

***PARTICULATE, MULTIPLE METALS, AND GASEOUS  
EMISSIONS TESTING  
ON THE CUPOLA BAGHOUSE EXHAUST***

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REPORT # 6209**

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## SOURCE DESCRIPTION

The system tested was the exhaust of the 128" i.d., 70 ton per hour cupola. It utilizes a vibratory material conveying system for charging cast iron, coke, and fluxes. The cupola passes through an afterburner prior to exhausting through a new fabric filter baghouse and the 70" ID stack.

| <i>PROCESS DATA</i>        |          |          |          |                  |
|----------------------------|----------|----------|----------|------------------|
| Parameter                  | Run #1   | Run #2   | Run #3   | Average          |
| Blast Rate (cfm)           | 19,086.4 | 18,968.2 | 18,991.8 | <b>19,015.5</b>  |
| Afterburner Temp. (F)      | 1,681.0  | 1,687.8  | 1,666.3  | <b>1,678.4</b>   |
| Pressure Drop (in. W.C.)   | 8.30     | 9.35     | 8.74     | <b>8.80</b>      |
| Baghouse Inlet Temp. (F)   | 325.2    | 326.9    | 331.8    | <b>328.0</b>     |
| Iron (lbs, total)          | 251,766  | 239,112  | 261,274  | <b>250,717.3</b> |
| Coke (lbs, total)          | 28,288   | 27,207   | 28,427   | <b>27,974</b>    |
| Limestone (lbs, total)     | 6,892    | 6,600    | 7,168    | <b>6,886.7</b>   |
| Ferro-silicon (lbs, total) | 8,268    | 7,685    | 8,357    | <b>8,103.3</b>   |
| Melt Rate (tons/hr)        | 62.94    | 59.78    | 65.32    | <b>62.68</b>     |

# RESULTS SUMMARY

SYSTEM

CHARLOTTE PIPE  
CUPOLA EXHAUST

TEST DATE

02/02/00

| PARAMETER                                | Run #1        | Run #2        | Run #3        | AVERAGE        |
|--|---------------|---------------|---------------|----------------|
| <b>GENERAL</b>                           |               |               |               |                |
| Exhaust Flow, $Q_s$ , ACFM (M5)          | 102,298       | 105,026       | 102,995       | 103,440        |
| Exhaust Flow, $Q_s$ , ACFM (MM)          | 105,139       | 110,032       | 102,684       | 105,952        |
| Dry Standard Exhaust Flow, DSCFM<br>(M5) | 65,932        | 64,883        | 64,879        | 65,231         |
| Dry Standard Exhaust Flow, DSCFM<br>(MM) | 68,871        | 70,086        | 65,183        | 68,047         |
| $V_m$ STD (ft3) from M5 sampling         | 50.10         | 49.78         | 47.50         |                |
| $V_m$ STD (ft3) from MM sampling         | 101.48        | 104.34        | 99.58         |                |
| %I from M5 sampling                      | 99.32         | 100.28        | 95.68         |                |
| %I from MM sampling                      | 96.28         | 97.28         | 99.83         |                |
| <b>PROCESS RATE, TONS/HR</b>             | 62.94         | 59.78         | 65.32         | 62.68          |
| <b>PARTICULATE EMISSIONS</b>             |               |               |               |                |
| <i>Front Half Only</i>                   |               |               |               |                |
| PM Emission Rate, lb/hr                  | 1.149         | 1.690         | 1.139         | 1.326          |
| PM Concentration, gr/scfd                | 0.0020        | 0.0030        | 0.0020        | 0.0024         |
| PM Emission Rate, lb/ton                 | 0.0183        | 0.0283        | 0.0174        | 0.0213         |
| <i>Back Half Only</i>                    |               |               |               |                |
| PM Emission Rate, lb/hr                  | 0.627         | 1.155         | 1.626         | 1.136          |
| PM Concentration, gr/scfd                | 0.0011        | 0.0021        | 0.0029        | 0.0020         |
| PM Emission Rate, lb/ton                 | 0.0100        | 0.0193        | 0.0249        | 0.0181         |
| <b>Total Particulate Emissions</b>       |               |               |               |                |
| PM Emission Rate, lb/hr                  | 1.776         | 2.845         | 2.765         | 2.462          |
| PM Concentration, gr/scfd                | 0.0031        | 0.0051        | 0.0050        | 0.0044         |
| PM Emission Rate, lb/ton                 | 0.0282        | 0.0476        | 0.0423        | 0.0394         |
| <b>MULTIPLE METALS EMISSIONS</b>         |               |               |               |                |
|  | <b>Run #1</b> | <b>Run #2</b> | <b>Run #3</b> | <b>AVERAGE</b> |
| Arsenic, lbs/hr                          | 5.91E-05      | 4.90E-05      | 0.00E+00      | 3.60E-05       |
| Chromium, lbs/hr                         | 5.34E-04      | 7.35E-04      | 1.64E-04      | 4.78E-04       |
| Lead, lbs/hr                             | 4.10E-03      | 3.84E-03      | 2.61E-03      | 3.52E-03       |
| Manganese, lbs/hr                        | 4.06E-02      | 1.38E-03      | 1.04E-03      | 1.43E-02       |
| Nickel, lbs/hr                           | 1.44E-03      | 5.22E-04      | 3.68E-04      | 7.78E-04       |
| Phosphorous, lbs/hr                      | 1.09E-02      | 1.88E-03      | 3.13E-04      | 4.36E-03       |
| <b>GASEOUS EMISSIONS</b>                 |               |               |               |                |
|  | <b>Run #1</b> | <b>Run #2</b> | <b>Run #3</b> | <b>AVERAGE</b> |
| CO, ppm                                  | 29.29         | 33.91         | 56.18         | 39.79          |
| CO, lbs/hr                               | 8.568         | 9.931         | 15.855        | 11.451         |
| CO Emission Rate, lb/ton                 | 0.1361        | 0.1661        | 0.2427        | 0.1817         |
| Oxides of Nitrogen, ppm                  | 39.77         | 41.08         | 45.18         | 42.01          |
| Oxides of Nitrogen, lbs/hr               | 19.113        | 19.766        | 20.948        | 19.942         |
| NO <sub>x</sub> Emission Rate, lb/ton    | 0.3037        | 0.3306        | 0.3207        | 0.3183         |
| Sulfur Dioxide, ppm                      | 18.78         | 22.46         | 23.14         | 21.46          |
| Sulfur Dioxide, lbs/hr                   | 12.56         | 15.04         | 14.93         | 14.174         |
| SO <sub>2</sub> Emission Rate, lb/ton    | 0.1995        | 0.2515        | 0.2285        | 0.2265         |



# **National Emission Standards for Hazardous Air Pollutants (NESHAP) for Iron and Steel Foundries - Background Information for Proposed Standards**

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EPA-453/R-02-013  
December 2002

National Emission Standards for Hazardous Air Pollutants (NESHAP) for  
Iron and Steel Foundries--  
Background Information for Proposed Standards

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**APPENDIX D**

**SOURCE TEST PARTICULATE MATTER DATA  
FOR CUPOLA BAGHOUSES**

## **D.1 SOURCE TEST PARTICULATE MATTER DATA FOR CUPOLA BAGHOUSES**

This appendix presents the individual sampling run data for the source tests available to characterize the control performance for baghouses applied to cupolas (Chapter 4). Summary test data are given in Table D-1 along with information on melting rates and capacities and a description of the control systems and the processes they serve.

The data in Table D-1 represent a range of cupola sizes and types of baghouses. The design melting rates range from 3.5 to 80 tons per hour, and ventilation rates range from 30,000 to 195,000 actual cubic feet per minute. The cupolas include both recuperative and non-recuperative, and both above and below charge take off. The baghouses include both negative and positive pressure operating modes and employ both shaker and pulse jet cleaning systems. Some were installed about 30 years ago, and some are relatively new (rebuilt). The design air-to-cloth ratios cover a range of 1.68 to 5.1 feet per minute. No information is available on the ages of the bags in service when the tests were conducted.

The reported results were checked to ensure the weights of PM from the filter and the probe catch were above detection limits. When the reported catch was less than 3 mg, a detection limit value of 3 mg and the sample volume were used to estimate the detection limit in gr/dscf. Values calculated in this manner are reported as “less than” (<).

**TABLE D-1. PM SOURCE TEST RESULTS FOR BAGHOUSES SERVING CUPOLAS**

| <b>Foundry WI-35 (tested March 1998)</b>    |                 |               |                 |                |              |                             |                    |   |  |
|---|-----------------|---------------|-----------------|----------------|--------------|-----------------------------|--------------------|---|--|
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1   | <0.0006         | <0.4          | 75,974          | 107,297        | 271          | 1.7                         |                    | 45 tph capacity,<br>afterburner,<br>recuperative, above<br>charge takeoff | Installed 1998, negative<br>pressure, pulse jet, horizontally-<br>supported bags, 10.8 oz Nomex<br>fabric, air:cloth = 2.4 ft/min,<br>design for 280°F and 148,000<br>acfm |
| 2   | <0.0006         | <0.4          | 75,412          | 107,145        | 273          | 1.7                         |                    |   |  |
| 3   | <0.0006         | <0.4          | 74,847          | 105,854        | 274          | 1.7                         |                    |   |  |
| Avg   | <0.0006         | <0.4          | 75,411          | 106,765        | 273          | 1.7                         |                    |   |  |
| <b>Foundry WI-35 (tested November 1998)</b> |                 |               |                 |                |              |                             |                    |   |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) |   |  |
| 1   | <0.0007         | <0.4          | 59,651          | 86,905         | 279          | 1.4                         | 40                 |   |  |
| 2   | <0.0008         | <0.4          | 56,350          | 81,221         | 270          | 1.3                         | 40                 |   |  |
| 3   | <0.0008         | <0.4          | 57,002          | 82,220         | 271          | 1.3                         | 42.5               |   |  |
| Avg   | <0.0008         | <0.4          | 57,668          | 83,449         | 273          | 1.3                         | 41                 |   |  |
| <b>Foundry WI-35 (tested May 2000)</b>      |                 |               |                 |                |              |                             |                    |   |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) |   |  |
| 1   | <0.0007         | <0.4          | 61,074          | 88,945         | 271          | 1.4                         |                    |   |  |
| 2   | <0.0007         | <0.4          | 60,856          | 88,346         | 269          | 1.4                         |                    |   |  |
| 3   | <0.0007         | <0.4          | 61,132          | 88,483         | 267          | 1.4                         |                    |   |  |
| Avg   | <0.0007         | <0.4          | 61,021          | 88,591         | 269          | 1.4                         |                    |   |  |

| <b>Foundry IN-01 (tested March 2000)</b>    |                 |               |                 |                |              |                             |                    |  |  |
|---|-----------------|---------------|-----------------|----------------|--------------|-----------------------------|--------------------|--|--|
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information                                       | Baghouse information   |
| 1   | 0.00086         | 0.43          | 58,178          | 81,782         | 259          |                             | 69.5               | 75 tph capacity,<br>afterburner, below<br>charge takeoff | New baghouse, pulse jet,<br>horizontally-supported bags  |
| 2   | 0.00079         | 0.42          | 61,481          | 87,303         | 270          |                             | 61.8               |  |  |
| 3   | 0.00069         | 0.39          | 65,454          | 95,494         | 293          |                             | 68.6               |  |  |
| Avg   | 0.00078         | 0.41          | 61,704          | 88,193         | 274          |                             | 66.6               |  |  |
| <b>Foundry MI-26 (tested December 1995)</b> |                 |               |                 |                |              |                             |                    |  |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information                                       | Baghouse information   |
| 1   | 0.0012          | 0.22          | 20,987          |                |              |                             | 10                 | 15 tph capacity,<br>afterburner, above<br>charge takeoff | Installed 1995, positive pressure,<br>shaker, fiberglass fabric,<br>air:cloth = 0.75 ft/min, design<br>for 500°F and 25,700 acfm |
| 2   | 0.0023          | 0.40          | 20,987          |                |              |                             |                    |  |  |
| 3   | 0.0017          | 0.29          | 21,029          |                |              |                             |                    |  |  |
| Avg   | 0.0017          | 0.30          | 21,001          |                |              |                             |                    |  |  |
| <b>Foundry NC-05 (tested February 2000)</b> |                 |               |                 |                |              |                             |                    |  |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information                                       | Baghouse information   |
| 1   | 0.0019          | 1.15          | 65,932          | 102,298        | 288          | 2.3                         | 62.9               | 70 tph capacity,<br>afterburner, above<br>charge takeoff | New baghouse, negative<br>pressure, pulse jet, air:cloth =<br>1.76 ft/min, design for 350°F<br>and 79,000 acfm                   |
| 2   | 0.0027          | 1.69          | 64,883          | 105,026        | 292          | 2.3                         | 59.8               |  |  |
| 3   | 0.0019          | 1.14          | 64,879          | 102,995        | 296          | 2.3                         | 65.3               |  |  |
| Avg   | 0.0022          | 1.33          | 65,231          | 103,440        | 292          | 2.3                         | 62.7               |  |  |

| <b>Foundry NJ-3 (tested August 1991)</b>     |                 |               |                 |                |              |                             |                    |   |  |
|--|-----------------|---------------|-----------------|----------------|--------------|-----------------------------|--------------------|---|--|
| Run  | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1  | 0.0048          | 12.7          | 306,488         | 390,656        | 213          | 3.5                         | 87                 | 2 cupolas with 64 tph capacity (only one operates at a time), afterburner, recuperative, below charge takeoff | Installed 1974, positive pressure, shaker, fiberglass fabric, air:cloth = 1.75 ft/min, design for 500°F and 195,000 acfm, controls melting   |
| 2  | 0.0055          | 11.2          | 238,254         | 305,489        | 217          | 2.7                         | 67                 |   |  |
| 3  | 0.0026          | 3.5           | 159,297         | 211,491        | 241          | 1.9                         | 88                 |   |  |
| Avg  | 0.0043          | 8.9           | 234,680         | 304,017        | 224          | 2.7                         | 81                 |   |  |
| <b>Foundry NJ-3 (tested September 1997)</b>  |                 |               |                 |                |              |                             |                    |   |  |
| Run  | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) |   |  |
| 1  | 0.0012          | 3.06          | 219,000         | 263,000        | 175          | 2.4                         | 80                 |   |  |
| 2  | 0.0023          | 1.89          | 220,100         | 282,000        | 216          | 1.9                         | 90                 |   |  |
| 3  | 0.0014          | 2.99          | 240,200         | 316,000        | 235          | 2.8                         | 75                 |   |  |
| Avg  | 0.0016          | 2.6           | 226,433         | 287,000        | 209          | 2                           | 82                 |   |  |
| <b>Foundry IN-34 (tested September 1997)</b> |                 |               |                 |                |              |                             |                    |   |  |
| Run  | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1  | 0.0026          | 0.71          | 32,100          | 45,000         | 231          | 1.2                         | 53                 | 80 tph capacity, afterburner, recuperative, below charge takeoff  | Installed 1997, negative pressure, pulse jet, Nomex, air:cloth = 1.8 ft/min, design for 320°F and 70,000 acfm, controls melting and charging |
| 2  | <0.0003         | <0.14         | 49,700          | 69,600         | 253          | 1.8                         | 41                 |   |  |
| 3  | 0.0011          | 0.46          | 48,500          | 68,200         | 254          | 1.8                         | 47                 |   |  |
| Avg  | <0.0013         | <0.5          | 40,300          | 56,600         | 243          | 1.5                         | 50                 |   |  |

| <b>Foundry VA-8 (tested January 1998)</b>   |                 |               |                 |                |              |                             |                    |   |  |
|---|-----------------|---------------|-----------------|----------------|--------------|-----------------------------|--------------------|---|--|
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1   | 0.0039          | 1.64          | 48,697          | 70,363         | 278          | 2.6                         | 49                 | 2 cupolas with 65 tph capacity (only one operates at a time), afterburner, recuperative, below charge takeoff | Installed 1997, negative pressure, pulse jet, Nomex, air:cloth = 3.74 ft/min, design for 375°F and 100,000 acfm, controls melting and charging                 |
| 2   | 0.0028          | 1.14          | 47,588          | 69,934         | 281          | 2.6                         | 51                 |   |  |
| 3   | 0.0026          | 1.08          | 48,934          | 72,472         | 283          | 2.7                         | 53                 |   |  |
| Avg   | 0.0031          | 1.29          | 48,407          | 70,923         | 281          | 2.6                         | 51                 |   |  |
| <b>Foundry FL-6 (tested February 1998)</b>  |                 |               |                 |                |              |                             |                    |   |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1   | 0.0028          | 0.52          | 21,976          | 35,420         | 246          | 0.9                         | 17.7               | 22 tph capacity, afterburner, recuperative, above charge takeoff  | Installed 1998, negative pressure, reverse air, fiberglass fabric, air:cloth = 1.68 ft/min, design for 460°F and 65,000 acfm, controls melting and charging    |
| 2   | 0.0031          | 0.67          | 25,178          | 42,114         | 266          | 0.7                         | 19.8               |   |  |
| 3   | 0.0051          | 1.11          | 25,288          | 41,495         | 272          | 0.7                         | 25.1               |   |  |
| Avg   | 0.0037          | 0.77          | 24,147          | 39,676         | 261          | 0.8                         | 20.9               |   |  |
| <b>Foundry IA-19 (tested February 1998)</b> |                 |               |                 |                |              |                             |                    |   |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information  | Baghouse information   |
| 1   | 0.0026          | 0.92          | 41,861          | 58,271         | 245          | 4.2                         | 13.5               | 20 tph capacity, afterburner, recuperative, below charge takeoff  | Installed 1992, negative pressure, pulse jet, Nomex felt fabric, air:cloth = 5.1 ft/min, design for 450°F and 70,000 acfm, controls melting, charging, tapping |
| 2   | 0.0015          | 0.58          | 46,281          | 63,363         | 233          | 4.6                         | 13.5               |   |  |
| 3   | 0.0022          | 0.90          | 46,811          | 64,433         | 238          | 4.7                         | 13.5               |   |  |
| Avg   | 0.0021          | 0.80          | 44,984          | 62,022         | 239          | 4.5                         | 13.5               |   |  |

| <b>Foundry IN-35 (tested November 1997)</b>     |                 |               |                 |                |              |                             |                    |  |  |
|---|-----------------|---------------|-----------------|----------------|--------------|-----------------------------|--------------------|--|--|
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information   | Baghouse information   |
| 1   | 0.0044          | 1.71          | 45,055          | 66,407         | 213          | 4.1                         |                    | 22 tph capacity,<br>afterburner,<br>nonrecuperative,<br>above charge takeoff         | Installed 1997, positive pressure,<br>pulse jet, Tuflex fabric, air:cloth<br>= 4.65 ft/min, design for 400°F<br>and 75,000 acfm, controls<br>melting                             |
| 2   | 0.0043          | 1.68          | 44,780          | 66,018         | 215          | 4.1                         |                    |  |  |
| 3   | 0.0043          | 1.66          | 44,773          | 66,532         | 212          | 4.1                         |                    |  |  |
| Avg   | 0.0043          | 1.69          | 44,869          | 66,319         | 213          | 4.1                         |                    |  |  |
| <b>Foundry SD-1 (tested March 1995)</b>         |                 |               |                 |                |              |                             |                    |  |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information   | Baghouse information   |
| 1   | 0.0058          | 0.72          | 14,580          | 20,403         | 227          | 2.7                         | 4.3                | 3.5 tph capacity, no<br>afterburner,<br>nonnonrecuperative,<br>above charge takeoff  | Installed 1994, negative<br>pressure, pulse jet, 16 oz Nomex<br>fabric, air:cloth = 3.96 ft/min,<br>design for 400°F and 30,000<br>acfm, controls melting and<br>charging        |
| 2   | 0.0035          | 0.48          | 16,008          | 21,992         | 216          | 2.9                         | 4.3                |  |  |
| 3   | 0.0047          | 0.62          | 15,336          | 21,567         | 231          | 2.9                         | 6.4                |  |  |
| Avg   | 0.0046          | 0.61          | 15,308          | 21,321         | 225          | 2.8                         | 5.0                |  |  |
| <b>Foundry WI-49/50 (tested September 1995)</b> |                 |               |                 |                |              |                             |                    |  |  |
| Run   | PM<br>(gr/dscf) | PM<br>(lb/hr) | Flow<br>(dscfm) | Flow<br>(acfm) | Temp<br>(°F) | Air:cloth ratio<br>(ft/min) | Melt rate<br>(tph) | Cupola information   | Baghouse information   |
| 1   | 0.0044          | 1.2           | 30,852          | 59,684         | 338          | 3.0                         | 29.7               | 2 cupolas, 30 tph<br>capacity, afterburner,<br>recuperative, above<br>charge takeoff | Installed 1994, negative<br>pressure, pulse jet, woven<br>fiberglas fabric, air:cloth = 2.4<br>to 3.7 ft/min, design for 450°F<br>and 50,000 to 70,000 acfm,<br>controls melting |
| 2   | 0.0047          | 1.2           | 30,826          | 59,347         | 332          | 3.0                         | 28.4               |  |  |
| 3   | 0.0060          | 1.5           | 29,750          | 60,281         | 339          | 3.0                         | 24.4               |  |  |
| Avg   | 0.0050          | 1.3           | 30,476          | 59,771         | 336          | 3.0                         | 27.5               |  |  |