Recent New Source MACT Determinations and Air Quality Compliance Experience in the Iron Foundry Industry

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ABSTRACT

Construction and operation air quality permits recently issued to iron foundries reflect current air quality compliance issues facing the foundry industry. These issues include the determination of Best Available Control Technology or BACT under the Prevention of Significant Deterioration requirements for major source expansions; emission control strategies for hazardous air pollutants released during the pouring and shakeout of castings, and the establishment of Maximum Available Control Technology or MACT for air toxics regulated under Title III of the 1990 Clean Air Act Amendments. Recent construction permits for iron foundries in Wisconsin, Indiana and Tennessee have established BACT for the emissions of PM_{10}, SO_2, NO_x, VOC, CO, Pb and Be, and new source MACT for inorganic and organic air toxics such as arsenic, chromium, cadmium, benzene and formaldehyde. Approved operations include continuous casting production lines with pouring, shakeout and sand handling operations, iron melting cupolas, and sand core manufacturing operations. BACT for PM_{10} continues to be the use of pulse jet fabric filter baghouses achieving outlet concentrations of 0.005 grains per actual cubic foot. BACT for VOC and CO emissions has required the use of incineration for cupola operations, and packed bed scrubbing systems for coldbox core making operations. New source MACT for air toxics has been determined to be the same as BACT with no additional requirements specific beyond that required for criteria pollutants. MACT for inorganic air toxics such as trace metals has been established as the same control methods required for PM_{10}. MACT for organic air toxics such as formaldehyde and benzene has been established as the same control methods required for VOC. BACT and MACT control methods and emission limitations for these pollutants are summarized. Other foundry projects which have not been subject to the BACT and MACT requirements may also affect future control requirements. For example, two Georgia foundries will use thermal incineration for the control of VOC emissions from their pouring operations. As part of the Wisconsin hazardous air pollutant control program, state foundries must implement a pollution prevention program aimed at a reduction of benzene and other organic emissions from pouring, mold cooling and shakeout operations.

INTRODUCTION

Construction and operation air quality permits recently issued to iron foundries reflect current air quality compliance issues facing the foundry industry. These issues include the determination of Best Available Control Technology or BACT under the Prevention of Significant Deterioration requirements for major source expansions; emission control strategies for hazardous air pollutants released during the pouring and shakeout of castings, and the establishment of Maximum Available Control Technology or MACT for air toxics regulated under Title III of the 1990 Clean Air Act Amendments.

BACT is primarily applied to the emission of criteria air pollutants identified under the Prevention of Significant Deterioration regulations. These are provided under 40 CFR 51.21 and repeated in the administrative rules of most states. Affected pollutants include particulate matter under ten microns (PM_{10}) , sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), lead (Pb), and beryllium (Be). Interpretation of the BACT requirement is provided in the USEPA draft report, *New Source Review Workshop Manual*.[1]

MACT is applied to the 187 air toxics identified under Title III of the 1990 Clean Air Act Amendments. These air toxics are constituents of the inorganic PM emissions and organic VOC emissions. The MACT standard for the foundry industry is under development and is expected to be proposed during 2001. MACT must be developed on a case-by-case basis for issuance of construction permits for new or modified operations under Section 112(g) of the Clean Air Act.

RECENT FOUNDRY PROJECTS IN THE U.S.

Recent construction permits for iron foundries in Wisconsin, Indiana and Tennessee have established BACT for the emissions of PM_{10}, SO_2, NO_x, VOC, CO, Pb and Be.

Additionally, some projects have also exceeded the major source threshold at which new source MACT was required for air toxics. These thresholds are 10 tons per year for a single pollutant, and 25 tons per year for combined pollutants. MACT was established for inorganic air toxics such as arsenic, chromium, cadmium, and for organic air toxics such as benzene and formaldehyde.

Approved foundry operations have included the following:

- Casting production lines with iron pouring, cooling and shakeout;
- Iron melting cupolas;
- Cast handling;
- Sand handling; and,
- Sand core manufacturing operations.

Table 1 summarizes recent air quality construction permits issued in the U.S. and the applicable requirements for these projects. These projects were identified through the new source review RACT/BACT/LAER Clearinghouse (RBLC) maintained by USEPA.[2] The RBLC database contains information from air quality permits issued by state and local air pollution control agencies in the U.S.

Table 1. Recent Iron Foundry BACT and MACT Determinations in the U.S.

Foundry	Approval Date	Air Pollutant	Determination
Waupaca Foundry, Inc. Plant 3 Waupaca, Wisconsin Cast Cooling Replacement Project	2000	PM_{10}	BACT
Waupaca Foundry, Inc. Plant 6 Etowah, Tennessee 180 Ton per Hour Foundry	2000	PM_{10}, SO_2, NO_x, VOC, CO, Pb, Be	BACT, MACT
Waupaca Foundry, Inc. Plant 3 Waupaca, Wisconsin Disa Line #2 Modification Project	1999	PM_{10}, VOC, CO	BACT
Waupaca Foundry, Inc. Plants 2/3 Waupaca, Wisconsin Cupola Modification Project	1999	PM_{10}, SO_2, NO_x, CO, Pb	BACT
Waupaca Foundry, Inc. Plant 1 Waupaca, Wisconsin Sand System Project	1999	PM_{10}	BACT
Wheland Foundry Chattanooga, Tennessee Phenolic-Urethane Core Making	1998	VOC	BACT
Badger Foundry Winona, Minnesota Core Washing Operations	1998	VOC	BACT
Waupaca Foundry, Inc. Plant 4 Marinette, Wisconsin Sand Cooler Project	1998	VOC	BACT
Waupaca Foundry, Inc. Plant 2/3 Waupaca, Wisconsin Disa Line #1	1998	VOC, CO	BACT
Waupaca Foundry, Inc. Plant 1 Waupaca, Wisconsin Disa Line #2	1998	PM_{10}, VOC, CO, Pb	BACT
Waupaca Foundry, Inc. Plant 5 Tell City, Indiana Phase II 80 Ton per Hour Foundry	1998	PM_{10}, SO_2, NO_x, VOC, CO, Pb, Be	BACT, MACT

References: 3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22

The RBLC can be accessed at the Clean Air Technology Center web site (www.epa.gov/ttn/catc/). This database was queried for BACT determinations in the iron foundry industry using Process Type 81.004. Several projects not yet added to the RBLC are also included in Table 1. Further information on these projects was obtained through a review of their air quality permits and support documents.

RECENT BACT DETERMINATIONS

Based on review of recent BACT determinations in the foundry industry, here is a summary of the control requirements for each type of operation described below:

Cupolas

Recently approved iron melting cupolas included the following:

- Two new 90 ton per hour cupolas approved for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- One new 80 ton per hour cupola approved for Waupaca Foundry, Inc. Plant 5 in Indiana;
- One modified 80 ton per hour cupola for Waupaca Foundry, Inc. Plant 5 in Indiana; and,
- One modified 130 ton per hour cupola for Waupaca Foundry, Inc. Plant 2/3 in Wisconsin.

These five new or modified cupolas were equipped with an emission control system consisting of incineration - dry reagent injection - baghouse equipment. Approved BACT control methods and emission limitations are summarized in Table 2.

Table 2. Recent BACT Determinations for Cupola Operations

Air Pollutant	Control Method	Emission Limitation
PM_{10}	Fabric filter baghouse	0.007 to 0.01 gr/acf
SO_2	Dry reagent injection 0.6% Sulfur Coke	0.22 lbs per ton of iron
CO	Incineration	0.4 lbs per ton of iron
VOC	Incineration	0.02 lbs per ton of iron
NO_x	Low-NO_x Incineration Burner	0.44 lbs per ton of iron
Pb	Fabric filter baghouse	43,000 ppm of PM_{10}
Be	Fabric filter baghouse	128 ppm of PM_{10}

The operations in Indiana have been constructed and completed successful compliance tests.

The Indiana cupola operations are equipped with continuous emissions monitoring systems for SO_2. Historical measurements have shown the lbs per ton format of the BACT limitation is impractical unless applied over a long averaging period. There are periods of low or no production when SO_2

emissions still occur, which causes short-term increases in the lbs per ton emissions. In this case, a lbs per hour format for this air pollutant may be more appropriate.

The cupola operations in Wisconsin and Tennessee are under construction.

Pouring and Mold Cooling Operations

Recently approved iron pouring and mold cooling operations range in capacity from 10 to 16 tons per hour and include the following:

- Eight new pouring/mold cooling operations for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- Two modified operations for Waupaca Foundry, Inc. Plant 2/3 in Wisconsin;
- One modified operation for Waupaca Foundry, Inc. Plant 1 in Wisconsin; and,
- Four new operations for Waupaca Foundry, Inc. Plant 5 in Indiana.

These new or modified pouring/mold cooling operations were equipped with an emission control system consisting of fabric filter baghouse equipment. Approved BACT control methods and emission limitations are summarized in Table 3.

Table 3. Recent BACT Determinations for Pouring/Mold Cooling Operations

Air Pollutant	Control Method	Emission Limitation
PM_{10}	Fabric filter baghouse	0.005 gr/acf
SO_2	None	0.02 lbs per ton of iron
CO	None	5 lbs per ton of iron
VOC	None	0.5 lbs per ton of iron
NO_x	None	0.01 lbs per ton of iron
Pb	Fabric filter baghouse	313 ppm of PM_{10}
Be	Fabric filter baghouse	13 ppm of PM_{10}

The operations in Wisconsin and Indiana have been constructed and testing has shown compliance with the BACT emission limitations. The operations in Tennessee are under construction.

Shakeout Operations

After cooling, the castings are separated from the molds in the shakeout operation. Approved shakeout operations range in capacity from 10 to 16 tons per hour and include the following:

- Eight new operations for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- Two modified operations for Waupaca Foundry, Inc. Plant 2/3 in Wisconsin;
- One modified operation for Waupaca Foundry, Inc. Plant 1 in Wisconsin; and,
- Four new operations for Waupaca Foundry, Inc. Plant 5 in Indiana.

Each of these new or modified shakeout operations was equipped with an emission control system consisting of fabric filter baghouse equipment. The control system is typically shared with other production operations. Approved BACT control methods and emission limitations are summarized in Table 4.

Table 4. Recent BACT Determinations for Shakeout Operations

Air Pollutant	Control Method	Emission Limitation
PM_{10}	Fabric filter baghouse	0.005 gr/acf
CO	None	1 lbs per ton of iron
VOC	None	0.1 lbs per ton of iron
Pb	Fabric filter baghouse	313 ppm of PM_{10}
Be	Fabric filter baghouse	13 ppm of PM_{10}

The operations in Wisconsin and Indiana have been constructed and testing has shown compliance with the BACT emission limitations. The operations in Tennessee are under construction.

Sand Handling Operations

Sand handling includes the mulling and formation of sand molds, cooling of sand separated from the castings, and handling of spent sand. Additional sand handling occurs during core making operations. Recently approved sand handling operations were included with the following projects:

- New foundry project for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- Sand System Project for Waupaca Foundry, Inc. Plant 1 in Wisconsin;
- Sand Cooler Project for Waupaca Foundry, Inc. Plant 4 in Wisconsin;
- Phase II Project for Waupaca Foundry, Inc. Plant 5 in Indiana.

Each of these new or modified sand handling operations was equipped with an emission control system consisting of fabric filter baghouse equipment. The control system is typically shared with other production operations. Approved BACT control methods and emission limitations are summarized in Table 5.

Table 5. Recent BACT Determinations for Sand Handling Operations

Air Pollutant	Control Method	Emission Limitation
PM_{10}	Fabric filter baghouse	0.005 gr/acf
VOC (Sand Cooling Only)	None	0.0041 lbs per ton of sand
Pb	Fabric filter baghouse	313 ppm of PM_{10}
Be	Fabric filter baghouse	13 ppm of PM_{10}

The operations in Wisconsin and Indiana have been constructed and testing has shown compliance with the BACT emission limitations. The operations in Tennessee are under construction.

Casting Handling Operations

Casting handling includes the following operations:

- Cooling of castings separated from the sand molds;
- Picking and sorting of castings separated from the sand molds;
- Gate and sprue handling; and,
- Cleaning and grinding of the finished castings.

Recently approved sand handling operations were included with the following projects:

- New foundry project for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- Line #2 Modification Project for Waupaca Foundry, Inc. Plant 2/3 in Wisconsin;
- Sand System Project for Waupaca Foundry, Inc. Plant 1 in Wisconsin;
- Sand Cooler Project for Waupaca Foundry, Inc. Plant 4 in Wisconsin;
- Phase II Project for Waupaca Foundry, Inc. Plant 5 in Indiana.

Each of these new or modified sand handling operations was equipped with an emission control system consisting of fabric filter baghouse equipment. The control system is typically shared with other production operations. Approved BACT control methods and emission limitations are summarized in Table 6.

Table 6. Recent BACT Determinations for Casting Handling Operations

Air Pollutant	Control Method	Emission Limitation
PM_{10}	Fabric filter baghouse	0.005 gr/acf
Pb	Fabric filter baghouse	313 ppm of PM_{10}
Be	Fabric filter baghouse	1 ppm of PM_{10}

The operations in Wisconsin and Indiana have been constructed and testing has shown compliance with the BACT emission limitations. The operations in Tennessee are under construction.

Core Making Operations

Cores are used to obtain interior spaces within the castings. They consist primarily of silica sand mixed with a binding resin.

Coldbox cores do not require any heat and use a catalyst gas such as triethylamine (TEA) or SO_2 to bind the resin to the sand in an enclosed core machine. During the making of cores using a phenolic-urethane resin and TEA catalyst, VOC emissions are generated by the discharge of the unreacted TEA catalyst, and resin handling during sand mixing, core formation, and core storage operations.

Warmbox cores require heat to bind the resin to the sand. During the making of cores using a warmbox resin, VOC emissions are generated by the handling of the resin during mixing with the sand, formation of the core, and storage of the finished cores.

Recently approved core making operations were included with the following projects:

- New coldbox and warmbox core making for Waupaca Foundry, Inc. Plant 6 in Tennessee;
- New Seiatsu Line coldbox core making operations for Wheland Foundry in Tennessee; and,
- New coldbox core making operations for Waupaca Foundry, Inc. Plant 5 in Indiana.

For coldbox core making, all catalyst used during the process (i.e. 2 to 7 lbs per ton of core) has been assumed to be emitted and require control. The predominate control system for coldbox core making is the use of a packed bed scrubber recirculating a sulfuric acid solution to capture TEA from the catalyst step of the process. For one project at Wheland Foundry in Tennessee, regenerative incineration was used instead of a scrubber due to the logistical problems with the handling of scrubber discharges.

To date, the amount of resin losses have not justified use of control systems for these emissions. Evaporative VOC emissions from resin handling operations were evaluated during a Ohio Cast Metals Association study conducted in 1998.[23] Mixing and storage operations were simulated in a laboratory. Based on resin usage of 1% of the core weight and a resin VOC content of 33.4%, the total VOC losses were 0.65 lbs per ton of core produced. The distribution of these losses during mixing, core machine, and storage operations were estimated to be 12, 17 and 71 percent, or 0.08, 0.11, and 0.46 lbs per ton of core produced, respectively.

Approved BACT control methods and emission limitations for the VOC emissions from coldbox core making are summarized in Table 7:

Table 7. Recent BACT Determinations for VOC from Coldbox Core Making Operations

Process Step	Control Method	Emission Limitation
Resin Handling	None	0.45 - 2.04 lbs per ton of core
Core Machine	Packed Bed Scrubber	0.18 - 0.3 lbs per ton of core
	Regenerative Incineration	0.16 lbs per ton of core

The Wheland Foundry operation in Tennessee and Waupaca Foundry operations in Indiana have been constructed and testing on the core machine has shown compliance with the BACT emission limitations. The Waupaca Foundry operations in Tennessee are under construction.

For warmbox core making, VOC emissions are generated by handling of the resin. To date, no control systems have been used to control these emissions. They are relatively low compared to coldbox core making as there are no catalyst losses. Approved BACT control methods and emission limitations for the VOC emissions from coldbox core making are summarized in Table 8.

Table 8. Recent BACT Determinations for VOC from Warmbox Core Making Operations

Process Step	Control Method	Emission Limitation
Resin Handling	None	0.288 lbs per ton of core

This warmbox core making operation in Tennessee is under construction.

RECENT MACT DETERMINATIONS

Under 1990 Clean Air Act Amendment, USEPA is developing Maximum Available Control Technology or MACT requirements for the emission of air toxics. For existing operations in the foundry industry, MACT requirements are still under development. In the meantime, new source MACT must be applied on a case-by-case basis to any major source of air toxics. This includes the emission of 10 tons per year of any one air toxic, and 25 tons per year of any combination of air toxics.

Foundry projects that have required case-by-case MACT determinations include the following:

- New foundry project for Waupaca Foundry, Inc. Plant 6 in Tennessee; and,
- Phase II Project for Waupaca Foundry, Inc. Plant 5 in Indiana.

Air toxics are present in foundry emissions as inorganic constituents of the PM_{10} emissions such as arsenic, chromium and cadmium, and as organic constituents of the VOC emissions such as benzene and formaldehyde.

A new source MACT determination requires a case-by-case determination of what constitutes a maximum achievable reduction of hazardous air pollutants considering the costs of achieving the emission reduction and any non-air quality health and environmental impacts and energy requirements. MACT may include but is not limited to control equipment, work practice standards, emission standards, process modifications or raw materials substitution and/or reformulation.

In general, the BACT determination procedure used for criteria air pollutants results in more restrictive control technologies than the MACT procedure. For this reason, the control methods determined to be BACT have been accepted as MACT for air toxics.

Table 9 presents new source MACT determinations that have been made in the foundry industry. At this time, no new requirements have been implemented beyond that required as BACT under the PSD regulations. MACT for inorganic air toxics contained in the PM_{10} emissions has been use of the same control equipment used for PM_{10} emissions - a fabric filter baghouse system. MACT for organic air toxics contained in the VOC emissions has been the same equipment or methods used for VOC. For the cupola, this required use of an incineration system. For the pouring/mold cooling and shakeout operations, no control equipment has been required. For the coldbox core making operations, this required the use of a packed bed scrubber system to capture the triethylamine (TEA) catalyst.

Table 9. Recent New Source MACT Determinations for Iron Foundry Operations

Foundry Operation	Air Toxics	MACT
Cupola	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
	Benzene, Formaldehyde, 2378-TCDD	Incinerator Reagent Injection Baghouse
Pouring/Mold Cooling	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
	Acrolein, Benzene, Cumene, Naphthalene, Formaldehyde, Phenol, Toluene, Xylene, Ethylbenzene	None
Shakeout	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
	Acrolein, Benzene, Cumene, Naphthalene, Formaldehyde, Phenol, Toluene, Xylene, Ethylbenzene	None
Sand Handling	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
Sand Cooling	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
	Acrolein, Benzene, Formaldehyde, Methylene bisphenyl diisocyanate	None
Casting Handling	Sb, As, Be, Cd, Cr, Co, Mn, Ni, Se	Baghouse
Coldbox Core Making	Cumene, Naphthalene, Phenol, Triethylamine, Xylene	TEA Packed Bed Scrubber
Warmbox Core Making	None	Not Applicable

COMPLIANCE DEMONSTRATION METHODS

Compliance demonstration methods include monitoring, recordkeeping and testing. Recent construction permits issued for foundry operations included demonstration methods which matched the type of operation and air pollution control equipment. Initial compliance tests were typically required for each limitation established as BACT. In a few cases, the use of continuous emissions monitoring systems have been required for the measurement of opacity, SO_2 and NO_x from cupola operations.[6,10,22]

Testing for air toxics which received MACT determinations has not been required. Compliance with the PM_{10} limitations has served as a surrogate for compliance with inorganic air toxic control requirements. Compliance with VOC limitations has served as a surrogate for compliance with organic air toxic control requirements.

Table 10 summarizes typical compliance demonstration requirements included in recent construction permits issued for foundry operations.

Table 10. Typical Compliance Demonstration Requirements for Iron Foundry Operations

Foundry Operation	Control System	Monitored Parameter
Cupola	Baghouse	Pressure Drop
	Incinerator	Operating Temperature
	Reagent Injection	Reagent Injection Rate
	Baghouse	Pressure Drop
Pouring/Mold Cooling	Baghouse	Pressure Drop
Shakeout	Baghouse	Pressure Drop
Sand Handling	Baghouse	Pressure Drop
Sand Cooling	Baghouse	Pressure Drop
Casting Handling	Baghouse	Pressure Drop
Coldbox Core Making	TEA Packed Bed Scrubber	Pump Pressure Reagent pH
Warmbox Core Making	None	None

RECENT DEVELOPMENTS

Recent foundry projects which have received BACT and MACT determinations set a precedent for interpretation of these requirements for future projects. However, there have also been recent foundry projects which did not require BACT or MACT determinations but should be followed closely by those interested in future air pollution control requirements.

Control of VOC and CO Emissions from Pouring Operations

Sometimes emission limitations and control requirements are established to avoid the applicability of the BACT and MACT requirements. This approach may be considered necessary to avoid project delays due to the time needed to comply with these requirements, or to avoid more restrictive emission control requirements.

Two recent foundry projects in Georgia established emission limitations to avoid the BACT and MACT requirements and required the use of thermal incineration to attain these limitations. To date, BACT determinations have concluded that the use of incineration was either economically or technically infeasible for the control of VOC and CO emissions from pouring, cooling and shakeout operations. These operations typically require high exhaust flow rates to assure adequate capture of process emissions, dilution of process gases to avoid condensation, and duct velocities which avoid particle settling. These high flow rates have translated into high capital and operating costs for incineration. Typical cost effectiveness estimates for VOC exceed $10,000 per ton. This exceeds the $3,000 to $4,000 typically considered reasonable and indicative of BACT. With higher emissions, the cost effectiveness for CO has been more reasonable, less than $1,000. However, due to the complex mixture of the exhaust gas from these operations and lack of experience on an actual foundry operation, the use of incineration has yet to be considered BACT for these operations.

Two production lines were approved for the Intermet Corporation foundry in Columbus, Georgia in 1999 which required the installation of a regenerative thermal oxidizer after the fabric filter baghouse for iron pouring operations.[24,25,26] The oxidizer system was installed to control emissions below the thresholds for PSD permit and BACT requirements. This system was tested in the fall of 2000 and found to comply with its limitations of 0.052 lbs of CO per ton of iron and 0.029 lbs of VOC per ton of iron. Another project at Georgia Ductile in Cordelle, Georgia has been tentatively approved and will require the installation of a regenerative thermal oxidizer on pouring, mold cooling and mold dump operations from 28 tons per hour of iron production.[26] The oxidizer is necessary to maintain project emissions of VOC and CO below the thresholds at which the PSD permit requirements would apply. If these two projects are successful, they will demonstrate that incineration is technically feasible for the control of VOC and CO emissions from foundry pouring, cooling and shakeout operations. This will influence future BACT and MACT determinations.

As previously noted for coldbox core making operations, Wheland Foundry in Tennessee received a BACT determination in 1998 which required the use of a regenerative incineration system to control the VOC emissions from the core machine. Traditionally, packed bed scrubbers have been used to capture and reclaim emissions from the catalysis step, which represents the majority of the process emissions. The incineration system has the advantage of controlling the non-catalyst VOC emissions, those evaporated from the organic core resin. Future BACT determinations for cold box core making operations will need to consider if the non-catalyst VOC emissions justify the added expense of using an incineration system over the traditional packed bed scrubber.

Control of Benzene Emissions from Pouring & Shakeout Operations

Under Wisconsin hazardous air pollutant rules, Chapter NR 445, Wis. Adm. Code, any industrial facility which emits more than 300 lbs per year of benzene is required to control its emissions to the Lowest Achievable Emission Rate (LAER). The pouring, mold cooling and shakeout operations from approximately 32 iron foundries in the state are subject to this requirement. Benzene has been identified as a trace constituent in the VOC emissions from these operations. In 1999, the Wisconsin Department of Natural Resources negotiated with the Wisconsin Cast Metals Association to determine how this rule will be applied to benzene emissions from state foundries.[27] It was concluded that use of add-on control equipment such as incineration or biofiltration was LAER. To qualify for a variance from the LAER requirement, foundries must meet the following requirements:

- Demonstrate that LAER is economically infeasible due to high cost effectiveness;
- Conduct dispersion modeling to verify emissions do not pose excessive risk to the general public;
- Implement Best Available Control Technology (BACT) which consists of a pollution prevention strategy; and,
- Allow the general public to review the variance during a comment period and public hearing.

The pollution prevention strategy requires foundries to investigate methods for reducing benzene emissions from the pouring, mold cooling and shakeout operations. Some methods already implemented include reductions in the combustible materials in the sand system and the preparation of mold sand using oxygenated water. Variances and BACT control requirements are now being approved as part of the Title V operation permit program in Wisconsin. The results of the pollutant prevention program will provide information on successful methods for reducing benzene and other organic emissions from these foundry operations.

CONCLUSIONS

Recent construction permits for iron foundries in Wisconsin, Indiana and Tennessee have established BACT for the emissions of PM_{10}, SO_2, NO_x, VOC, CO, Pb and Be, and new source MACT for inorganic and organic air toxics such as arsenic, chromium, cadmium, benzene and formaldehyde. Approved operations include continuous casting production lines with pouring, shakeout operations, sand and casting handling operations, iron melting cupolas, and sand core manufacturing operations. BACT for PM_{10} continues to be the use of pulse jet fabric filter baghouse achieving outlet concentrations of 0.005 grains per actual cubic foot. BACT for VOC and CO emissions has required the use of incineration for cupola operations, and packed bed scrubbing systems for coldbox core making operations. New source MACT for air toxics has been determined to be BACT with no additional requirements specific beyond that required for criteria pollutants. MACT for inorganic air toxics such as trace metals has been established as the same control methods required for PM_{10}. MACT for organic air toxics such as formaldehyde and benzene has been established as the same control methods required for VOC.

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KEY WORDS

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