Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

State of Wisconsin \ **DEPARTMENT OF NATURAL RESOURCES**

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

April 15, 1982

File Ref: 4530

Mr. Douglas E. Seely
GCA Corporation - Technology Division
213 Burlington Road
Bedford, MASS. 01730

GRAY
IRON FOUNDRIES 12.10
AP-42 Section ~~7.10~~
Reference Number
12

Dear Mr. Seely:

Enclosed is information which you had requested concerning Gray Iron Foundries. The majority of the data is taken from stack tests performed at the respective facilities. Should you have any questions regarding the information contact me or Joe Brehm of my staff. His telephone number is (608) 267-7541.

Sincerely,
Bureau of Air Management

Dean G. Packard

Dean G. Packard, Chief
Engineering & Surveillance Section

DGP:JB:dl

(1) International Harvester-Foundry Division, 1401 Perkins Avenue, Waukesha, Wisconsin 53186, A.E.I. #680008, Plant Contact: Mr. T. W. Grannis (414)547-5521. The stack test was conducted on the canopy type hood system, serving three induction furnaces, a holding furance, and a desulfurization process. The molten metal goes from the induction and holding furnaces to the desulfurization station in large ladles. Calcium carbide is added and the metal is stirred by bubbling nitrogen gas through it. Slag forms and is skimmed off the top. The whole process takes from 3 to 5 minutes per ladle. The metal then proceeds to the molding lines. The induction furnaces have a maximum melt rate of 10 tons per hour each. During the test, the induction furnaces were producing about 3.67 tons per hour each. This is the normal melt rate used during the night shift which is about three times higher than the day shift melt rate. The Department considers the furnaces and the desulfurization station as part of the same process and, therefore, the process weight rate would be 11.0 ton per hour.

The test was performed on September 15, 1981 by Environmental Technology and Engineering Corporation (ETE), 13020 West Bluemound Road, Elm Grove, Wisconsin 53122, Crew Chief Lowell Huenink (414)784-2434.

The applicable emission limit is 15.88 lb/hr, Process weight rate. The emission rate was tested at 9.04 lb/hr, with the isokinetic ratio at 100%. The desulfurization process portion of the emission rate was 0.36 lb/hr. The emission limit is calculated from the equation $E=3.59(P)^{0.62}$, where E is the emission limit and P is the process weight. There are no pollution control devices.

(2) Grede Foundry - Liberty Plant, 6432 West State Street, Wauwatosa, Wisconsin 53226 A.E.I. #410052, Plant Contact: Mr. James Williams (414)771-6700. The process tested consists of a molding line, a shakeout, a sand mixer, and a sand handling system. The normal mode of operation for this process is to mix sand on the first shift and to mold and shakeout on the second shift. The rate for the molding line was about five tons per hour sand plus metal. For the test, the operation was modified by sand mixing during Run 1 and then switching to mold and shakeout for Runs 2 & 3. The emissions are ducted to a three stage tower-type wet collector. The pressure drop across the collector was 9 to 11 inches of water. It was using about 70 GPM. The test was performed by ETE on August 6, 1981.

The RACT limit is more restrictive than the process weight limit, and therefore, the emissions are expressed in pounds per 1000 pounds gas. This limit is 0.1 lb/1,000 lb gas. The test emissions for all three runs were the same, 0.004 lb/1,000 lb. gas. The isokinetic ratio was 100%.

(3) Sharon Foundry, Inc., 141 Seymour Street, Sharon, WI 53585, A.E.I.#650001, Plant Contact: Mr. Philip Kilkenny (414)736-4444. The stack test was performed on a grey iron cupola. This is a Modern #5. A typical charge for this cupola consists of 1,025 pounds of metal and 150 pounds of Coke. The cupola is lined down to a 48" diameter at the charging zone and a 36" diameter at the melt zone. During the test, the cupola was producing about 7.4 tons

per hour at a blast rate of 3,020 CFM. For air pollution control, the cupola is equipped with a venturi scrubber followed by a demister. The pressure drop across the venturi was about 18" during the test.

The test was done on November 24-26, 1980 by Clean Air Engineering (CAE), 835 Sterling Avenue, Palatine, Illinois 60067. Crew Chief, Mr. John Chapman (312)359-4202.

The applicable emission rate is 0.45 pounds per 1,000 pounds gas. The test results were 0.306 lb/1,000 lb. gas, with the isokinetic ratio at 98%. The first run was voided because it failed the post-run leak check. The cupola and its control device were operating normally during the test.

(4) Briggs & Stratton Grey Iron Foundry, 1501 South 83rd Street, West Allis, Wisconsin 53214, A.E.I. #410166, Plant Contact: Mr. Allan Hasse, (414)259-5372. The stack test was performed on an automated molding process. The process consists of a sand handling system, twin molding lines, and a shakeout. The process was handling about 67 tons per hour during the test. All emissions from this process are ducted to a baghouse. The baghouse has nine sections and 864 bags. The sections are cleaned separately by reverse air pulse. The pressure drop across the baghouse was 6 to 7 inches of water. During the test the baghouse hoppers were being continuously emptied by a screw conveyor.

The test was done on September 4, 1980 by Cory Laboratories, Inc., 823 5th Street, Menominee, MI 49858, Crew Chief: Mr. Jerry Hagen (906)863-9336.

The applicable emission limit was 16 pounds per hour. The average test rate was 13.30 lb/hr. with the isokinetic ratio of 98%.

This process was tested on May 13, 1980 also. The results were an average emission of 24.52 lb/hr. while handling about 64 tons per hour. The reasons for the high emission rate were defects in the baghouse. Also the baghouse manufacturer recommended that the baghouse hoppers be cleaned continuously instead of once a shift.

(5) Alpha Cast Inc., 520 North Jefferson, Whitewater, Wisconsin 53190, A.E.I. #650002, Plant Contact: Mr. James Newmann (414)473-4400. The stack test was conducted on a #6 Whiting Grey Iron Cupola. The melt rating of the cupola is nine tons per hour.

A typical charge weighs 0.62 tons and is composed of 1,000 pounds of metal, 175 pounds of coke, and 60 pounds of limestone. During the test the average melt rate was 8.23 tons per hour at a blast rate of 2,600 CFM and 10 ounces of back pressure on the windbox. For the control of air pollution, this cupola is equipped with a #72 Schneible DW Wetcap and an afterburner with three burners.

The test was performed by CAE on January 10, 14, and 15, 1980 with one run per day.

The applicable emission limit that applies to this source is 0.45 pounds per 1,000 pounds of gas. The emission rate for the test was 0.424 lb/1,000 lb gas, with an isokinetic ratio of 97%. The cupola was operating normally during the test.

(6) M&M Grey Iron Foundry, Inc., 640 Maxon Street, Waupun, Wisconsin 53963, A.E.I. #140005, Plant Contact: Mr. G. E. McBridge, Jr. (414)324-2711. The test was on a #4 Whiting Cupola melting furnace that is lined down to a 32 inch inside diameter. A typical charge weighs 0.59 tons and consists of 1,000 pounds of metal, 150 pounds of coke, 15 pounds of limestone and 10 pounds of flux. The average melt rate was 4.6 tons per hour during the test. The recommended air flow through the tuyeres for a whiting cupola of this size is 1,810 CFM. At the maximum allowable dilution of five times the air through the tuyeres, the maximum air flow through the cupola should be 10,860 CFM.

The average air flow during the test was 15,400 CFM. This is about 42% in excess of what they should have an would bias the emission concentration low. The emissions from this cupola are controlled by a wet scrubber followed by a spray chamber with baffles. The exhaust gas then goes through an induced draft fan and out the stack. The test was conducted by the Wisconsin Department of Natural Resources on June 24-26, 1980, Joe Perez, Crew Chief (608)266-8401.

The emission limit that applies to this source is 0.45 pounds per 1,000 of gas. The actual emission rate was 0.316 lb/1,000 lb. gas, with the isokinetic ratio at 98%. The cupola and air pollution control equipment operated normally during the test. The Department recommended that the air flow on the cupola be reduced by 40%.

(7) General Castings Corporation, 706 East Main Street, Waukesha, Wisconsin 53186, A.E.I. #680023, Plant Contact: Mr. J. R. Bettinghaus (414)544-7676. The system tested was a CoReCo Borings Drier, Model 1232. The unit is a controlled temperature, continuous, indirectly heated, inclined, rotary furnace used for reclaiming metals by means of controlled temperature drying and de-oiling. The process is performed inside an externally heated, high alloy stainless steel revoking drum assembly. The raw materials used in this operation are machine shop scrap chips. The process weight input is listed as 4,000 pounds per hour maximum. The fuel is natural gas, with a maximum demand of 5,000 CFH. There are two gas streams to the atmosphere. One exhaust hood on the feed end of the drier collects the off gases from the drier drum and the combustion gases from the burners. The gases are drawn from the hood by a fan through a high efficiency cyclone collector and burned in the CoReCo hot cyclone afterburner at a minimum temperature of 1450°F, with a retention time of 1.25 seconds. The other gas stream is air drawn through the enclosed vibrating conveyor that transports the material from the drier to a bucket elevator feeding a borings storage bin. The air stream is intended to cool the material and to pick up the ashes, oxides, dirt, and other fine particles off the conveyor. The gas stream passes through a cyclone collector followed by a baghouse before being vented to the atmosphere.

The test was conducted on April 25, 26, and 28, 1978 and May 1, 1978 by the Wisconsin DNR, Howard Hofmeister, Crew Chief.

The emission limit is 4.616 pounds per hour based on the operational process weight rate of 3,000 pounds per hour. Although there are two separate exhaust systems, there is only one process. For this reason the emissions from the two exhaust systems are combined to get the actual emission rate.

The afterburner stack emission rate was 3.586 pounds per hour and the baghouse stack was 1.526 pounds per hour and the baghouse stack was 1.526 pounds per hour. The total is 5.112 pounds per hour which is over the limit. The source is operating in a nonattainment area for TSP.

(8) Milwaukee Malleable & Grey Iron Works, 2773 South 29th Street, Milwaukee, Wisconsin 53201, Plant Contact: W. R. Kerner (414)645-0200. The source tested was the exhaust stack of the sand handling system. The 60,000 CFM dust collection system consists of a 200 horsepower suction blower, a venturi water-air scrubber and 1,000 feet of ducting to convey the dust from the points of generation to the collector.

The test was conducted by C.A.E. on July 23, 1979.

The process weight under normal operating conditions is 60 tons per hour. The emission limit for this source is 33.33 lb/hr. The actual emission rate is 0.654 which is only about 2% of the allowable limit. Visible emissions throughout the test were limited to steam.

(9) Iroquois Foundry Company, Inc., Browntown, Wisconsin 53522, A.E.I. #230001, P[lant Contact: A. W. Vierthaler. The cupola tested is a size 6, clay lined to a 48 inch inside diameter, producing about 8 tons of molten metal per hour. The air pollution control device is an Invirotech Engineering water scrubber.

The test was performed by the Almega Corporation, 607 C. Country Club Drive, Bensenville, Illinois 60106, Crew Chief: Meryl R. Jackson (302)595-0175 on January 12, 1979.

The emission limit for this source is 0.45 pounds per 1,000 pounds of gas. The actual tested emission rate was averaged to be 0.2211 pounds per 1,000 pounds of gas. Their blow rate was 2,700 CFM which provided an excess air average of 20.35 percent which is acceptable.

(10) Barclay Foundry Industries, Inc., 4239 West Lincoln Avenue, Milwaukee, Wisconson 53246, A.I.E. #410128, Plant Contact: Mr. Allan S. Payleitner (414)671-5556. The process tested was a jacketed #5 Whiting grey iron cupola with an inside lining diameter of 50 inches. This lining is normally 45 inches but this cupola has water jacketing. The cupola is operated at a rate of approximately 10 1,200 pound charges per hour with 150 pounds of coke per charge. The initial control device is a system of spray nozzles in the ducting off the cupola tower. The flue gases then pass through a cooling tower that also has spray nozzles. These nozzles are only used when the flue gas is too hot for the baghouse. The final and main collector is a Dustex model 3500-14-26 baghouse.

The test was conducted by Swanson Environmental, Inc., 24680 Swanson Road, Southfield, Michigan 48076, Crew Chief: Jon R. Swanson. The date of the test was January 19-20, 1977.

The applicable emission limit was 0.45 pounds per 1,000 pounds of gas. Only Run 3 was acceptable and its emission rate was 0.032 lb/1,000 lb. gas with an isokinetic ratio of 95%.

(11) Pioneer Foundry, 1905 South First Street, Milwaukee, Wisconsin 53204, Plant Contact: Mr. Bob Moreno (414)384-1200. The cupola is a Whiting #6 lined to 48" in diameter. This cupola is charged by hand, the charge material is dumped from a wheelbarrow. A typical charge consists of 1,000 pounds of metal, 180 pounds of coke, and 30 pounds of limestone. It has a melt rate capacity of 9 tons per hour. During the test, the average melt rate was 6.4 tons per hour, with a windbox pressure of 11-15 oz. The blast rate is not recorded on this cupola. The pollution control equipment consists of a Skinner Quench Tower followed by a Purity Pentapure Venturi Scrubber and demister. The cupola is not equipped with afterburners.

The stack was performed by ETE on October 18 & 20, 1976.

The average emission rate was 0.438 lb/1,000 lb. gas, the limit is 0.45 lb/1,000 lb. gas. The isokinetic ratio was 108%. This source is no longer in operation.

(12) Mid-City Foundry Co., 1521 West Bruce Street, Milwaukee, Wisconsin 53204, A.E.I. #410106, Plant Contact: Mr. James Wieland (414)645-0840. Two tests were performed on the breeching from the sand handling system. Runs #1 and 4 were performed on the shakeout system, and Runs #2 and 3 were conducted on the muller system. The sand handling system has a maximum listed process rate of 12 tons per hour. The average daily process rate was 7.3 tons per hour. The control device is a 40,000 CFM Environeering Venturi Rod Scrubber System.

The tests were conducted on August 7 and 8, 1975 by CAE.

The emission limit that applies to this process in 0.4 lb. per 1,000 lb. of gas. The average emission rate on the shakeout system was 0.0032 lb./1,000 lb. gas and 0.0021 lb./1,000 lb. gas for the muller system. The isokinetic ratios were 93% and 96%, respectively.

(13) Neenah Foundry Co., 500 Winneconne Avenue, Neenah, Wisconsin 54956, Plant Contact: Mr. Jack Gondywaard. The #1 cupola tested had an inside diameter of 60 inches and had an average melting rate of 14.7 tons per hour. The air pollution control device is a Venturi Scrubber with an average pressure drop of 38" of water.

The test was performed on September 4, 1974 by Neenah Foundry.

The average emission rate was 0.3274 lb./1,000 lb. gas while the limit is 0.45 lb./1,000 lb. gas. The isokinetic average was 118% which at that time was acceptable. The present limit is 110%.

Neenah Foundry's #2 cupola was tested on August 23, 1977 by DNR staff. This cupola has a 62" inside diameter and a melt rate capacity 15 tons per hour. The exhaust gases pass through a quencher, pass on through a throat (Kinpactor), pass on through a separator, and then enter a cyclone which is at the base of the exit stack. The charge rate to the cupola during the test was 14.5 to 15.0 tons per hour. The emission rate was 0.45 lb./1,000 lb. gas and the isokinetic ratio was 109%.

(14) Motor Castings Company, Plant #3, 1323 South 65th Street, West Allis, Wisconsin 53214, A.E.I. #410153, Plant Contact: Mr. Gerald B. Pickett (414)476-1434, Ext. 0049. This plant has two identical cupolas that are operated on alternate days. They have a lined-out inside diameter of 48" in the melt zone. The listed melt rate is 11 tons per hour. During the test the melt rate varied from 10.2 to 11.9 tons per hour. The particulate emission control device is a rotoclone wet collector, installed in 1972.

The test was conducted on July 21 and 22, 1977 by DNR staff.

The emission allowed are 0.45 pounds per 1,000 pounds of gas. The results from Runs 2 and 3 averaged out at 0.636 lb./1,000 lb. gas, with an isokinetic ratio of 105%. Run 1 was not accepted because the isokinetic ratio was over the limit, 129%. The dilution of the air flow through the tuyeres was within the allowable limits. 4,000 to 5,000 CFM is recommended while actual was from 9,900 to 10,500 CFM, only 2 times the allowable.

(15) Beloit Corporation, Foundry #1, 1 St. Lawrence Avenue, Beloit, Wisconsin 53511, Plant Contact: Mr. Donald Koebernick (414)365-3311, A.E.I. #540002. The stack test was run on cupola #1, a coke-fired cupola manufactured by the Beloit Corporation. When lined-out the inside diameter is 66 inches. The melt rate is listed 15-22 tons per hour with a blast rate of 7,800 to 8,400 CFM. With hot blast at 900°F the listed melt rate is 18-27 tons per hour with a blast rate of 6,300-6,700 CFM. The maximum blast rate for the equipment is 9,000 CFM at 1000°F. The blast air rate to the cupola was 7,500 CFM for runs 1 and 2, and for run 3 7,150 CFM. The dilution rate figure was within the 500% limit. Runs 1 and 3 had a melt rate between 11-13 tons per hour, for Run 2 it was approximatelyu 16 tons per hour. The cupola's emissions are controlled by a standard wet cap followed by an American Air Filter Kinpactor Emission Control System. This system includes a centrifugal mist eliminator.

The average particulate matter emission from the cupola was 0.237 pounds per 1,000 pounds of gas. This is 53% of the allowable limit of 0.45 pounds per 1,000 pounds of gas.

The facility uses a variety of charge compositions which seem to affect the nature of the emission concentration in the effluent. In Run 1 there 88% of the run was performed while the cuplas operated with a low iron to coke ratio, 5.6/1, and only 12% of the run was at a high iron to coke ratio, 9.2/1, the highest emission concentration occurred, 0.274. Run 2 was performed 75% of the time at a high iron to coke ratio of 9.7/1 and 25% of the time at an iron to coke ratio of 5.8/1. It was in this run that we received the lowest

emission concentration, 0.204 lb./1,000 lb. gas. All of Run 3 was run at an iron to coke ratio of 5.8/1. The reason the emission concentration for Run 3, 0.233, is less than for Run 1 is because the wind was turned off 22 minutes before the finish of Run 3.

The test was conducted by DNR staff on September 16 and 17, 1975.

(18) Falls Foundry, N91W16228 Pershing Road, Menomonee Falls, Wisconsin 53051, Plant Contact: Mr. Donald J. Sielaff (414)251-2730. The cupola tested was a Whiting #6 cupola with a lined-out inside diameter of 42 inches. The charge composition for the three test runs was 270 lbs. pig iron, 315 lbs. sprue, 300 lbs. purchased scrap, and 115 lbs. of structural steel with 115 lbs. of coke. The iron/coke ratio is 8.7 to 1.0. The initial bed before light off contains 14 to 16 charges. The average melt rates were 2.6 tons per hour for Run 1, 3.4 tons per hour for Run 2, and 3.3 tons per hour for Run 3. The air blast pressure at the window box was normally maintained at 3.5 to 4.0 oz. The pollution control device is a wet cap scrubber manufactured by the Schneible Company, model DW. The water rates are given as 280 GPM and 145 GPM for the top and bottom stages, respectively.

The average particulate emission from the cupola was 0.276 pounds/1,000 pounds gas, which is 61% of the allowable of 0.45 lb./1,000 lb. gas. The melt rate was only 43% of the maximum which is 7.2 tons per hour. The air dilution through the tuyeres was only 2 times the general operating recommendation.

The test was conducted by DNR staff on August 5, 6 and 7, 1975.

(19) Grede Foundries, Inc., 700 Ash Street, Reedsburg, Wisconsin 53959, Plant Contact: Mr. Brew Newton (608)524-4361. The test was performed on the magnesium innoculation unit. The exhaust system tested handles the fumes resulting from the magnesium process. The fumes are drawn into the stack by a fume hood located above two molten iron holding kettles. In the innoculation process, molten iron is poured intermittently into ladles containing a measured amount of magnesium. The ladles are then taken up to the line for casting. The iron from the first kettle going to the pallet line is poured every 6-7 minutes. The pouring process takes only a matter of seconds. During the rest of the time when no pouring is occurring, the fume hood remains in operation to assist in vesting fugitive dust.

The average emission from the system was 0.12 lb./1,000 lb. gas, which is 30% of the allowable for a magnesium innoculation process. The average magnesium concentration in pounds per hour was 8.4863.

Because the exhaust system is an open system, a constant dilution is occurring and not all dust particles are captured. When pouring occurs, excessive dust is emitted through the plant windows, which is easily observed. There is also a problem due to the nature of the exhaust system whereby it occasionally trips itself off.

The stack test was conducted by DNR staff on July 30 and 31, 1975.

(18) Waupaca Foundry, Plant #1, 406 North Division Street, Waupaca, Wisconsin 54981, A.E.I. #690005, Plant Contact: Michael Arvey (715)258-8511 Ext. 242. Waupaca Foundry Plant #1 operates two identical grey iron cupolas which exhaust through a common stack. Normally the cupolas are operated on alternating days at a melt rate of 8-10 tons per hour. For this test cupola #1 was on line and operated at a melt rate of 12 tons per hour. Particulate emissions are controlled by an American Air Filter Venturi wet scrubber. The test was performed by Sommer-Frey Laboratories, Inc., 6125 West National Avenue, Milwaukee, Wisconsin 53214, Crew Chief: Edward Carroll (414)475-6700. The date of this test was February 9, 1977. The average emissions were 0.23 lb./1,000 lb. gas which is 51% of the allowable.

(19) Kirsh Foundry, Inc., 127 Rowell Street, Beaver Dam, Wisconsin 53916, A.E.I. #140008, Plant Contact: James T. Kirsh (414)885-4461. The emission test was performed on a Whiting #3-1/2 cupola exhaust stack. Emissions are controlled by a Schneible "DW" #51 wet cap. Two series of tests were performed on the cupola exhaust stack. The first test consisted of three runs while the cupola was operating normally (uncleaned returns). The second test, consisting of two runs, was performed while the cupola was charged with wheelabrated sprue (cleaned scrap returns). The results for the normal operation showed emission to be 0.49 lb./1,000 lb. gas. While using sprue the results were 0.44 lb./1,000 lb. gas. The limit is 0.45 lb./1,000 lb. gas.

The equipment was operating at an average melt rate of 5 tons per hour, which is normal operating conditions for this facility.

JB:cm/1674Q