasiv shut off Lost a boiler at the power plant - low steam press. to ammonia vaporizer forced shut down.

1210 - restarted Purasiv - initial flow 5350, changed to 4800 @ 1230.
1305 - raised Purasiv flow rate to 5700.
1412 - Unit B switched on adsorption mode, feed flow increased to 5950.
1517 - Started Voltage & Amperage Recorder
1520 - Feed rate ~~[illegible]~~ lowered to 5700 scfm (design rate)
1800 - Unit auto.-switched to adsorber A, flow started at 5750
Bed ΔP set point changed to 61.

3/6/75 DAILY LOG . Compressor #3 being used by powder line
0800 arrived at plant - plant & Purasiv had operated continuously during the night. Outlet chart recorder had stopped inking at
0830 Purasiv ΔP set point changed from 61 in. W.C. to 56 in. W.C. Purasiv flow droped from 5900 scfm to 5750 scfm ~~Recycle~~ Regen. flow rate changed from 1010 to 1040 scfm
1010 Purasiv auto-switched from A to B on adsorption mode. Bed ΔP jumped from 58 to 60.5.
1035 Inlet flow up to 5750, bed ΔP set point changed from 58.0 to 60.5 in. W.C.
1408 ~~1355~~ Purasiv auto switched to B on adsorption, A on regen. Inlet flow jumped to 5900 scfm and bed ΔP droped to 56 with no change in the ΔP set point
1709 Failure of push rod linkage on X.R.D. caused plant to shut down for about 5 minutes. Flow to Purasiv was droped but did not shut down unit. Plant back in about 20 minutes. Ran up & down for next 20 min
1812 Purasiv auto switched to A adsorption, B regen. New bed ΔP about 46 in. W.C. Inlet flow rate 5250
Plant still lining out
1820 Compressor #6 failed Plant kept running at reduced rate Inlet flow 575, Regen flow 1050, ΔP 12.5,

| ENGINEERING-SCIENCE, INC. | PROJECT BESSEMER $HNO_3$ JOB NO. 1850 | DATE 3/5/75 | SHT. 1 |
|---|---|---|---|
| | DETAIL DAILY LOG | BY JTG | OF 8 |

3/6/75 CONT.

1800 to M.N. Continued operating at a reduced rate. Plant running about 60 on air flow chart.

3/7/75

M.N. to 0430 Sieve operated at about 800 scfm inlet and 1020 regen until 0430 when high liquid level in the sieve demister shut the Purasiv down. Attempts by operator to restart were unsuccessful. Plant also down.

0730 Purasiv restarted by Bob Allbright. Plant running about 50 on air flow chart

0830 Plant up to 85 air flow - but then lost something and could only get 75. Plant not sure what is causing lower flow.

0850 auto sieve change to B on adsorb, A on regen.

1000 Compressor #6 kicked off - air flow to plant off for a min or so - plant brought back up immediately. Purasiv flow maintained although at reduced rate of 4500 for about 25 min - then back up to 5700.

1255 Purasiv auto switch to A on adsorb., B on regen Flow before switch was 5800 scfm, regen 1010 scfm. After switch inlet

1308 Increased air flow to bleacher to get more $O_2$ into tower. Total air flow went from 73 to 77 on chart. Purasiv inlet went from 5550 to 5650, regen from 1010 to 1020. $O_2$ in tail gas went from 1.70 to 3.3%

1655 PuraSiv auto switch to B on adsorb, A on regen

| ENGINEERING-SCIENCE, INC. | PROJECT EPA-LOE JOB NO. 1850 | DATE 3/7/75 | SHT. 2 |
|---|---|---|---|
| | DETAIL HERCULES $HNO_3$ TESTS | BY 7J6 | OF 8 |

3/10/75 - Daily Log - R.L. Roberson

Arrived at plant approx 8:00 AM. Review data to be taken and locations of various meters.
Part for water meter is expected around 13:00.

09:45 Waiting for plant to come on-line. Delay - for $NH_3$ pressure to build in feed tanks

11:00 Pressure Rising very slowly in $NH_3$ - Tank #3

14:00 Pressure at 145 psig in Tank #3
Plant has decided to try to raise sufficient feed pressure in Tank #4. Will light off on #4 & switch to #5

Note: The $NH_3$ pressure in feed (supply) tanks must be 165 psig because
1) $NH_3$ must be a gas when it goes into burner
2) $NH_3$ pressure must be greater than the combustion air pressure, else there would be "blow-back" into receiver

15:10 $NH_3$ Combustor is lighted

16:00 Acid being made, as system smooths out the Pura Siv will be purged.

16:20 Purging began, will require at least one (1) hour.

16:45 Pura Siv not started because of thermocouple failure in the heater unit of the Siv. Thus, flame could not be stabalized.

| ENGINEERING-SCIENCE, INC. | PROJECT EPA - LOE  JOB NO. 1850 | DATE 3/10/75 | SHT. 3 |
|---|---|---|---|
| | DETAIL Hercules $HNO_3$ Tests | BY RLR | OF 8 |

3-11-75 Daily Log

07:10 Unit shut down to repair leak in discharge line from oxidizing unit

08:15 Begin to remove line with leak (bad weld)

08:30 Estimated start-up time ⇒ 10:30

13:00 Leak repaired, other minor repairs completed Combustor Ignited.

14:00 PuraSiv Cycle Began Adsorber - A

One Air compressor with a 1300 cfm capacity is down. This reduces production rate - the ~~cm~~ compressor may be down for the rest of the week. At this lower production rate, the adsorption tower is much more efficient and thus lower inlet concentrations are to be expected!

15:~~20~~ 30 An Auxiliary compressor with 600 cfm capacity was brought online. This will increase production rate

16:30 Process appears to have leveled-out.. Data to be taken hourly

17:10 No Acid samples have been taken until 4pm. It takes ≈ ~~1/2~~, 4 hrs. after start-up for acid to get up to strength.

17:54 CYCLE OVER ⇒ ADSORPTION B

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PROJECT EPA-LOE JOB NO. 1850 DATE 3/11/75 SHT. 4

DETAIL Hercules $HNO_3$ Tests BY RSR OF 8

3-12-75 Daily Log

07:00 The auxiliary compressor was taken off line. Actually, this compressor is still running but its air (output) belongs to another part of the plant. Thus, the AOP will be at less than rated capacity for all of the 2nd shift (7am-3pm).

10:02 Vessel B ADSORBING

11:00 Bob Albright reports that the #6 Compressor may be online by Noon 3/13 (Thur.) This would put the plant close to capacity

13:45 Auxiliary Compressor put on line. This is the #3 Compressor which adds about 600 cfm.

14:04 Cycle Change - VESSEL A ADSORBING

18:06 Cycle Change - VESSEL B ADSORBING

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850 DATE 3/12/75 SHT. 5

DETAIL Hercules $HNO_3$ Tests BY RLR OF 8

3-13-75 Daily Log

6:45 No. 3 Compressor shunted back to power house. Thus, Production Rate dropped.

10:16 CYCLE CHANGE VESSEL B ADSORBING

10:22 Flame FAILURE in Heater (Regen cycle for vessel A)

10:40 By-Pass open, flow thru Sieve dropped to 3000 cfm. Differential pressure down to 38/1 By-Pass should be wide open

11:15 Flame still out, continuing to Bypass Sieve

11:30 Compressor No. 6 has been repaired and is running. The production rate will increase
Air flow is reading 74 (x4500) cfh
X.R.D Speed = 174 rpm
Flow thru Sieve is up to 5300 cfm
By pass closing ⇒ Flame lighted

11:32 Sieve flow increased to 6800 cfm but falling off!

11:33 Discover loose line on X.R.D (Power Recovery)
Its speed has dropped to 136 rpm
Problem: Broken Valve connection on XRD.

11:36 Alarm X.R.D Down, Air Flow and production dropping
XRD intake valve must be repaired
Flow thru Sieve = 3000 cfm

11:41 X.R.D repaired and back on-line. Should get up to rate if nothing else happens

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|---|---|---|---|
| | DETAIL Hercules, $HNO_3$ Testing | BY R&R | OF 8 |

3-13-75 Continued

11:45 AOP is beginning to approach rate
Flow thru Sieve 6200 cfm.
The flame was ignited ≈ 11:30.
PuraSieve reset to automatic and cycle will continue.

12:55 Plant operating smoothly. This is the first time the plant has approach rate this week (10 March 75)

13:55 No. 3 Compressor put on line. This should give max. rate

13:59 High diff pressure alarm in ADSORBTION TOWER.
14:00 By-Pass open (Auto VALVE is not openning thus creating high ΔP in tower)

14:10 B. Albright is not sure why, but the regen flow began to fluctuate between 600 - 1350 scfm.
PuraSieve ΔP ≈ 22 in W.C. ; Bypass is fully open

1455 - PuraSieve began to settle down, Production rate was slightly reduced

15:03 CYCLE CHANGE : VESSEL A ADSORBING

16:24 Alarm : High ΔP in adsorption tower. This is the same problem that ocurred at 14:00. Corrected w/ no problem for PuraSieve

19:05 CYCLE CHANGE : VESSEL B ADSORBING

| | | | |
|---|---|---|---|
| ENGINEERING-SCIENCE, INC. | PROJECT EPA - LOE JOB NO. 1850 | DATE 3/13/75 | SHT. 7 |
| | DETAIL Hercules, $HNO_3$ Testing | BY RRR | OF 8 |

## TECHNICAL REPORT DATA
*(Please read Instructions on the reverse before completing)*

| | | |
|---|---|---|
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| 4. TITLE AND SUBTITLE<br>Molecular Sieve Tests for Control of NOx Emissions from a Nitric Acid Plant; Volume II--Appendices | | 5. REPORT DATE<br>March 1976<br>6. PERFORMING ORGANIZATION CODE |
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15. SUPPLEMENTARY NOTES Project officer for this report is E.J. Wooldridge, Ext 2547.


16. ABSTRACT The report gives results of performance testing for NOx emission control on Union Carbide's PuraSiv N unit, now controlling emissions from the tail gas stream of the ammonia oxidation nitric acid production facility of Hercules, Inc. in Bessemer, Alabama. Simultaneous measurements of NO2/NOx concentrations were performed in the PuraSiv N inlet and outlet streams during 11 individual 4-hour adsorption cycles, using continuous photometric analyzers. NOx concentrations were also measured at the test sites, using the EPA Method 7 reference procedure, to provide comparative data. Total NOx mass loading to the sieve was variable from cycle to cycle, ranging from 63,370 to 251,800 grams, reported as NO2. Average efficiency of the control unit for the cycles tested ranged from 98.68 to 95.92%. The integrated average concentrations of NOx emitted over the complete cycles ranged from 17 to 154 ppm.


17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Air Pollution | Air Pollution Control | 13B |
| Nitric Acid | Stationary Sources | 07B |
| Chemical Plants | Molecular Sieves | 07A |
| Absorbers (Materials) | Ammonia Oxidation | 11G |
| Nitrogen Oxides | Tail Gas | |
| Adsorption | PuraSiv N | |

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|---|---|---|
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