W-24

56

Report to

**BRIGGS & STRATTON CORPORATION**
Wauwatosa, Wisconsin

for

**PARTICULATE MATTER EMISSION TESTS**
**68th Street Foundry Cupola**

**December 8, 1994**

by

**ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION**
13020 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

W1·24
57

## SUMMARY

On December 8, 1994, Environmental Technology & Engineering Corp personnel performed a particulate matter emissions test on the scrubber used to control the cupola emissions at the Briggs & Stratton Corporation facility located on 68th Street in West Allis, Wisconsin. The results demonstrate that the emissions were well below the RACT limit of 0.25 pounds of particulate per 1,000 pounds of exhaust gas as set by the State of Wisconsin Department of Natural Resources in Chapter NR415.05(4). The results were as follows:

| TEST | EMISSIONS | % OF ALLOWABLE |
|---|---|---|
| 1 | 0.043 lb/1000 lb | 17.2 |
| 2 | 0.044 | 17.6 |
| 3 | 0.019 | 7.6 |
| AVG | 0.035 lb/1000 lb | 14.1 |

BRIGGS & STRATTON CUPOLA S12 TEST 1 TABLE 2-1 12-8-94

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BAROMETRIC PRESSURE, in Hg = 29.680
TIP DIAMETER, in = .3720
STACK AREA, sq ft = 20.295
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 44.84
SATURATION WATER, ml = 270
PARTICULATE COLLECTED, grams = 0.0813
ORSAT RESULTS
CO2 = 10.40 O2 = 10.00 N2 = 79.60

| SAMPLING POINT | STACK TEMP deg F | PITOT DEL P inches | ORIFICE METER inches | GAS METER OUTLET T deg F | GAS VELOCITY fps |
|---|---|---|---|---|---|
| 1 | 144 | 0.150 | 1.85 | 59 | 23.91 |
| 2 | 144 | 0.130 | 1.60 | 59 | 22.26 |
| 3 | 145 | 0.130 | 1.60 | 59 | 22.28 |
| 4 | 145 | 0.160 | 2.00 | 59 | 24.72 |
| 5 | 145 | 0.180 | 2.25 | 60 | 26.22 |
| 6 | 145 | 0.180 | 2.25 | 60 | 26.22 |
| 7 | 147 | 0.190 | 2.35 | 60 | 26.98 |
| 8 | 146 | 0.170 | 2.10 | 61 | 25.50 |
| 9 | 145 | 0.170 | 2.10 | 62 | 25.48 |
| 10 | 144 | 0.170 | 2.10 | 63 | 25.46 |
| 11 | 144 | 0.150 | 1.85 | 63 | 23.91 |
| 12 | 140 | 0.140 | 1.70 | 64 | 23.03 |
| 13 | 142 | 0.190 | 2.35 | 66 | 26.87 |
| 14 | 143 | 0.200 | 2.45 | 67 | 27.59 |
| 15 | 145 | 0.200 | 2.45 | 68 | 27.64 |
| 16 | 144 | 0.170 | 2.10 | 68 | 25.46 |
| 17 | 143 | 0.150 | 1.85 | 68 | 23.89 |
| 18 | 145 | 0.160 | 2.00 | 68 | 24.72 |
| 19 | 145 | 0.180 | 2.25 | 68 | 26.22 |
| 20 | 142 | 0.170 | 2.10 | 68 | 25.42 |
| 21 | 144 | 0.170 | 2.10 | 68 | 25.46 |
| 22 | 145 | 0.150 | 1.85 | 68 | 23.93 |
| 23 | 146 | 0.130 | 1.60 | 68 | 22.30 |
| 24 | 145 | 0.130 | 1.60 | 69 | 22.28 |
| AVG VALUES | 144 | | 2.019 | 64 | 24.91 |

TOTAL GAS WITHDRAWN, scf = 57.83
DRY AIR WITHDRAWN, scf = 45.12
WATER VAPOR WITHDRAWN, scf = 12.71
PERCENT WATER VAPOR = 21.98
ACTUAL WET FLOW RATE, acfm = 30,327
STANDARD DRY FLOW RATE, scfm = 20,502
, m3/hr = 34,838
PARTICULATE CONCENTRATION, grains/dscf = 0.028
PARTICULATE EMISSION RATE, lb/hr = 4.85
LB PARTICULATE PER 1000 LB GAS = 0.043
PERCENT OF ISOKINETIC SAMPLING = 98.6

BRIGGS & STRATTON CUPOLA S12 TEST 2 TABLE 2-2 12-8-94

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BAROMETRIC PRESSURE, in Hg = 29.680
TIP DIAMETER, in = .3720
STACK AREA, sq ft = 20.295
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 45.93
SATURATION WATER, ml = 276
PARTICULATE COLLECTED, grams = 0.0860
ORSAT RESULTS
CO2 = 12.00 O2 = 8.80 N2 = 79.20

| SAMPLING POINT | STACK TEMP deg F | PITOT DEL P inches | ORIFICE METER inches | GAS METER OUTLET T deg F | GAS VELOCITY fps |
|---|---|---|---|---|---|
| 1 | 145 | 0.160 | 2.00 | 62 | 24.64 |
| 2 | 144 | 0.130 | 1.60 | 63 | 22.19 |
| 3 | 142 | 0.170 | 2.10 | 64 | 25.34 |
| 4 | 140 | 0.160 | 2.00 | 64 | 24.54 |
| 5 | 143 | 0.200 | 2.45 | 65 | 27.51 |
| 6 | 144 | 0.170 | 2.10 | 67 | 25.38 |
| 7 | 142 | 0.160 | 2.00 | 67 | 24.58 |
| 8 | 143 | 0.180 | 2.25 | 67 | 26.09 |
| 9 | 143 | 0.200 | 2.45 | 68 | 27.51 |
| 10 | 143 | 0.170 | 2.10 | 69 | 25.36 |
| 11 | 142 | 0.150 | 1.85 | 70 | 23.80 |
| 12 | 142 | 0.160 | 2.00 | 70 | 24.58 |
| 13 | 143 | 0.180 | 2.25 | 71 | 26.09 |
| 14 | 145 | 0.180 | 2.25 | 71 | 26.14 |
| 15 | 145 | 0.180 | 2.35 | 71 | 26.14 |
| 16 | 144 | 0.200 | 2.45 | 72 | 27.53 |
| 17 | 145 | 0.200 | 2.45 | 72 | 27.55 |
| 18 | 146 | 0.200 | 2.45 | 72 | 27.57 |
| 19 | 144 | 0.170 | 2.10 | 72 | 25.38 |
| 20 | 145 | 0.170 | 2.10 | 73 | 25.40 |
| 21 | 143 | 0.170 | 2.10 | 73 | 25.36 |
| 22 | 146 | 0.180 | 2.25 | 73 | 26.16 |
| 23 | 144 | 0.140 | 1.70 | 74 | 23.03 |
| 24 | 142 | 0.130 | 1.60 | 74 | 22.16 |
| AVG VALUES | 144 | | 2.123 | 69 | 25.42 |

TOTAL GAS WITHDRAWN, scf = 59.25
DRY AIR WITHDRAWN, scf = 46.26
WATER VAPOR WITHDRAWN, scf = 12.99
PERCENT WATER VAPOR = 21.93
ACTUAL WET FLOW RATE, acfm = 30,952
STANDARD DRY FLOW RATE, scfm = 20,964
, m3/hr = 35,622
PARTICULATE CONCENTRATION, grains/dscf = 0.029
PARTICULATE EMISSION RATE, lb/hr = 5.13
LB PARTICULATE PER 1000 LB GAS = 0.044
PERCENT OF ISOKINETIC SAMPLING = 98.9

W1-24

60

BRIGGS & STRATTON CUPOLA S12 TEST 3 TABLE 2-3 12-8-94

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BAROMETRIC PRESSURE, in Hg = 29.680
TIP DIAMETER, in = .3720
STACK AREA, sq ft = 20.295
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 38.35
SATURATION WATER, ml = 230
PARTICULATE COLLECTED, grams = 0.0303
ORSAT RESULTS
CO2 = 12.50 O2 = 8.30 N2 = 79.20

| SAMPLING POINT | STACK TEMP deg F | PITOT DEL P inches | ORIFICE METER inches | GAS METER OUTLET T deg F | GAS VELOCITY fps |
|---|---|---|---|---|---|
| 1 | 145 | 0.120 | 1.50 | 70 | 21.32 |
| 2 | 144 | 0.120 | 1.50 | 71 | 21.30 |
| 3 | 144 | 0.120 | 1.70 | 71 | 21.30 |
| 4 | 143 | 0.110 | 1.35 | 72 | 20.38 |
| 5 | 146 | 0.100 | 1.22 | 72 | 19.48 |
| 6 | 143 | 0.130 | 1.60 | 72 | 22.16 |
| 7 | 142 | 0.120 | 1.50 | 72 | 21.27 |
| 8 | 144 | 0.120 | 1.50 | 73 | 21.30 |
| 9 | 145 | 0.110 | 1.35 | 73 | 20.41 |
| 10 | 142 | 0.100 | 1.22 | 73 | 19.42 |
| 11 | 142 | 0.100 | 1.22 | 73 | 19.42 |
| 12 | 142 | 0.090 | 1.10 | 73 | 18.42 |
| 13 | 145 | 0.100 | 1.22 | 73 | 19.46 |
| 14 | 145 | 0.110 | 1.35 | 73 | 20.41 |
| 15 | 146 | 0.110 | 1.35 | 74 | 20.43 |
| 16 | 144 | 0.110 | 1.35 | 74 | 20.40 |
| 17 | 144 | 0.120 | 1.50 | 74 | 21.30 |
| 18 | 143 | 0.140 | 1.70 | 74 | 22.99 |
| 19 | 144 | 0.120 | 1.50 | 74 | 21.30 |
| 20 | 142 | 0.130 | 1.60 | 74 | 22.14 |
| 21 | 143 | 0.100 | 1.22 | 74 | 19.43 |
| 22 | 145 | 0.100 | 1.22 | 74 | 19.46 |
| 23 | 144 | 0.100 | 1.22 | 74 | 19.45 |
| 24 | 143 | 0.080 | 1.00 | 74 | 17.38 |
| AVG VALUES | 144 | | 1.375 | 73 | 20.43 |

TOTAL GAS WITHDRAWN, scf = 49.39
DRY AIR WITHDRAWN, scf = 38.57
WATER VAPOR WITHDRAWN, scf = 10.83
PERCENT WATER VAPOR = 21.92
ACTUAL WET FLOW RATE, acfm = 24,880
STANDARD DRY FLOW RATE, scfm = 16,849
, m3/hr = 28,629
PARTICULATE CONCENTRATION, grains/dscf = 0.012
PARTICULATE EMISSION RATE, lb/hr = 1.77
LB PARTICULATE PER 1000 LB GAS = 0.019
PERCENT OF ISOKINETIC SAMPLING = 102.6

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61

# BRIGGS STRATTON CORPORATION

## PARTICULATE EMISSIONS COMPLIANCE TESTS-12/8/94

PRODUCTION/PARAMETRIC MONITORING REPORT- 1/5/95

| Description of Parameter Monitored during Tests | Compliance Test Run Number | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Test Time Increment (Hours) | 1 | 1 | 1 |
| Process Weight Rate Total Charge (Tons / Hr) | 34.13 | 34.09 | 36.02 |
| Charge Composition (% by wt Constituents) | (Same for Each Charge) C (3.55), Si (2.43), S (0.08), Mn (0.25), P (0.022), Mg (0.049), Cu (0.59), Sn (0.006), Ti (0.014), Cr (0.035), Mo (0.013), Ni (0.031), V (0.013), Al (0.013), Pb (0.003), Ce (0.005), Fe (93.3) | | |
| Afterburner Temperature (Degrees Fahrenheit) | 1529 | 1551 | 1623 |
| Static Pressure Differential Across Scrubber (Inches $H_2O$) | 27.9 currently recommended to achieve | 29.1 | 45.1 |
| Scrubber Water Flow (GPM) | 565 | 565 | 565 |
| Cupola Blast Rate (SCFM) | 10970 | 10970 | 11090 |
| Oxygen Injection Rate (Lbs / Hr) | 1158.7 | 1242.9 | 1242.8 |
| **SCRAP COMPOSITION** | | | |
| Low (Mn) Steel (% of Total Charge) | 22.4 | 22.9 | 22.3 |
| Tubing Steel (% of Total Charge) | 10 | 9.6 | 10.1 |
| Pig Iron (% of Total Charge) | 12.2 | 12.4 | 12.3 |
| Ductile Iron Returns (% of Total Charge) | 42.5 | 42.2 | 42.4 |
| Coke (% of Total Charge) | 7.8 | 7.8 | 7.8 |
| SiC (% of Total Charge) | 3 | 3 | 3 |
| CaO (% of Total Charge) | 2.1 | 2.1 | 2.1 |

maximum PM exhaust PM

| Pollutant | CUPOLA STACK<br>December 08, 1994<br>METAL THROUGHPUT: 34.11 TON/HR | | CENTER POURING HOOD<br>December 02, 1994<br>METAL THROUGHPUT: 26.87 TON/HR | |
|---|---|---|---|---|
| | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) |
| Particulate Matter ✓ | 4.99 | 0.146 | 1.17 | 4.354e-02 |
| Carbon Monoxide | 26.72 | 0.783 | 20.12 | 0.749 |
| VOC ✓ | - | - | 0.21 | 7.815e-03 |
| $NO_x$ | 3.11 | 9.118e-02 | - | - |
| Sulfur Dioxide | 5.00e-02 | 1.466e-03 | - | - |
| Benzene | - | - | 5.00e-02 | 1.861e-03 |
| Formaldehyde | - | - | 1.00e-02 | 3.722e-04 |
| Phenol | - | - | 0.39 | 1.451e-02 |
| Toluene | - | - | 7.00e-02 | 2.605e-03 |
| Xylene | - | - | 3.00e-02 | 1.116e-03 |
| Naphthalene | - | - | 1.00e-02 | 3.722e-04 |
| Ammonia | - | - | 3.00e-02 | 1.116e-03 |
| $H_2S$ | 5.000e-03 | 1.466e-04 | 9.000e-03 | 3.349e-04 |
| Hydrogen Cyanide | - | - | 1.00e-02 | 3.722e-04 |
| Arsenic ✓ | 2.00e-05 | 5.863e-07 | 1.00e-03 | 3.722e-05 |
| Calcium | 9.00e-02 | 2.639e-03 | 4.67e-02 | 1.738e-03 |
| Cadmium ✓ | 5.00e-05 | 1.466e-06 | 9.00e-05 | 3.349e-06 |
| Cobalt ✓ | 3.00e-05 | 8.795e-07 | 6.00e-05 | 2.233e-06 |
| Chromium ✓ | 1.01e-03 | 2.961e-05 | 1.30e-03 | 4.838e-05 |
| Copper | 5.72e-03 | 1.677e-04 | 4.11e-03 | 1.530e-04 |
| Magnesium | 0.15 | 4.398e-03 | 4.90e-02 | 1.824e-03 |
| Manganese ✓ | 0.10363 | 3.038e-03 | 1.99e-03 | 7.406e-05 |
| Molybdenum | 8.00e-05 | 2.345e-06 | 1.40e-04 | 5.210e-06 |
| Nickel ✓ | 1.19e-03 | 3.489e-05 | 1.10e-04 | 4.094e-06 |
| Lead ✓ | 3.01e-03 | 8.824e-05 | 5.50e-04 | 2.047e-05 |
| Selenium ✓ | 5.80e-04 | 1.700e-05 | 2.00e-05 | 7.443e-07 |
| Tin | 4.50e-04 | 1.319e-05 | 8.20e-04 | 3.052e-05 |

M-29
6-3

| Pollutant | NORTH POURING HOOD December 02, 1994 METAL THROUGHPUT: 27.34 TON/HR | | TOTAL, BOTH POURING HOODS[1] | |
|---|---|---|---|---|
| | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor[1] (lb/ton metal) |
| Particulate Matter | 0.72 | 2.634e-02 | 1.890 | 6.988e-02 |
| Carbon Monoxide | 9.92 | 0.363 | 30.040 | 1.112 |
| VOC | 0.22 | 8.047e-03 | 0.430 | 1.586e-02 |
| $NO_x$ | - | - | - | - |
| Sulfur Dioxide | - | - | - | - |
| Benzene | 3.00e-02 | 1.097e-03 | 8.000e-02 | 2.958e-03 |
| Formaldehyde | 6.00e-03 | 2.195e-04 | 1.600e-02 | 5.916e-04 |
| Phenol | 0.37 | 1.353e-02 | 0.760 | 2.805e-02 |
| Toluene | 0.12 | 4.389e-03 | 0.190 | 6.994e-03 |
| Xylene | 2.00e-02 | 7.315e-04 | 5.000e-02 | 1.848e-03 |
| Naphthalene | 1.00e-02 | 3.658e-04 | 2.000e-02 | 7.379e-04 |
| Ammonia | 0.1 | 3.658e-03 | 0.130 | 4.774e-03 |
| $H_2S$ | 7.000e-03 | 2.560e-04 | 1.600e-02 | 5.910e-04 |
| Hydrogen Cyanide | 1.00e-02 | 3.658e-04 | 2.000e-02 | 7.379e-04 |
| Arsenic | 7.00e-05 | 2.560e-06 | 1.070e-03 | 3.978e-05 |
| Calcium | 2.95e-02 | 1.079e-03 | 7.621e-02 | 2.817e-03 |
| Cadmium | 9.00e-05 | 3.292e-06 | 1.800e-04 | 6.641e-06 |
| Cobalt | 5.00e-05 | 1.829e-06 | 1.100e-04 | 4.062e-06 |
| Chromium | 1.30e-04 | 4.755e-06 | 1.430e-03 | 5.314e-05 |
| Copper | 2.42e-03 | 8.851e-05 | 6.530e-03 | 2.415e-04 |
| Magnesium | 6.68e-02 | 2.443e-03 | 0.116 | 4.267e-03 |
| Manganese | 1.43e-03 | 5.230e-05 | 3.420e-03 | 1.264e-04 |
| Molybdenum | 1.40e-04 | 5.121e-06 | 2.800e-04 | 1.033e-05 |
| Nickel | 1.10e-04 | 4.023e-06 | 2.200e-04 | 8.117e-06 |
| Lead | 5.30e-04 | 1.939e-05 | 1.080e-03 | 3.985e-05 |
| Selenium | 1.00e-05 | 3.658e-07 | 3.000e-05 | 1.110e-06 |
| Tin | 7.80e-04 | 2.853e-05 | 1.600e-03 | 5.905e-05 |

[1]Together, these two pouring vents account for approximately 75% of total pouring emissions. Therefore, real emission factors will be 33% higher than the values shown above

M-24
69

| Pollutant | DESULFURIZATION November 29, 1994 METAL THROUGHPUT: 25.15 TON/HR | | SAND SYSTEM November 30, 1994 METAL THROUGHPUT: 19.48 TON/HR | |
|---|---|---|---|---|
| | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) |
| Particulate Matter | 7.7 | 0.306 | 59.64 | 3.062 |
| Carbon Monoxide | - | - | 0.2 | 1.027e-02 |
| VOC | - | - | 2.00e-02 | 1.027e-03 |
| $NO_x$ | - | - | - | - |
| Sulfur Dioxide | 3.04 | 0.121 | - | - |
| Benzene | - | - | 1.50e-03 | 7.700e-05 |
| Formaldehyde | - | - | 1.00e-03 | 5.133e-05 |
| Phenol | - | - | - | - |
| Toluene | - | - | - | - |
| Xylene | - | - | - | - |
| Naphthalene | - | - | - | - |
| Ammonia | - | - | - | - |
| $H_2S$ | 1.000e-03 | 3.976e-05 | - | - |
| Hydrogen Cyanide | - | - | - | - |
| Arsenic | 3.00e-05 | 1.193e-06 | - | - |
| Calcium | 2.66 | 0.106 | - | - |
| Cadmium | 6.00e-04 | 2.386e-05 | - | - |
| Cobalt | 3.80e-04 | 1.511e-05 | - | - |
| Chromium | 2.70e-04 | 1.074e-05 | - | - |
| Copper | 4.37e-03 | 1.738e-04 | - | - |
| Magnesium | 4.02e-02 | 1.598e-03 | - | - |
| Manganese | 5.10e-02 | 2.028e-03 | - | - |
| Molybdenum | 1.00e-04 | 3.976e-06 | - | - |
| Nickel | 1.80e-04 | 7.157e-06 | - | - |
| Lead | 2.95e-03 | 1.173e-04 | - | - |
| Selenium | 5.00e-05 | 1.988e-06 | - | - |
| Tin | 5.60e-04 | 2.227e-05 | - | - |

W1-24
65

| Pollutant | SHAKEOUT LINES 1&2<br>November 22, 1994<br>METAL THROUGHPUT: 13.95 TON/HR | | SCRUBBER S55<br>November 21, 1994<br>METAL THROUGHPUT: 25.20 TON/HR | |
|---|---|---|---|---|
| | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) |
| Particulate Matter | 594.67 | 42.629 | 4.1 | 0.163 |
| Carbon Monoxide | 1.25 | 8.961e-02 | 17.06 | 0.677 |
| VOC | 0.2 | 1.434e-02 | 2.46 | 9.762e-02 |
| $NO_x$ | - | - | - | - |
| Sulfur Dioxide | - | - | - | - |
| Benzene | 3.00e-02 | 2.151e-03 | 0.58 | 2.302e-02 |
| Formaldehyde | 4.00e-02 | 2.867e-03 | 0.12 | 4.762e-03 |
| Phenol | 0.69 | 4.946e-02 | 1.5 | 5.952e-02 |
| Toluene | 8.00e-02 | 5.735e-03 | - | - |
| Xylene | 1.00e-02 | 7.168e-04 | - | - |
| Naphthalene | 1.00e-02 | 7.168e-04 | 3.00e-02 | 1.190e-03 |
| Ammonia | 6.00e-02 | 4.301e-03 | 3.00e-02 | 1.190e-03 |
| $H_2S$ | 3.000e-02 | 2.151e-03 | 0.450 | 1.786e-02 |
| Hydrogen Cyanide | 1.00e-02 | 7.168e-04 | 3.00e-02 | 1.190e-03 |
| Arsenic | 3.50e-04 | 2.509e-05 | - | - |
| Calcium | 9.24 | 0.662 | - | - |
| Cadmium | 1.50e-04 | 1.075e-05 | - | - |
| Cobalt | 7.00e-05 | 5.018e-06 | - | - |
| Chromium | 3.22e-03 | 2.308e-04 | - | - |
| Copper | 1.26e-02 | 9.054e-04 | - | - |
| Magnesium | 2.51 | 0.180 | - | - |
| Manganese | 0.10874 | 7.795e-03 | - | - |
| Molybdenum | 1.80e-04 | 1.290e-05 | - | - |
| Nickel | 5.71e-03 | 4.093e-04 | - | - |
| Lead | 8.20e-03 | 5.878e-04 | - | - |
| Selenium | 1.80e-04 | 1.290e-05 | - | - |
| Tin | 1.06e-03 | 7.599e-05 | - | - |

W-24

66

| Pollutant | MOLD COOLING November 17, 1994 METAL THROUGHPUT: 27.95 TON/HR | | SHAKEOUT LINE 3 November 17, 1994 METAL THROUGHPUT: 11.00 TON/HR | |
|---|---|---|---|---|
| | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) | Stack Test Emission Rate (lb/hr) | Stack Test Emission Factor (lb/ton metal) |
| Particulate Matter | 12.61 | 0.451 | 165.35 | 15.032 |
| Carbon Monoxide | 17.63 | 0.631 | 0.48 | 4.364e-02 |
| VOC | 3.38 | 0.121 | 0.2 | 1.818e-02 |
| $NO_x$ | - | - | - | - |
| Sulfur Dioxide | - | - | - | - |
| Benzene | 0.53 | 1.896e-02 | 3.00e-02 | 2.727e-03 |
| Formaldehyde | 3.00e-02 | 1.073e-03 | 2.00e-02 | 1.818e-03 |
| Phenol | - | - | 0.12 | 1.091e-02 |
| Toluene | - | - | 6.00e-02 | 5.455e-03 |
| Xylene | - | - | 3.00e-02 | 2.727e-03 |
| Naphthalene | - | - | 1.00e-02 | 9.091e-04 |
| Ammonia | - | - | 9.00e-02 | 8.182e-03 |
| $H_2S$ | - | - | 2.000e-02 | 1.818e-03 |
| Hydrogen Cyanide | - | - | 3.00e-03 | 2.727e-04 |
| Arsenic | - | - | 1.40e-04 | 1.273e-05 |
| Calcium | - | - | 2.98 | 0.271 |
| Cadmium | - | - | 3.30e-04 | 3.000e-05 |
| Cobalt | - | - | 1.00e-05 | 9.091e-07 |
| Chromium | - | - | 9.00e-04 | 8.182e-05 |
| Copper | - | - | 4.43e-03 | 4.027e-04 |
| Magnesium | - | - | 0.84 | 7.636e-02 |
| Manganese | - | - | 3.83e-02 | 3.481e-03 |
| Molybdenum | - | - | 4.00e-05 | 3.636e-06 |
| Nickel | - | - | 8.60e-04 | 7.818e-05 |
| Lead | - | - | 2.50e-03 | 2.273e-04 |
| Selenium | - | - | 1.30e-04 | 1.182e-05 |
| Tin | - | - | 2.10e-04 | 1.909e-05 |

W1-24
67

m-24
68

Report to

**BRIGGS & STRATTON CORPORATION**
Wauwatosa, Wisconsin

for

**Part 70 Stack Emission Testing**
**68th Street Foundry**
November - December, 1994

by

**ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION**
13020 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

W1-24
69

## SUMMARY

During the period of November 17 - December 8, 1994, Environmental Technology & Engineering Corp personnel performed stack emissions testing on nine (9) stacks at the Briggs & Stratton Corp. Foundry, located on 68th Street in West Allis, Wisconsin. The results were as follows:

W1-24
70

BRIGGS & STRATTON 68TH STREET FOUNDRY
SHAKEOUT LINE 3 AVG THROUGHPUT TONS/HR
NOVEMBER 17, 1994 11.00

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 165.35 | 15.03 |
| CO | .48000 | .043636 |
| VOC | .20000 | .018182 |
| BENZENE | .03000 | .002727 |
| FORMALDEHYDE | .02000 | .001818 |
| PHENOL | <.12000 | <.010909 |
| TOLUENE | .06000 | .005455 |
| XYLENE | .03000 | .002727 |
| NAPHTHALENE | <.01000 | <.000909 |
| AMMONIA | .09000 | .008182 |
| H2S | .02000 | .001818 |
| HYDROGEN CYANIDE | <.00300 | <.000273 |
| ARSENIC | .00014 | .000012 |
| CALCIUM | 2.98000 | .270909 |
| CADMIUM | .00033 | .000030 |
| COBALT | <.00001 | <.000001 |
| CHROMIUM | .00090 | .000082 |
| COPPER | .00443 | .000403 |
| MAGNESIUM | .84000 | .076364 |
| MANGANESE | .03829 | .003481 |
| MOLYBDENUM | <.00004 | <.000003 |
| NICKEL | .00086 | .000079 |
| LEAD | .00250 | .000227 |
| SELENIUM | .00013 | .000011 |
| TIN | <.00021 | <.000019 |

M-24
71

BRIGGS & STRATTON 68TH STREET FOUNDRY
MOLD COOLING AVG THROUGHPUT TONS/HR
NOVEMBER 17, 1994 27.95

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 12.61 | .45 |
| CO | 17.63000 | .630769 |
| VOC | 3.38000 | .120930 |
| BENZENE | .53000 | .018962 |
| FORMALDEHYDE | .03000 | .001073 |

m-24

72

BRIGGS & STRATTON 68TH STREET FOUNDRY
SCRUBBER S55 AVG THROUGHPUT TONS/HR
NOVEMBER 21, 1994 25.20

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 4.10 | .16 |
| CO | 17.06000 | .676984 |
| VOC | 2.46000 | .097619 |
| BENZENE | .58000 | .023016 |
| FORMALDEHYDE | .12000 | .004762 |
| PHENOL | <1.50000 | <.059524 |
| NAPHTHALENE | <.03000 | <.001190 |
| AMMONIA | <.03000 | <.001190 |
| H2S | .45000 | .017857 |
| HYDROGEN CYANIDE | <.03000 | <.001190 |

M-24

73

BRIGGS & STRATTON 68TH STREET FOUNDRY
SHAKEOUT LINES 1&2 AVG THROUGHPUT TONS/HR
NOVEMBER 22, 1994 13.95

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 594.67 | 42.63 |
| CO | 1.25000 | .089606 |
| VOC | .20000 | .014337 |
| BENZENE | .03000 | .002151 |
| FORMALDEHYDE | .04000 | .002867 |
| PHENOL | .69000 | .049462 |
| TOLUENE | .08000 | .005735 |
| XYLENE | <.01000 | <.000717 |
| NAPHTHALENE | <.01000 | <.000717 |
| AMMONIA | .06000 | .004301 |
| H2S | .03000 | .002151 |
| HYDROGEN CYANIDE | <.01000 | <.000717 |
| ARSENIC | .00035 | .000025 |
| CALCIUM | 9.24000 | .662366 |
| CADMIUM | .00015 | .000011 |
| COBALT | <.00007 | <.000005 |
| CHROMIUM | .00322 | .000231 |
| COPPER | .01263 | .000905 |
| MAGNESIUM | 2.51000 | .179928 |
| MANGANESE | .10874 | .007795 |
| MOLYBDENUM | <.00018 | <.000013 |
| NICKEL | .00571 | .000410 |
| LEAD | .00820 | .000588 |
| SELENIUM | .00018 | .000013 |
| TIN | <.00106 | <.000076 |

W-24

74

BRIGGS & STRATTON 68TH STREET FOUNDRY
DESULFURIZATION AVG THROUGHPUT TONS/HR
NOVEMBER 29, 1994 25.15

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 7.70 | .31 |
| SULFUR DIOXIDE | 3.04000 | .120875 |
| H2S | <.00100 | <.000040 |
| ARSENIC | .00003 | .000001 |
| CALCIUM | 2.66000 | .105765 |
| CADMIUM | <.00060 | <.000024 |
| COBALT | <.00038 | <.000015 |
| CHROMIUM | .00027 | .000011 |
| COPPER | .00437 | .000174 |
| MAGNESIUM | .04020 | .001598 |
| MANGANESE | .05100 | .002028 |
| MOLYBDENUM | <.00010 | <.000004 |
| NICKEL | .00018 | .000007 |
| LEAD | .00295 | .000117 |
| SELENIUM | .00005 | .000002 |
| TIN | <.00056 | <.000022 |

M-24
75

BRIGGS & STRATTON 68TH STREET FOUNDRY
SAND SYSTEM AVG THROUGHPUT TONS/HR
NOVEMBER 30, 1995 19.48

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 59.64 | 3.06 |
| CO | .20000 | .010267 |
| VOC | .02000 | .001027 |
| BENZENE | .00150 | .000077 |
| FORMALDEHYDE | .00100 | .000051 |

m 24

716

BRIGGS & STRATTON 68TH STREET FOUNDRY
NORTH POURING HOOD AVG THROUGHPUT TONS/HR
DECEMBER 2, 1994 27.34

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | .72 | .03 |
| CO | 9.92000 | .362838 |
| VOC | .22000 | .008047 |
| BENZENE | .03000 | .001097 |
| FORMALDEHYDE | .00600 | .000219 |
| PHENOL | <.37000 | <.013533 |
| TOLUENE | .12000 | .004389 |
| XYLENE | <.02000 | <.000732 |
| NAPHTHALENE | <.01000 | <.000366 |
| AMMONIA | .10000 | .003658 |
| H2S | .00700 | .000256 |
| HYDROGEN CYANIDE | <.01000 | <.000366 |
| ARSENIC | .00007 | .000002 |
| CALCIUM | .02950 | .001079 |
| CADMIUM | <.00009 | <.000003 |
| COBALT | <.00005 | <.000002 |
| CHROMIUM | .00013 | .000005 |
| COPPER | .00242 | .000089 |
| MAGNESIUM | .06678 | .002443 |
| MANGANESE | .00143 | .000052 |
| MOLYBDENUM | <.00014 | <.000005 |
| NICKEL | <.00011 | <.000004 |
| LEAD | <.00053 | <.000019 |
| SELENIUM | <.00001 | .000000 |
| TIN | <.00078 | <.000029 |

m 24
77

BRIGGS & STRATTON 68TH STREET FOUNDRY
CENTER POURING HOOD AVG THROUGHPUT TONS/HR
DECEMBER 2, 1994 26.87

| PARAMETER | EMISSIONS LB/HR | EMISSIONS LB/TON METAL |
|---|---|---|
| PARTICULATE | 1.17 | .04 |
| CO | 20.12000 | .748790 |
| VOC | .21000 | .007815 |
| BENZENE | .05000 | .001861 |
| FORMALDEHYDE | .01000 | .000372 |
| PHENOL | <.39000 | <.014514 |
| TOLUENE | .07000 | .002605 |
| XYLENE | <.03000 | <.001116 |
| NAPHTHALENE | <.01000 | <.000372 |
| AMMONIA | .03000 | .001116 |
| H2S | .00900 | .000335 |
| HYDROGEN CYANIDE | <.01000 | <.000372 |
| ARSENIC | .00010 | .000004 |
| CALCIUM | .04671 | .001738 |
| CADMIUM | <.00009 | <.000003 |
| COBALT | <.00006 | <.000002 |
| CHROMIUM | .00013 | .000005 |
| COPPER | .00411 | .000153 |
| MAGNESIUM | .04902 | .001824 |
| MANGANESE | .00199 | .000074 |
| MOLYBDENUM | <.00014 | <.000005 |
| NICKEL | <.00011 | <.000004 |
| LEAD | <.00055 | <.000020 |
| SELENIUM | .00002 | .000001 |
| TIN | <.00082 | <.000031 |

## 1.0 GENERAL

During the period of November 17 through December 8, 1994, Environmental Technology & Engineering Corp (ETE) personnel performed stack emissions testing on nine (9) sources at the Briggs & Stratton Corp facility located on 68th Street in West Allis, Wisconsin. The purpose of the testing was to document the current emissions from the sources for use in accurately completing the Part 70 permit application for the facility. The sources tested were:

1. Shakeout Line 3 (inlet to scrubber)
2. Mold Cooling (inlet to scrubber)
3. Shakeout Lines 1 & 2 (inlet to scrubber)
4. Scrubber Stack S55
5. Desulfurization
6. Sand System (inlet to scrubber)
7. North Pouring Hood
8. Center Pouring Hood
9. Cupola

John Raflowski and Fred Quilling of Briggs & Stratton were responsible for ensuring proper operating conditions throughout the testing. All testing was coordinated with John Raflowski. The tests were performed solely for the information of Briggs & Stratton and the DNR was not notified of the tests or invited to witness. The field tests, corresponding laboratory analysis, and report preparation were performed by ETE personnel; William Dick was the test team leader.

The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected. Discussions on the interpretation of the data are provided where appropriate. The report, therefore, includes much necessary detail. The results, however, have been presented in the SUMMARY section at the beginning of this report for those readers not wishing to be burdened by the details.

M-24
79

BRIGGS & STRATTON METALS RESULTS
TEST 1 CUPOLA
DECEMBER 8, 1994

| METAL | EMISSIONS UG | LB/HR |
|---|---|---|
| AS | .4 | .000024 |
| CA | 1690 | .10 |
| CD | <.8 | <.000048 |
| CO | <.5 | <.000030 |
| CR | 15.6 | .000938 |
| CU | 93.4 | .005614 |
| MG | 2710 | .16 |
| MN | 1687 | .101396 |
| MO | -1.3 | <.000078 |
| NI | 24.1 | .001449 |
| PB | 49.3 | .002963 |
| SE | 1.76 | .000106 |
| SN | <7.5 | <.000451 |

SAMPLE VOLUME, DSCF = 45.12
FLOW RATE, DSCFM = 20502

BRIGGS & STRATTON METALS RESULTS
TEST 2
NOVEMBER 17, 1994

| METAL | EMISSIONS UG | LB/HR |
|---|---|---|
| AS | .35 | .000021 |
| CA | 1350 | .08 |
| CD | <.8 | <.000048 |
| CO | <.5 | <.000030 |
| CR | 18.1 | .001085 |
| CU | 97.2 | .005827 |
| MG | 2360 | .14 |
| MN | 1766 | .105861 |
| MO | <1.3 | <.000078 |
| NI | 15.4 | .000923 |
| PB | 51 | .003057 |
| SE | 1.59 | .000095 |
| SN | <7.5 | <.000450 |

SAMPLE VOLUME, DSCF = 46.26
FLOW RATE, DSCFM = 20964