

Middletown Coke Company
Application for Major New Source
Permit to Install

April 2009

Prepared for:

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PERMIT TO INSTALL

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ACRONYMS

AK	AK Steel Corporation
BACT	Best Available Control Technology
BAT	Best Available Technology
CAA	Clean Air Act
CAM	Compliance Assurance Monitoring
CaSO ₃	Calcium Sulfite
CaSO ₄	Calcium Sulfate
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DEM	Digital Elevation Model
dscf	dry standard cubic foot
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitation
FGD	Flue Gas Desulfurization
FLM	Federal Land Manager
GECC	Gateway Energy and Coke Company
GEP	Good Engineering Practice
H ₂ SO ₄	Sulfuric Acid Mist
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HNCC	Haverhill North Coke Company
HRSR	Heat Recovery Steam Generator
LAER	Lowest Achievable Emission Rate
LNB	Low NO _x Burner
MACT	Maximum Achievable Control Technology
MAGLC	Maximum Acceptable Ground-level Concentration
MCC	Middletown Coke Company
NAAQS	National Ambient Air Quality Standards

NESHAP	National Emission Standards for Hazardous Air Pollutants
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NSR	New Source Review
OAC	Ohio Administrative Code
OAQPS	Office of Air Quality Planning and Standards
PM	Particulate Matter
PM ₁₀	Particulate Matter less than 10 micrometers in diameter
PM _{2.5}	Particulate Matter less than 2.5 micrometers in diameter
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTI	Permit-to-Install
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
SIA	Significant Impact Area
SCR	Selective Catalytic Reduction
SNCR	selective Non-catalytic Reduction
SO ₂	Sulfur Dioxide
TDS	Total Dissolved Solids
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compound

1.0 INTRODUCTION/OVERVIEW

On November 25, 2008, the Middletown Coke Company (MCC) received a Permit to Install (PTI) authorizing it to construct and operate a heat recovery coke-making facility adjacent to AK Steel Corporation's Middletown Works in Middletown, Ohio. Certain challenges to that permit are ongoing. While MCC possesses a valid PTI, it hereby applies to obtain a major new source permit if MCC determines that such a permit is preferable to the PTI. MCC is owned by SunCoke Energy, Inc., which is a business unit of Sunoco, Inc. This application package contains information required by the Ohio Environmental Protection Agency (EPA) to evaluate the project and issue an air pollution control PTI for the project.

The proposed operation will consist of 100 heat recovery coke ovens in three batteries. Operations at the facility will include coal handling, charging, heat recovery coking, pushing, quenching, coke handling, and coke storage. Heat recovery steam generators (HRSGs) will recover waste heat from the ovens to produce steam and electricity. At design capacity, the facility will coke 910,000 tons/year of coal and produce up to 614,000 tons/year of furnace coke. A nominal 52 megawatts of electricity will be produced from the waste heat. All the power produced will be sent to AK through the grid under a bilateral trade agreement.

The facility will be located in Butler County, Ohio. Butler County, as part of the Cincinnati-Hamilton metropolitan area, is currently designated as nonattainment for 8-Hour Ozone (Subpart 1) and particulate matter less than 2.5 micrometers in diameter (PM_{2.5}). The area is designated as attainment with all other ambient air quality standards.

Table 1-1 lists the potential emissions from the heat recovery coke plant and the values that represent significant emission rates in Ohio Administrative Code (OAC) 3745-31-01 (MMMM). The facility will be a major source of particulate matter (PM), particulate matter less than 10 micrometers in diameter (PM₁₀), PM_{2.5}, sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), and sulfuric acid mist (H₂SO₄). The information required to obtain a PTI under the requirements of OAC 3745-31 is included with this permit application.

Table 1-1

Comparison of Heat Recovery Coke Plant Emissions with Significant Emission Rates

Pollutant	Potential Emission Rate (tons/year)	Significant Threshold (tons/year)	Significant (Yes/No)
PM (filterable)	175.1	25	Yes
PM ₁₀ (filterable)	127.4	15	Yes
PM _{2.5} (filterable)	113.4	10	Yes
SO ₂	1,152.3	40	Yes
NO _x	483.7	40	Yes
CO	129.5	100	Yes
VOC	31.4	40	No
Lead	0.28	0.6	No
H ₂ SO ₄	36.3	7	Yes

CO = Carbon Monoxide

H₂SO₄ = Sulfuric Acid Mist

NO_x = Nitrogen Oxides

PM = Particulate Matter

PM_{2.5} = Particulate Matter less than 2.5 micrometers in diameter

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

SO₂ = Sulfur Dioxide

VOC = Volatile Organic Compound

The attainment provisions [in OAC-3745-31-(11-18)] apply to PM, PM₁₀, CO, and H₂SO₄. Applicable requirements addressed in this application include installation of Best Available Control Technology (BACT) (see Section 5.0), Ambient Air Impacts (see Section 6.0), and Additional Impacts (see Section 7.0).

The nonattainment provisions [in OAC-3745-31-(21-27)] apply to PM_{2.5}, to NO_x as an ozone precursor, and to SO₂ as a PM_{2.5} precursor (see Section 4.0). Applicable requirements include installation of Lowest Achievable Emission Rate (LAER) (see Section 8.0).

Because of the nonattainment status of Butler County, the emission increases of PM_{2.5}, NO_x, and SO₂ will be offset with emission offset credits that are at least 1.0 to 1.0. Most of the emission offset credits will come from shutdown of the AK Sinter Plant. In addition, AK will install a flame management system at the No. 2 Boiler House that will reduce the amount of gas required by the pilot burners. Reduced natural gas usage will reduce emissions from natural gas combustion. Table 1-2 shows that the AK reductions satisfy the emission offset requirement for all pollutants except NO_x. Approximately 45 tons of additional NO_x are needed. These additional offsets will be obtained by MCC's startup date.

Table 1-2
Emission Offset Credits from AK Steel

Pollutant	Emissions (tons/year)		
	PM _{2.5}	SO ₂	NO _x
Emissions Increases			
Heat Recovery Coke Plant	113.4	1,152.3	483.7
AK Material Handling	0.3		
Total Project	113.7	1,152.3	483.7
Emissions Reductions from Sinter Plant Shutdown			
Raw Materials Unloading	9.27		
Windbox	104.24	1,615.4	394.6
Breaker End	17.08		
Cold Sinter Screening	3.43		
Subtotal	134.0	1,615.4	394.6
Other Emissions Reductions Project			
No. 2 Boiler Burner Management Project			45.9
Total AK Emission Offset Credits	134.0	1,615.4	440.5
Additional Emission Offset Credits Needed			43.20

NO_x = Nitrogen Oxides

PM_{2.5} = Particulate matter less than 2.5 micrometers in diameter

SO₂ = Sulfur Dioxide

MCC will voluntarily purchase ambient PM₁₀ monitors, PM_{2.5} monitors and Volatile Organic HAP monitors. The monitors will be sited and operated by the Hamilton County Department of Environmental Services. They will be installed, sited, and operated in accordance with all Ohio EPA and USEPA regulations and be operational by the startup date of the facility.

Section 2.0 includes a more detailed discussion of the heat recovery coke plant. Section 3.0 presents the air pollutant emission analysis. Source-specific emissions requirements for the facility are discussed in Section 4.0. The remaining sections of the application text present specific information required by the attainment and nonattainment rules for major sources. The Ohio EPA forms and supporting calculations are included in Appendices B and C, respectively, and were submitted electronically using eBusiness Center. The appendices include other supporting information.

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2.0 HEAT RECOVERY COKE PLANT DESCRIPTION

A total of 100 ovens are planned at MCC. They will be arranged in three batteries – one with 20 ovens and two with 40 ovens each. At design capacity, the facility will carbonize 910,000 tons/year of coal and produce up to 614,000 tons/year of furnace coke.

MCC will use SunCoke Energy's Jewell-Thompson heat recovery type of oven. In coke production from both heat recovery and byproduct ovens, the volatile fraction of the coal is driven off in a reducing atmosphere. Coke is essentially the remaining carbon and ash. With byproduct ovens, the volatiles and combustion products are collected downstream of the oven chamber and refined in a chemical plant to produce coke oven gas and other products such as tar, ammonia, and light oils. In heat recovery ovens, all the coal volatiles are oxidized within the ovens.

Each technology has its own set of design objectives that affect its emissions. Both types of ovens are typically constructed of refractory brick shapes and other materials that, with day-to-day operation, can form small cracks in the refractory and around the removable parts. Byproduct ovens are kept at a positive pressure to avoid oxidizing recoverable products and overheating the ovens. Heat recovery ovens are kept at a negative pressure, adding air from the outside to oxidize volatile matter and release the heat of combustion within the oven system. The opposite operating pressure condition and combustion within the oven system are important design differences between heat recovery ovens and byproduct ovens. Small openings or cracks in byproduct ovens allow raw coke oven gas (and hazardous pollutants) to leak into the atmosphere. The openings or cracks in the heat recovery ovens simply allow additional air to be drawn into the oven.

Figure 2-1 shows a cut-away drawing of a heat recovery oven. Coal is charged onto the oven floor at the beginning of the cycle. Heat from the hot refractory starts the carbonization cycle. Air is first introduced into the oven crown. Partially combusted gases pass into a sole flue system beneath the oven floor where essentially all combustion is completed. The gases then pass into an afterburner tunnel where any remaining uncombusted gases are oxidized. The afterburner tunnel system routes the hot gases to the HRSGs.

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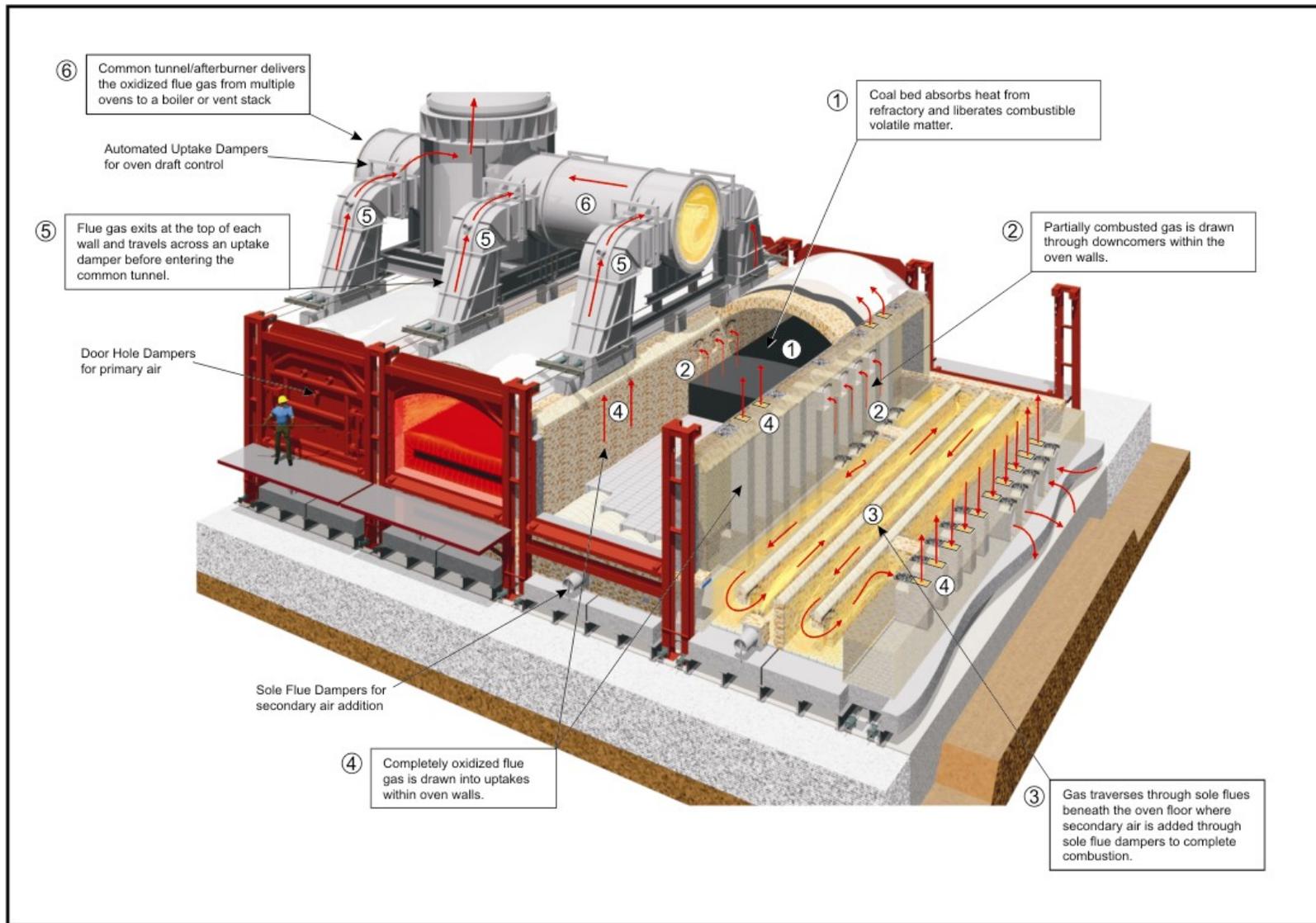


Figure 2-1. SunCoke Heat Recovery Oven Diagram

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Coal will come into the facility by rail. A thaw shed will be installed that can heat the coal cars, as needed, using electric heaters. Coal will be stored in open piles partially enclosed by berming and wind screening and will be equipped with watering systems to minimize emissions. Emissions from material transfer will be controlled by enclosures except in a few areas where the potential to overheat coal or interfere with dispersion of steam from coke may pose a safety hazard. A traveling hood/baghouse system on the pushing/charging machine will control charging emissions that escape the ovens. HRSGs will recover heat from the oven waste gases and protect the downstream pollution control devices. PM and SO₂ will be removed from the oven gases in a lime spray dryer/baghouse system. All flue gases will go through this system except during times of HRSG or spray dryer/baghouse maintenance. Use of the spray dryer/baghouse is maximized so that approximately 96% of the flue gases are treated by these air pollution controls. A mobile flat hot push car with multicyclone will capture pushing emissions. Quenching will be performed in a specially designed quench tower with baffles. Quenching emissions will be controlled by using water with total dissolved solids (TDS) levels less than or equal to 1,100 mg/L for quenching and by a unique baffle design. A baghouse will control emissions from the coke screening and crushing facilities. Coke will normally be transferred directly to AK by conveyor, but a system to allow coke to be loaded into rail cars will be installed. Provisions will be made to store a run of oven coke, screened coke, and coke breeze in open coke piles if necessary. Plant roads will be paved to control PM.

The individual waste heat stacks will be used during annual inspection and maintenance of each HRSG so that these procedures can be performed safely. The maximum time that will be required for planned maintenance and inspection of each HRSG is 10 days/year. The planned outages will be scheduled so that the HRSGs are brought down one at a time for maintenance and inspection. During the scheduled maintenance, 20 ovens will vent waste gases directly into the atmosphere, bypassing the flue gas desulfurization (FGD)/fabric filter system. These gases will still pass through the common tunnel afterburner system, which will fully combust the gases prior to release into the atmosphere. The remaining 80 ovens will continue to pass through the spray dryer/baghouse. On an annual basis, 2.7% of the waste gases from the ovens will be vented through the waste heat stacks.

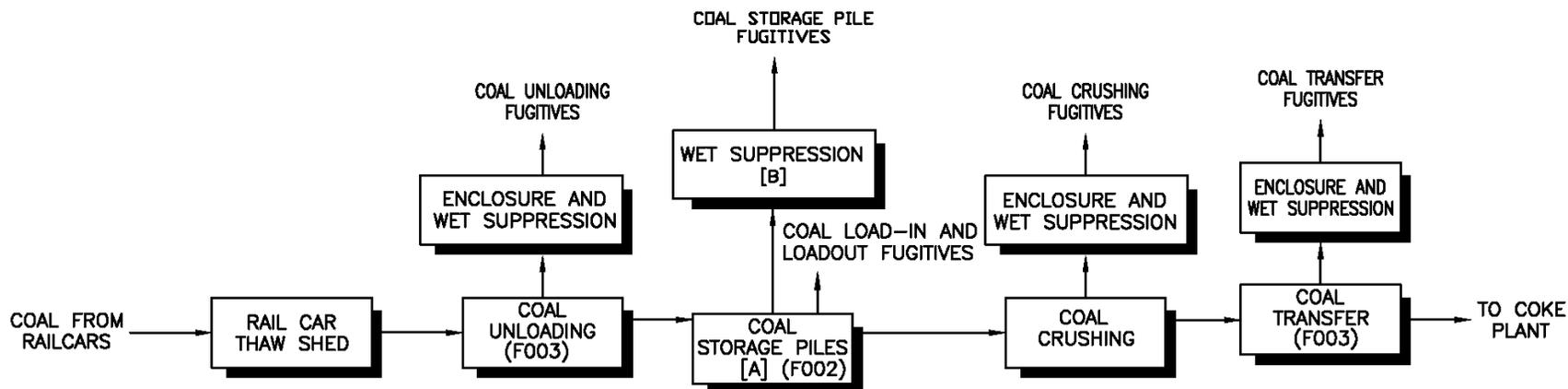
It was originally envisioned that the HRSGs could be inspected and maintained once a year in a single 8-day outage. However, experience at Haverhill North Coke Company (HNCC) has been that the HRSGs tend to foul heavily with the waste gases from heat recovery coking – even with regular soot blowing. This causes two problems. First, this ultimately shortens HRSG tube life and increases the likelihood of HRSG malfunctions. Second, the thermal efficiency of the HRSG degrades and the temperature of the gases going to the FGD system increases. The result is that more water is required to cool the gases entering the spray dryer. This causes an increase in the dew point temperature, which makes it more likely for corrosion in the spray dryer, baghouse, and ductwork. Increased corrosion in the FGD system increases the likelihood of having to take the FGD system offline for extensive repairs. The recommended resolution is to perform a “mini outage” for the HRSG halfway through the year in addition to the primary outage for maintenance and inspection. It takes several days to safely inspect and maintain a HRSG considering the time to cool the HRSG down, close the entrance and exit so that it is safe to enter, perform the inspection and maintenance, open the entrance and exit, and gradually heat up the HRSG to avoid thermal shock. Experience at HNCC has shown that 10 days/year are ideal for performing the two outages for maintenance and inspection.

The spray dryer/baghouse will be designed so that much of the routine inspection and maintenance can be performed while the system is operating. For example, the rotary atomizers can be exchanged during operation, and external components such as hopper heaters, level detectors, and the filter bag cleaning system can all be inspected and replaced during normal operation. The baghouse will have extra compartments so that some can be offline during operation, allowing filter bags and cages to be inspected and replaced when necessary. In addition, there will be three fans so that there will be a spare as well as one offline for inspection and maintenance.

The proposed supplier of this equipment (Hamon Research-Cottrell) recommends an annual internal inspection for spray dryer/baghouse installations for their operating units. Quick inspections are also needed during unexpected plant forced outages. Recognizing the more challenging service for a heat recovery coking facility, they recommend an aggressive preventive maintenance program for optimum performance that will promote the maximum effective service life of all components. Correspondence from Hamon with these recommendations is

included in Appendix A. As such, MCC proposes 5 days/year for inspection/maintenance of the spray dryer/baghouse. This work will be performed using good work practices and scheduling the work to be performed in the shortest possible time. During these 5 days, the flue gases will be routed around the FGD system and emitted from the main stack. On an annual basis, 1.4% of the waste gases from the ovens will bypass the FGD system during maintenance.

The process is illustrated schematically in Figures 2-2 through 2-4. Figure 2-2 shows the coal processing, Figure 2-3 shows the coke plant, and Figure 2-4 shows the coke processing. Figure 2-5 shows the overall plant layout.



NOTE:

[A] COAL STORAGE PILE INCLUDES COAL LOAD-IN FUGITIVES, COAL PILE FUGITIVES, AND COAL LOADOUT FUGITIVES.

[B] OPEN PILE WITH WET SUPPRESSION.



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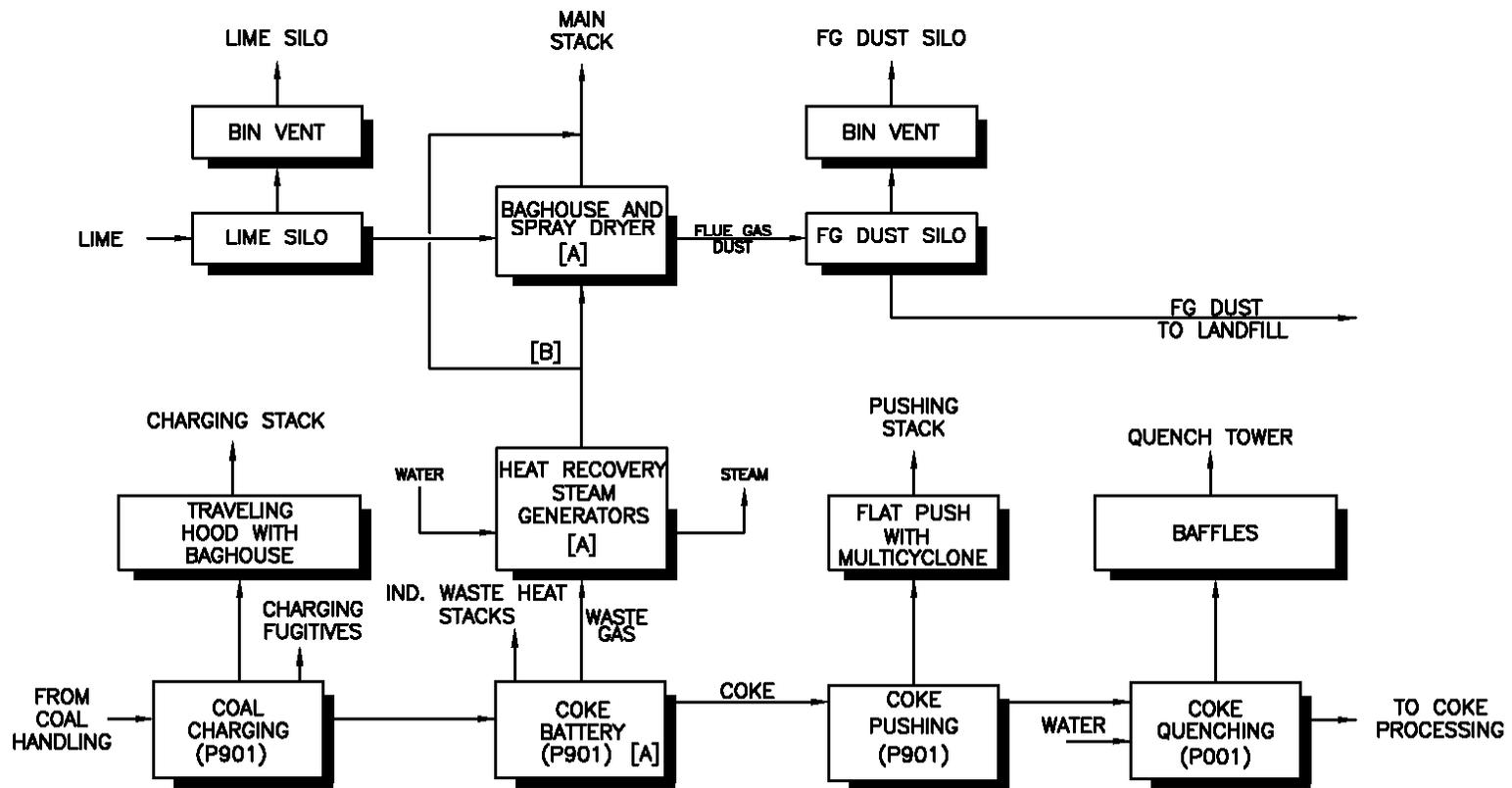
Figure 2-2 Coal Processing Flow Diagram
Middletown, OH

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[A] 96% of waste gas to spray dryer/baghouse, 4% of waste gas vented.

[B] Waste gases bypass spray dryer and baghouse during maintenance.



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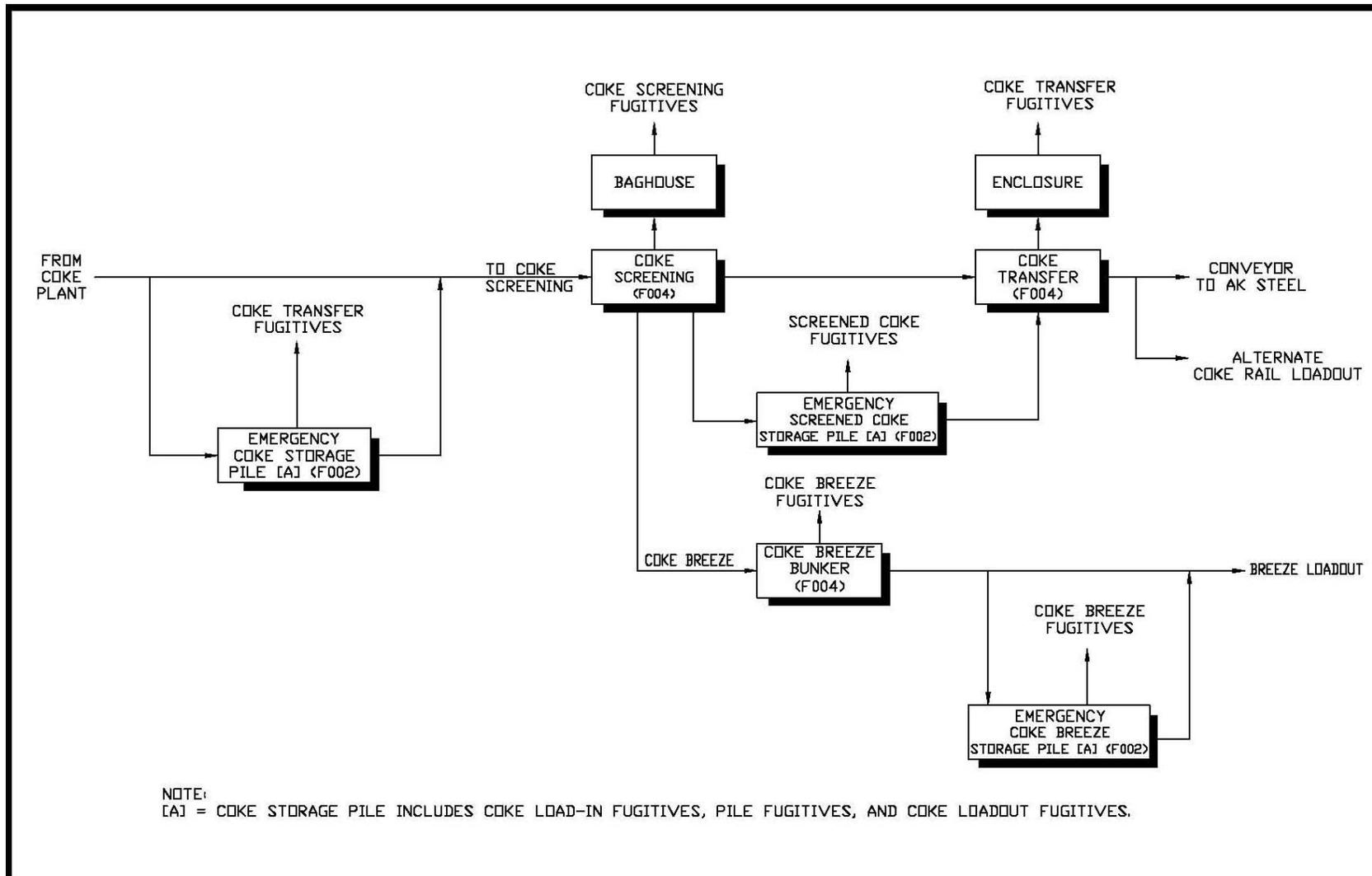
Figure 2-3 Coke Plant Flow Diagram
Middletown, OH

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DATE: 12/12/08

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NOTE:
 [A] = COKE STORAGE PILE INCLUDES COKE LOAD-IN FUGITIVES, PILE FUGITIVES, AND COKE LOADOUT FUGITIVES.



Figure 2-4 Coke Processing Flow Diagram
 Middletown, OH

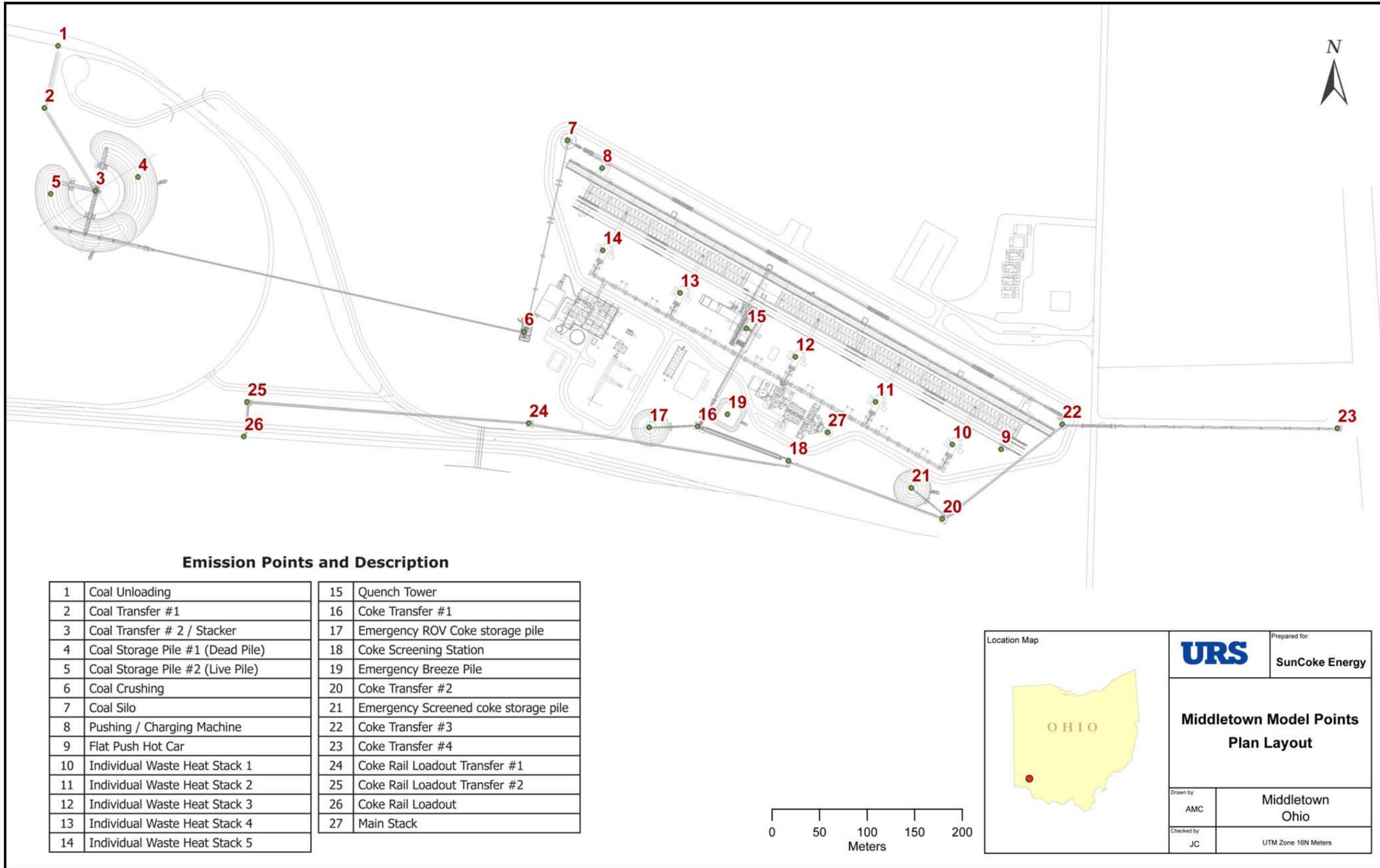
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Figure 2-5. MCC Plant Layout

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3.0 EMISSIONS ANALYSIS

This section contains a summary of air pollutant emissions from MCC. Facility-wide emissions are summarized in Table 1-1. Plant operation will be continuous (8,760 hours/year). Annual emissions are based on the maximum oven charge rate of 910,000 tons/year of coal. Many of the processes are batch operations and do not operate continuously. Production and emissions are limited by the nature of the operation. The cycle time is typically 48 hours. Half the ovens are charged each day with each oven charged every other day.

Table 3-1 presents the annual stack and fugitive criteria pollutant (plus sulfuric acid) emissions by emissions unit. Note that the emissions from heat recovery coking represent potential to emit and overestimate actual emissions. For example, during annual spray dryer/baghouse maintenance, all emissions from coking will be exhausted from the main stack bypassing the spray dryer/baghouse as it will be offline. The emissions in Table 3-1 are calculated as though both typical and maintenance emissions could occur simultaneously. This results in a conservative estimate of emissions. NO_x, for example, is overestimated by 18.75 tons/year since emissions during maintenance will be emitted from either the waste heat stacks or the main stack – but not both simultaneously.

The majority of hazardous air pollutant (HAP) emissions are from hydrogen chloride (HCl). The facility total emissions of HAPs, other than HCl, will be less than 5 tons/year. Table 3-2 summarizes the HAP emissions.

Although there are no specific regulations requiring heat recovery coke ovens to control mercury emissions, as a voluntary measure, MCC is proposing a mercury emission control system for the facility. During coking, some of the mercury in the coal is volatilized and converted to mercury vapor. This vapor may subsequently form mercury compounds or may be adsorbed onto the surface of other particles. The mechanisms are complex, but mercury is ultimately present as a mixture of mercury vapor, ionic mercury compounds, and particulate mercury. A spray dryer followed by a baghouse has the potential to effectively remove mercury in the ionic and particle phases.

Table 3-1
Maximum MCC Emissions

Emissions Unit	Designation	Associated Control Device^a	Filterable PM (tons/year)	Filterable PM₁₀ (tons/year)	Filterable PM_{2.5} (tons/year)	SO₂ (tons/year)	NO_x (tons/year)	CO (tons/year)	VOCs (tons/year)	Lead (tons/year)	Sulfuric Acid (tons/year)
Fugitive emissions	Coal unloading, storage, handling, and processing	WS, E	9.97	4.80	1.60	—	—	—	—	—	—
Coal charging	Charge	Traveling hood with baghouse	4.63	3.77	3.58	0.14	—	1.28	0.91	0.00005	—
Heat recovery coking	Coking (main stack)	Baghouse, common tunnel afterburner, and lime spray dryer	46.93	46.93	46.93	700.8	456.25	95.54	20.47	0.12	11.13
Heat recovery coking – spray dryer/baghouse maintenance	Coking (main stack)	Baghouse, common tunnel afterburner, and lime spray dryer	6.30	6.30	6.30	107.64	6.25	1.31	0.28	0.03	7.63
Heat recovery coking – HRSG maintenance	Coking (individual waste heat stacks)	Common tunnel afterburner	12.60	12.60	12.60	299.00	12.50	2.62	0.56	0.07	15.25
Coke pushing	Pushing	Flat push and traveling hood with multicyclone	13.09	13.09	13.09	44.71	8.67	28.74	9.13	0.008	2.28
Coke quenching	Quench	Baffles, with TDS control water	54.75	20.08	12.32	—	—	—	—	0.05	—
Coke screening	Processing	Baghouse, E	15.02	15.02	15.02	—	—	—	—	—	—
Fugitive emissions	Coke handling, storage, and loadout	WS, E	6.90	3.29	1.08	—	—	—	—	—	—
Fugitive emissions	Industrial roads	Paving, W, GH	4.31	0.84	0.21	—	—	—	—	—	—
Other fugitive emissions	FGD dust, lime silo, and cooling tower	Bin vent	0.64	0.64	0.64	—	—	—	—	—	—
Total Emissions			175.14	127.36	113.38	1,152.29	483.67	129.49	31.35	0.28	36.29

^a W = watering as needed, E = enclosure, GH = good housekeeping, WS = wet suppression or wet material

CO = Carbon Monoxide
 FGD = Flue Gas Desulfurization
 MCC = Middletown Coke Company
 NO_x = Nitrogen Oxides
 PM = Particulate Matter

PM_{2.5} = Particulate matter less than 2.5 micrometers in diameter
 PM₁₀ = Particulate matter less than 10 micrometers in diameter
 SO₂ = Sulfur Dioxide
 TDS = Total Dissolved Solids
 VOC = Volatile Organic Compound

Table 3-2

Summary of Maximum Annual HAP Emissions from MCC

Compound	Coking - Main and Waste Heat Stacks (tons/year)	Charging (tons/year)	Pushing (tons/year)	Quenching (tons/year)	Total Maximum Annual Emissions (tons/year)
Anthracene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Benzene	2.28E-01	1.64E-02	NM	ND	2.44E-01
Benzo(a)pyrene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Benzo(b,k)fluoranthene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Bromoform	5.70E-04	ND/NR	NM	ND	5.70E-04
Bromomethane	2.66E-01	ND/NR	NM	ND	2.66E-01
Benzene Soluble Organics	ND/NR	ND/NR	9.58E-02	ND	9.58E-02
2-Butanone	2.99E-02	ND/NR	NM	ND	2.99E-02
Carbon disulfide	7.60E-03	9.58E-04	NM	ND	8.56E-03
Chlorobenzene	5.70E-04	ND/NR	NM	ND	5.70E-04
Chloroform	5.23E-03	ND/NR	NM	ND	5.23E-03
Chloromethane	3.61E-01	9.13E-04	NM	ND	3.62E-01
Chrysene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Cumene	6.65E-04	ND/NR	NM	ND	6.65E-04
Ethylbenzene	1.52E-03	3.33E-04	NM	ND	1.85E-03
Fluoranthene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Fluorene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Hydrogen chloride	118.04	NM	NM	NM	118.04
Iodomethane	2.99E-03	ND/NR	NM	ND	2.99E-03
Isooctane	7.60E-03	ND/NR	NM	ND	7.60E-03
Methylene chloride	3.14E-01	ND/NR	NM	ND	3.14E-01
2-Methylnaphthalene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
4-Methyl-2-Pentanone	4.23E-03	ND/NR	NM	ND	4.23E-03
2-Methylphenol	ND/NR	ND/NR	NM	4.75E-03	4.75E-03
4-Methylphenol/3-Methylphenol	ND/NR	ND/NR	NM	1.53E-02	1.53E-02
Naphthalene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
n-Hexane	7.13E-03	ND/NR	NM	ND	7.13E-03
Phenanthrene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Phenol	3.37E-02	ND/NR	NM	1.11E-02	4.49E-02
Pyrene	Part of total PAHs	Part of total PAHs	NM	Part of total PAHs	Part of total PAHs
Styrene	3.28E-03	ND/NR	NM	ND	3.28E-03
Tert-butyl methyl ether	2.23E-05	ND/NR	NM	ND	2.23E-05
Tetrachloroethane	1.95E-04	ND/NR	NM	ND	1.95E-04
1,1,2,2-Tetrachloroethane	9.50E-04	ND/NR	NM	ND	9.50E-04

**Table 3-2
(Continued)**

Compound	Coking - Main and Waste Heat Stacks (tons/year)	Charging (tons/year)	Pushing (tons/year)	Quenching (tons/year)	Total Maximum Annual Emissions (tons/year)
Toluene	2.42E-01	7.76E-03	NM	ND	2.50E-01
Total PAHs	1.29E-01	2.01E-02	NM	3.57E-03	1.52E-01
1,1,1-Trichloroethane	1.19E-03	ND/NR	NM	ND	1.19E-03
1,1,2-Trichloroethane	2.76E-04	ND/NR	NM	ND	2.76E-04
Trichloroethene	4.12E-03	ND/NR	NM	ND	4.13E-03
Vinyl acetate	3.28E-03	ND/NR	NM	ND	3.28E-03
Xylenes	7.70E-03	3.06E-03	NM	ND	1.08E-02
Antimony ^a	5.40E-03	ND/NR	ND	3.71E-03	9.12E-03
Arsenic	5.40E-02	1.10E-04	5.48E-03	7.36E-02	1.33E-01
Beryllium	8.31E-04	3.97E-06	ND	2.44E-04	1.08E-03
Cadmium	7.48E-03	ND/NR	ND	ND	7.48E-03
Chromium	2.62E-02	4.56E-05	ND	1.28E-03	2.75E-02
Cobalt	ND/NR	3.24E-05	ND	7.85E-04	8.18E-04
Lead	1.90E-01	4.56E-05	6.98E-03	3.96E-02	2.36E-01
Manganese	1.25E-02	2.10E-04	9.58E-04	1.48E-02	2.84E-02
Mercury ^b	8.15E-02	3.60E-07	ND	ND	8.15E-02
Nickel	2.41E-02	6.48E-05	ND	1.86E-03	2.60E-02
Phosphorus	5.82E-01	ND/NR	ND	3.53E-02	6.17E-01
Selenium	1.33E-02	ND/NR	ND	6.03E-03	1.93E-02
Total HAPs (tons/year)	120.70	0.05	0.11	0.21	121.07
Total HAPs without HCl (tons/year)	2.66	0.05	0.11	0.21	3.03
Total HAPs without HCl with buffer (tons/year)^c					3.64

^aEstimated 95% removal in spray dryer/baghouse for all metals except mercury.

^bEstimated 50% mercury removal in spray dryer/baghouse with carbon injection.

^cTotal HAPs (except HCl) emissions include 20% buffer that recognizes the emission factors are based on AP-42 emission factors, which can change, and limited test data.

HAP = Hazardous Air Pollutant
HCl = Hydrogen Chloride
MCC = Middletown Coke Company
ND = Not Detected
NM = Not Measured
NR = Not Reported
PAH = Polynuclear Aromatic Hydrocarbon

Various studies have shown that carbon injection has the capability to remove vapor phase mercury with a spray dryer/baghouse. The sorbent is injected upstream of the spray dryer. The gas-phase mercury contacts the sorbent in the ductwork and spray dryer and attaches to its surface. The sorbent with the mercury is then collected in the baghouse.

This potential for mercury control is potentially a significant advantage for the spray dryer/baghouse when used with carbon injection. MCC intends to install a system that can inject carbon upstream of the spray dryer at a rate of up to 10 lb carbon per million actual cubic feet of flue gas. This same system is installed at SunCoke's Haverhill II facility at a carbon injection rate of 2 lb carbon per million actual cubic feet of flue gas.

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4.0 SOURCE-SPECIFIC REGULATORY ANALYSIS

This section summarizes the pertinent regulations associated with the types of operations proposed at the MCC plant. Section 4.1 discusses federal rules, and Section 4.2 discusses Ohio rules. Other sections of the application discuss general requirements for major sources in attainment and nonattainment areas.

4.1 Federal Rules

The federal rules evaluated for potential applicability to the MCC plant are New Source Review (NSR), New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants (NESHAP). The applicability of each rule is discussed below. Table 4-1 provides a summary of the applicable federal rules, recordkeeping, and reporting information. In addition, the MCC facility will be required to obtain a Part 70 Title V air operating permit.

4.1.1 NESHAP for Source Categories

This section discusses the NESHAP for coke oven batteries, pushing, quenching, and combustion stacks.

National Emission Standards for Coke Oven Batteries—The Maximum achievable Control Technology (MACT) standards for coke oven batteries are contained in 40 Code of Federal Regulations (CFR) 63, Subpart L, National Emission Standards for Coke Oven Batteries. Specific requirements for nonrecovery (same as heat recovery) batteries are in Section 303 of this rule. The requirements are 0% leaks for doors, a capture/control system for charging, and daily monitoring of pressure in each oven or in a common battery (afterburner) tunnel.

The heat recovery ovens proposed for the MCC plant will be operated under negative pressure. This meets the requirements of the MACT rule and ensures compliance with the 0% door leakage standard. The ovens to be installed at the MCC plant have no topside lids or offtake piping, so those requirements are not applicable.

Table 4-1

Federal Rules for Nonrecovery Coke Oven Batteries

Emissions Unit	Rule Citation	Rule Summary	Compliance Demonstration		Recordkeeping		Reporting	
			Activity	Frequency	Activity	Frequency	Activity	Frequency
Coke Oven Batteries	40 CFR 63.306	Prepare work practice plan that addresses training and controlling emissions	Prepare and revise work practice plan that addresses training and procedures for controlling emissions	NA	Keep on file for 5 years	Initial and revise as necessary	Submit to Administrator if requested	As necessary
	40 CFR 63.310(a)	Operate equipment using good air pollution control practices	Operate according to standard operating procedures	Ongoing	NA	NA	NA	NA
	40 CFR 63.310(b) and 40 CFR 63.7310(c)	Develop and implement startup, shutdown, and malfunction plan	Describe procedures for operating during these periods	NA	Keep on file for 5 years	Initial and revise as necessary	Notify agency of malfunction within 24 hours; submit written report within 14 days	As necessary
	40 CFR 63.311(b)(2)	Certify initial compliance	Provide written statement to certify initial compliance	NA	Keep on file for 5 years	NA	Submit required notification within 45 days of compliance date	Initial
	40 CFR 63.311(c)	Written notification of intention to construct new coke oven battery	Provide agency with the notification	NA	Keep on file for 5 years	NA	Submit required notification	Initial
	40 CFR 63.311(d)	Semiannual compliance certification	Submit semiannual compliance certification to agency	NA	Keep on file for 5 years	Ongoing	Submit certifications and reports	Semiannually
	40 CFR 63.311(f)(1)	Documentation of nonrecovery requirements	Maintain files of required information (daily pressure monitoring, performance of work practice requirements)	Ongoing	Maintain information on-site for 1 year and available for 5 years	Ongoing	Submit certifications and deviations with semiannual report	Semiannually

**Table 4-1
(Continued)**

Emissions Unit	Rule Citation	Rule Summary	Compliance Demonstration		Recordkeeping		Reporting	
			Activity	Frequency	Activity	Frequency	Activity	Frequency
Coke Oven Doors	40 CFR 63.303(b)(1)(ii)	Demonstrate negative pressure	Monitor and record once a day the pressure of each oven or in a battery common tunnel	Daily	Summary of pressure in each battery common tunnel	Daily	Report incidence of positive pressure	Semiannually
	40 CFR 63.303(c)(1)	Observe each door for visible emissions	Record oven number from which visible emissions occur	Daily	Summary of doors with visible emissions	Daily	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.303(c)(2)	Corrective actions for doors with visible emissions	Stop visible emissions within 15 minutes	As necessary	Summary of actions taken	As necessary	Submit certifications and deviations with semiannual report	Semiannually
Charging	40 CFR 63.303(b)(2)	Use emission control system for capture and collection of charging emissions	Achieve compliance by the use of a traveling hood with a baghouse to capture and control emissions	Ongoing	Maintain design characteristics on file	Initial and revise as necessary	NA	NA
	40 CFR 63.303(d)(1)	Visible emissions from charging must be $\leq 20\%$	Observe five consecutive charges/week for each charging capture system	Weekly	Maintain records in file	Weekly	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.303(d)(2)	PM (filterable) emissions from control device must be ≤ 0.0081 lb/dry ton of coal	Perform stack test to demonstrate compliance	Initial within 180 days, then once per Title V permit term	Maintain test results in file	NA	Submit certification of test results	When test is performed

**Table 4-1
(Continued)**

Emissions Unit	Rule Citation	Rule Summary	Compliance Demonstration		Recordkeeping		Reporting	
			Activity	Frequency	Activity	Frequency	Activity	Frequency
Charging (continued)	40 CFR 63.303(d)(3)	Visible emissions from control device stack must be $\leq 10\%$	Operator will observe stack daily for any visible emissions. If any visible emissions are observed, perform visible emissions measurement using EPA Method 9	Daily	Summary of observations	Daily	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.303(d)(4)	Operating procedures during charging	Operating procedures must address uptake damper operation during charging	NA	Keep on file for 5 years	Initial and revise as necessary	Submit to Administrator if requested	NA
Pushing	40 CFR 63.7290(a)(4)	PM (filterable) limited to 0.04 lb/ton of coke from mobile control device that captures emissions during travel	Compliance is achieved by use of flat car pushing with traveling hood and multicyclone. Demonstrate with performance test	Initial within 180 days, then twice per Title V permit term	Keep on file for 5 years	Initial and revise as necessary	Submit certification of test results	When test is performed
	40 CFR 63.7290(b)(3)	Establish minimum volumetric flow rate	Establish minimum volumetric flow rate during performance test	Initial within 180 days, then twice per Title V permit term	Keep on file for 5 years	Initial and revise as necessary	Submit certification of test results	When test is performed
	40 CFR 63.7290(b)(3)(i)	Monitor pushing fan amps	Monitor multicyclone fan amps as a surrogate for flow rate. Daily average must be above minimum	Once per shift (every 8 hours)	Summary of data	Daily	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.7290(b)(4)	Monitor multicyclone pressure drop	Monitor multicyclone pressure drop. Describe in monitoring plan. Daily average must be in range	Each push	Summary of data	Daily	Submit certifications and deviations with semiannual report	Semiannually

Table 4-1
(Continued)

Emissions Unit	Rule Citation	Rule Summary	Compliance Demonstration		Recordkeeping		Reporting	
			Activity	Frequency	Activity	Frequency	Activity	Frequency
Pushing (continued)	40 CFR 63.7293(a)	Visually inspect ovens before pushing	Do not push an oven until operator verifies by looking into the oven that coking is complete	Daily	Summary of data	Daily	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.7300(c)(1)	Inspections	Inspect components important to system capture. Repair within 30 days or submit notice that repair will take longer	Monthly	Summary of data	Monthly	Submit notice for delayed repair or request for extension if necessary	As necessary.
	40 CFR 63.7300(c)(2)	Preventive maintenance	Establish preventive maintenance schedule	NA	Keep on file	Initial, revise as necessary	NA	NA
Quenching	40 CFR 63.7295(b)(1)	Quench tower baffle construction requirement	No more than 5% of the quench tower may be open to the sky	Ongoing	NA	NA	NA	NA
	40 CFR 63.7295(b)(2)	Quench tower baffle washing requirement	Baffles must be washed each day unless prohibited by cold temperature	Daily	Summary of data on file	Daily	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.7295(b)(3)	Quench tower inspection	Monthly inspection for blockage or missing baffles	Monthly	Summary of data on file	Monthly	Submit certifications and deviations with semiannual report	Semiannually
	40 CFR 63.7295(b)(4)	Quench tower repair	Initiate repair or replacement of baffles within 30 days	As necessary	Keep maintenance records on file	As necessary	NA	NA

Table 4-1
(Continued)

Emissions Unit	Rule Citation	Rule Summary	Compliance Demonstration		Recordkeeping		Reporting	
			Activity	Frequency	Activity	Frequency	Activity	Frequency
Quenching (continued)	40 CFR 63.7295(a)(1)(i)	Quench water quality	Verify that the quench water TDS is $\leq 1,100$ mg/L by sampling	Weekly	Summary of data	Weekly	Submit initial certification, then certifications and deviations with semiannual report	Initial and semiannually

CFR = Code of Federal Regulations

EPA = U.S. Environmental Protection Agency

NA = Not Applicable

PM = Particulate Matter

TDS = Total Dissolved Solids

The charging system will be equipped with collection hoods that are vented to baghouses for control. The estimated capture efficiency is 90%, and the estimated collection efficiency of the baghouses is 99%. This system satisfies the requirement to have a system that minimizes emissions.

National Emission Standards for Coke Ovens: Pushing, Quenching and Combustion Stacks—The MACT standards for pushing and quenching are contained in 40 CFR 63, Subpart CCCCC, National Emission Standards for Coke Ovens: Pushing, Quenching, and Battery Stacks. No requirements for combustion stacks have been promulgated for nonrecovery ovens because of the negative pressure design.

The MACT standard for pushing establishes PM limits and monitoring requirements for control devices. Work practice procedures are also established for ensuring that an oven is coked out before pushing.

The MACT standard for quenching establishes a limitation for TDS in quench water. The standard contains construction requirements for baffles. Work practice procedures for cleaning baffles are also established.

4.1.2 Standards of Performance for New Stationary Sources

The coal crusher is regulated under “Standard of Performance for Coal Preparation Plant,” 40 CFR 60, Subpart Y. The requirement is that fugitive emissions from these operations are limited to 20% opacity.

4.1.3 Compliance Assurance Monitoring

Coking emissions will be controlled by an FGD system that requires a Compliance Assurance Monitoring (CAM) Plan as discussed in 40 CFR 64. Accordingly, a CAM Plan for the FGD system based on EPA guidance is included in Appendix E.

4.1.4 Applicability of Rules for Steam Generating Units

EPA evaluated whether a heat recovery (also referred to as nonrecovery) coke plant would be considered a steam generating unit and subject to regulations (e.g., for boilers) under 40 CFR 60, 60.40(b), and 41(b). An applicability determination, Control Number 9900003, was issued that the facility was not subject to these rules. Full text of the determination is available on the EPA web site at <http://cfpub.epa.gov/adi/index.cfm>.

4.2 Ohio Rules

The MACT standards listed in Section 4.1.1 were promulgated by EPA specifically for the nonrecovery (heat recovery) coke making technology. By contrast, Ohio Air Pollution Control rules for coke ovens were written specifically for the byproduct coke making technology. For example, heat recovery ovens are charged by a horizontal flight conveyor rather than through charging ports and do not have charging hole lids. Heat recovery coke ovens do not collect partially combusted oven gases and consequently do not have off-takes or off-take piping. Therefore, rules that limit emissions from off-take piping and charging hole lids do not apply to heat recovery ovens. Other differences in the technologies are discussed in Section 2.0. For this reason, the MACT standards establish more appropriate requirements and limitations for operations specific to heat recovery coke making. General Ohio Air Pollution Control Rules that are applicable to the MCC facility are listed in Table 4-2.

Because of the ozone and PM_{2.5} nonattainment designation of the area, the nonattainment provisions and conditions for approval of a PTI in OAC 3745-31-22(A) apply.

- LAER is required. See Section 8.0 for LAER demonstration.
- Compliance or a schedule to be in compliance is required for all existing major sources owned or operated by the applicant. MCC will provide a compliance certification prior to permit issuance.
- Emission offsets are required. As shown in Table 1-2, MCC will obtain emission offset credits from AK Steel for PM_{2.5} and the precursors for PM_{2.5} and ozone. Approximately 45 additional tons of NO_x are needed. MCC is currently pursuing these additional offsets and will obtain them by MCC's startup date.

Table 4-2

Applicable State General Rules and Compliance Demonstration

Emission Unit	Rule Citation	Rule Summary	Compliance Demonstration Activities
All emission units	3745-15-06	Air pollution control equipment shall be maintained and malfunctions shall be reported	Ongoing maintenance of control equipment and submit necessary reports as needed
	3745-15-07	No public nuisance (i.e., the emission of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, or any other substances or combination of substances, in such manner or amounts to endanger the health, safety or welfare of the public, or cause unreasonable injury or damage to property)	Unless otherwise specified for a specific source, compliance is achieved by good operating practices and investigation of any complaints
	3745-16-02	Stack height requirements	Compliance is achieved by good engineering practice
Coke screening, charging, pushing, waste gases, and quenching	3745-17-11	Allowable particulate matter from operation, process, activity, and stacks except fugitive emissions	Compliance is achieved by use of control equipment to capture and control emissions
Charging	3745-17-07 (A)(1)	Stack: VE ≤20% (6 min average) VE ≤60% (6 min in each 60 min)	Use of a traveling hood with baghouse
Pushing	3745-31-05	BAT applied to each activity or operation that emits more than 10 tons/year of air contaminants	Compliance is achieved by use of BAT
	3745-17-07 (A)(1) and (B)(1)	Stack: VE ≤20% (6 min average) VE ≤60% (6 min in each 60 min) Fugitives: VE ≤20% (3 min)	Compliance will be achieved by the use of flat car pushing with traveling hood and multiclone.
Waste gas	3745-31-05	BAT applied to each activity or operation that emits more than 10 tons/year of air contaminants	Compliance is achieved by use of BAT
	3745-17-07 (A)(1)	Stack: VE ≤20% (6 min average) VE ≤60% (6 min in each 60 min)	Compliance by initial stack test
	3745-18-06	SO ₂	Compliance using spray dryer/baghouse; CEMS monitoring of main stack SO ₂ concentration and process data
Quenching	3745-31-05	BAT applied to each activity or operation that emits more than 10 tons/year of air contaminants	Compliance is achieved by use of BAT
	3745-17-07 (A)(1) and (B)(1)	Stack: VE ≤20% (6 min average) VE ≤60% (6 min in each 60 min) Fugitives: VE ≤ 20% (3 min)	Compliance will be achieved by the use of a baffled quench tower and control of total dissolved solids in quench water

**Table 4-2
(Continued)**

Emission Unit	Rule Citation	Rule Summary	Compliance Demonstration Activities
Coal piles and coke pile	3745-17-07 (B)(6)	VE ≤13 min/hour	Compliance will be achieved by the use of control equipment to capture and control emissions
	3745-17-08	RACM	Compliance will be achieved by control measures minimizing particulate emissions
Coal unloading, coal and coke handling, lime and flue gas desulfurization dust silo	3745-17-07 (B)(1)	VE ≤20% (3 min)	Compliance will be achieved by the use of control equipment to capture and control emissions
	3745-17-08	RACM	Compliance will be achieved by control measures minimizing particulate emissions
Coke screening	3745-31-05	BAT applied to each activity or operation that emits more than 10 tons/year of air contaminants	Compliance is achieved by use of BAT
	3745-17-07 (A)(1) and (B)(1)	Stack: VE ≤20% (6 min average) VE ≤60% (6 min in each 60 min) Fugitives: VE ≤20% (3 min)	Compliance will be achieved by the use of good operating practices
Paved roads	3745-17-07 (B)(4)	VE ≤6 min/hour	Compliance is achieved by road watering and good housekeeping
	3745-17-08	RACM	Compliance will be achieved by control measures minimizing particulate emissions

BAT = Best Available Technology
CEMS = Continuous Emission Monitoring System
RACM = Reasonably Available Control Measures
SO₂ = Sulfur Dioxide
VE = Visible Emissions

- The project must demonstrate a positive net air quality benefit. A net air quality benefit for ozone is demonstrated for NO_x if the offsets come from the same demonstration area (OAC 3745-31-25). Most of the NO_x will be from AK Steel, which is adjacent to MCC (less than 1 mile away), which satisfies this requirement. Other appropriate NO_x offsets will be obtained. PM_{2.5} is a complex mixture of primary particles directly emitted into the air as solids and secondary particles that form in the atmosphere as a result of various chemical reactions. Virtually all nonattainment problems appear to result from a combination of local emissions and transported emissions from upwind areas (“Clean Air Fine Particle Implementation Rule; Final Rule,” Federal Register, April 25, 2007). Consequently, it is important to consider the PM_{2.5} net air quality benefit on a regional basis. A positive net air quality benefit for PM_{2.5} will be demonstrated by:
 - Offsetting primary PM_{2.5} by a ratio of at least 1.0 to 1.0 from the adjacent AK Steel facility (less than 1 mile away),
 - Offsetting the PM_{2.5} precursors of SO₂ and NO_x by a ratio of at least 1.0 to 1.0, and
 - Producing electric power from the coke oven waste heat, which will reduce emissions that would otherwise be produced by coal-fired generators and other fossil-fired sources in Ohio and the Midwest.

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5.0 BEST AVAILABLE CONTROL TECHNOLOGY AND BEST AVAILABLE TECHNOLOGY ANALYSES

Ohio Attainment Provisions require a control technology review (OAC 3745-31-15). The key requirement of this rule is that new major stationary sources apply BACT for pollutants that the source has the potential to emit in significant amounts. For MCC, these pollutants are PM, PM₁₀, CO, and H₂SO₄.

Control technologies and practices that control PM₁₀ will also control PM. PM and PM₁₀ are addressed together. CO and H₂SO₄ are addressed separately.

BACT is defined in OAC 3745-31-01 (S) as:

Best available control technology or "BACT" means an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each regulated NSR pollutant which would be emitted from any proposed major stationary source or major modification which the director, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such major stationary source or major modification through application of production processes or available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of BACT result in emissions of any pollutant that would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63. If the director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be approved by the director instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice or operation and shall provide for compliance by means which achieve equivalent results.

Ohio EPA has a similar requirement to employ "best available technology," or BAT. BAT is defined in Ohio PTI Rules [3745-31-01 (T)] as follows:

Best available technology or "BAT" means any combination of work practices, raw material specifications, throughput limitations, source design characteristics, and air pollution control devices that have been previously demonstrated

to the director of environmental protection to operate satisfactorily in this state or other states with similar air quality on substantially similar air pollution sources.

The requirement to employ BAT is applied to each separate operation or activity with the potential to emit more than 10 tons/year of each criteria air contaminant. Generally speaking, demonstration of BACT requires a more thorough investigation and is a more rigorous requirement. Control technologies and practices that meet BACT will also meet BAT.

5.1 Best Available Control Technology Requirements Summary

The BACT requirement is defined as an emission limitation based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act (CAA) emitted from or that results from a major emitting facility that the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable.

5.1.1 “Top-Down” Methodology Summary

The BACT analysis presented in this report is based on a “top-down” approach, consistent with the draft top-down BACT guidance document issued by EPA on March 15, 1990, which is reflected in EPA’s draft *New Source Review Workshop Manual* (1990). In the “top-down” methodology, available control technology options are identified based on knowledge of the source and previous regulatory decisions for other identical or similar sources. These alternatives are then ranked in descending order of control effectiveness (i.e., the “top” option is the most stringent). The feasibility or appropriateness of each alternative as BACT is based on technical feasibility and economic, energy, and environmental impacts. If the top control alternative is technically infeasible or is otherwise rejected as inappropriate after considering site-specific impacts, it is rejected and the next most stringent alternative is then considered. This process continues until a control alternative is determined to be technically feasible and without adverse economic, energy, and environmental impact. This alternative is then selected as BACT.

5.1.2 Identification of Available Control Technologies

To determine which control technologies or techniques were available for consideration for the proposed project, the following resources were consulted:

- *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA/452/B-02-001, January 2002;
- EPA's Office of Air Quality Planning and Standards (OAQPS) MACT developmental data;
- MACT standards for coke oven batteries (40 CFR 63, Subpart CCCCC, NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks; Final Rule);
- MACT standards for coke oven batteries (40 CFR 63, Subpart L, NESHAP for Coke Oven Batteries); and
- EPA's RACT/BACT/LAER Clearinghouse (RBLC).

The RBLC database, made available through EPA's OAQPS Technology Transfer Network, lists technologies that have previously been approved as BACT. As of March 2009, the only BACT determinations in the database for heat recovery coke ovens are for SunCoke's Haverhill facility and U.S. Coking's facility, both located in Ohio.

5.2 PM from Coking and Related Activities

Consistent with the "top-down" methodology discussed above, PM controls were evaluated in the BACT analysis for the coking process and related activities. Related activities include charging, pushing, quenching, and coke crushing and screening. In addition, several fugitive operations such as coal unloading, coal and coke transfer, coke sizing, and coke load-out account for approximately 10% of the particulate emissions.

The types of air pollution control systems used for coal-fired utility boilers could generally be used for heat recovery coke ovens. However, there are differences in the nature of the process and flue gas characteristics that prevent direct comparison of performance. The heat recovery flue gas is unique. It does not contain the light coal flyash of a coal-fired boiler. The particulate loading in heat recovery coke oven flue gases is low due to the inherently excellent

combustion. However, with little alkaline flyash to adsorb HCl, chloride salts form in air pollution control devices. Coal flyash is light and stays suspended, whereas calcium chloride is sticky and easily forms deposits. The air pollution control system for heat recovery coke ovens must be operated to minimize deposition of chloride salts. Also, coke ovens cannot be shut down without causing severe damage to the ovens. This is not the case with utility boilers, which can be routinely shut down if problems develop in the air pollution control system. Because of the uniqueness of this application, BACT determinations in the RBLC database were restricted to those for heat recovery coke ovens. Two BACT determinations were identified and are presented in Table 5-1.

Ohio EPA issued a PTI to the FDS Coke Plant in Oregon, Ohio. This facility has not been constructed. Consequently, the technology and limits for the FDS facility are not demonstrated and do not represent BACT or BAT for the MCC facility. Although this is a heat recovery coke plant to be designed by the German company Uhde (a ThyssenKrupp company), the conceptual design is very different from the heat recovery SunCoke design to be used at MCC. Some of the key differences include:

- The ovens are larger — designed to carbonize 67 tons of coal compared to 50 tons at MCC.
- Charging is to be accomplished by a stamped (compacted) coal cake with a very small air pollution control system [3,000 cubic feet per minute (cfm)].
- Coke is to be pushed as a coke cake with a small air pollution control system (9,500 cfm).

The only heat recovery coke ovens operated in the United States are at SunCoke's facilities. Based on that experience, there are many technical questions about the design assumptions that affect emission limits. One of these is oven size. SunCoke's ovens are designed to carbonize 50 tons of coke in 48 hours. To the best of our knowledge, no heat recovery coke ovens designed to carbonize 67 tons of coal have ever been constructed and controlled by a spray dryer/baghouse. Other differences are emissions from the charging and pushing systems.

Table 5-1

RBLC Database Search Results for BACT PM Control at Nonrecovery Coke Facilities

RBLC ID	Facility Name	Last Updated	Process Name	Control Description	Pollutant	Emission Limit	Efficiency
OH-0297	FDS Coke (heat recovery coke plant)	6/6/2008	Coke oven batteries (2) with 168 ovens, battery stack	Fabric filter	PM/PM ₁₀	0.008 gr/dscf	99%
			Coke oven batteries (2), HRSG bypass (6)	NA	PM/PM ₁₀	No standard limit	NA
			Coke oven batteries (2) with 168 ovens, charging	Fabric filter with traveling hood, oven negative pressure	PM/PM ₁₀	0.008 gr/dscf	99%
			Coke oven batteries (2) with 168 ovens, pushing	Fabric filter with traveling hood, oven negative pressure, flat bed pushing	PM	0.03 lb/ton coal	NA
			Quench tower (2)	Internal baffles	PM/PM ₁₀	No standard limit	NA
OH-0305	Haverhill North Coke Company (heat recovery plant)	6/23/2008	Batteries A&B, Charging	Baghouse with traveling hood	PM ₁₀	0.0081 lb/ton	70%
			Batteries A&B, Pushing	Multiclone dust collector	PM ₁₀	0.04 lb/ton	80%
			Batteries A&B, Coke oven batteries	Baghouse	PM ₁₀	0.008 gr/dscf	99%
			Batteries A&B, HRSG bypass vent	Bypass of controls	PM ₁₀	No standard limit	NA
			Batteries C&D, Charging	Baghouse with traveling hood	PM ₁₀	0.0081 lb/ton	70%
			Batteries C&D, Pushing	Multiclone dust collector	PM ₁₀	0.04 lb/ton	80%
			Batteries C&D, Coke oven batteries	Baghouse	PM ₁₀	0.014 gr/dscf (with condensable PM)	99%
			Batteries C&D, HRSG bypass vent	By pass of controls	PM ₁₀	No standard limit	NA
			Quench tower (2)	Quench tower is the control	PM/PM ₁₀	No standard limit	NA
Coke and breeze handling and processing	Baghouse	PM ₁₀	0.008 gr/dscf	70%			

BACT = Best Available Control Technology

dscf = dry standard cubic foot

HRSG = Heat Recovery Steam Generator

NA = Not Applicable

PM = Particulate Matter

PM₁₀ = Particulate matter less than 10 micrometers in diameter

RBLC = RACT/BACT/LAER Clearinghouse

SunCoke's experience is that these systems require large enough airflow to ensure that air moves into the capture devices. For example, the nominal flowrates for the SunCoke charging and pushing control systems are 45,000 cfm and 50,000 cfm, respectively. Based on this experience, pollution control systems and the estimated emissions from the FDS systems are likely undersized. To the best of our knowledge, the FDS heat recovery coke oven design, charging system, and pushing system have never been constructed or used anywhere in the world. Consequently, the technology and limits for the FDS facility are not "achievable" since they have never been demonstrated and do not represent BACT or BAT for the MCC facility.

5.2.1 Coking

Coal is charged onto the oven floor at the beginning of the cycle. Heat from the hot refractory starts the carbonization cycle. No additional fuel is used. PM emissions from the heat recovery coke oven are partially controlled by combustion in the sole flues and in the common tunnel/afterburner. This occurs whether the gases are emitted from the waste heat stacks (during maintenance) or pass through the HRSGs to downstream air pollution controls.

5.2.1.1 Coking – Main Stack

A baghouse (used in conjunction with a spray dryer to control SO₂) is typically used as the primary PM/PM₁₀ air pollution control device for heat recovery coking. Because the ovens are maintained under negative pressure, the capture efficiency is virtually 100%.

Fabric filtration has been widely applied to coal combustion sources since the early 1970s and consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Collection efficiencies of fabric filters (baghouses) can be as high as 99.9%. Variability in overall control efficiencies associated with baghouses is due to the efficiency of the capture device (e.g., hood) used to route the air stream to the baghouse. Baghouses are technically feasible for the heat recovery coking process and related activities.

Electrostatic precipitation (ESP) technology offers a control efficiency that is comparable to baghouses. ESP is a proven technology for a variety of coal combustion sources. Because of their modular design, ESPs, like baghouses, can be applied to a wide range of system sizes. The operating parameters that influence ESP performance include fly ash mass loading, particle size distribution, fly ash electrical resistivity, and precipitator voltage and current. Data for ESPs applied to coal-fired sources show fractional collection efficiencies greater than 99% for fine (less than 0.1 micrometer) and coarse particles (greater than 10 micrometers). These data show a reduction in collection efficiency for particle diameters between 0.1 and 10 micrometers. Other PM/PM₁₀ air pollution control options (such as wet scrubbers and mechanical collectors) are technically feasible, but they are less efficient than baghouses and ESPs. A fabric filter offers the “top” or most effective control option for PM/PM₁₀ from coking.

As previously discussed, there are times when the main air pollution control system cannot be used. First is during inspection and maintenance of the HRSGs. Second is for inspection and maintenance of the main air pollution control system. These are addressed in the following sections.

5.2.1.2 Coking – HRSG Maintenance

The individual waste heat stacks will be used during annual inspection and maintenance of each HRSG so that these procedures can be performed safely. The maximum time that will be required for maintenance and inspection of each HRSG is 10 days/year. During the scheduled maintenance, 20 ovens will vent waste gases directly into the atmosphere, bypassing the FGD/fabric filter system. These gases will still pass through the common tunnel afterburner system, which will fully combust the gases prior to release into the atmosphere. The remaining 80 ovens will continue to pass through the spray dryer/baghouse.

This section presents three options for controlling PM/PM₁₀ from the individual waste heat stacks during the 10 days of maintenance on each HRSG. Additional equipment would allow the waste gases to be treated in the primary system. These three options are as follows:

- Spray quenches at each HRSG to cool individual waste heat gas
- Larger HRSGs and waste heat tunnel
- Additional HRSGs and larger waste heat tunnel

5.2.1.2.1 Individual Spray Quenches

Waste gases from the ovens typically pass through the HRSGs, which cool the gases enough to be treated in downstream pollution controls. With an HRSG offline, the hot gases (greater than 1,600°F) are typically exhausted from the waste heat stacks. Spray quenches could be installed adjacent to the HRSGs so that during HRSG maintenance, the hot gases could be routed through the spray quenches instead of the HRSGs where they could be cooled using water. In this option, water would be sprayed into the flue gas stream to cool the gas that usually goes through the HRSG to an operating point of approximately 400°F via evaporative cooling. The cooled gas would then be routed to the existing collection duct and combined with the flue gases from the four operating HRSGs for treatment in the primary emission control system. The spray quench chamber would consist of a refractory lined entrance section; a cocurrent, down flow tower; spray nozzles; control system; side discharge; and dry bottom. Water would be supplied to the spray quench for cooling at a variable rate to allow for cooling during the course of the facility operating cycle. This would require a system equipped with multiple banks of nozzles to supply the required turndown. Ash that collects in the spray quench would be discharged through a rotary valve located at the bottom of the quench chamber and collected in a bin for disposal with baghouse ash.

This option will require the following equipment for each group of 20 ovens, in addition to the controls for the primary system:

- A “Tee” in each crossover duct;
- A hot duct to each spray quench with provision for isolating knife gate;
- Spray quench chambers for each HRSG with multiple banks of atomizing nozzles, temperature control, rotary valve, and ash collection bin;
- Steel ductwork from each quench to collection duct;
- Flow control damper for each quench with control based on differential pressure across the quench;

- Isolation knife gate valve in steel duct exiting each spray quench;
- Increased collection duct size to accommodate additional flow from water vapor; and
- Increased spray dryer and baghouse size to accommodate additional flow.

The emissions from this option would be the same as the primary system. Bypassing the HRSGs using individual spray quenches to cool the waste heat gas and route it to the primary system is a technically feasible option for controlling PM/PM₁₀ emissions during HRSG maintenance.

5.2.1.2.2 Larger HRSGs and Waste Heat Tunnel

Five HRSGs handle the waste gases from 100 ovens (20 ovens/HRSG). This option would allow one of the HRSGs to be shut down for maintenance by routing waste gases to the remaining four HRSGs. The waste gases from the 40 ovens in two batteries go to 2 HRSGs. The waste gases from the 20 ovens in one the other battery go to 1 HRSG. To accommodate the shutdown of 1 HRSG, the other HRSGs for battery would need to be 100% larger to handle 40 ovens. This would not be an option for the battery with one HRSG.

The design basis of the waste heat tunnel (6 ft 2 in. to 7 ft 6 in. diameter) is to convey gases from 10 ovens on either side of a “Tee” in the waste heat tunnel. Consider the 40 oven batteries — the gases go to 2 HRSGs. The largest waste heat tunnel that could fit within the current design (8 ft 6 in. diameter) could convey gases from up to 16 ovens without producing excess draft. However, with 1 HRSG offline, the tunnel would have to be able to convey gases from 30 ovens. Since pressure drop in a duct is a function of velocity squared, the area of the waste heat tunnel would have to be 2.5 times larger, or approximately 12 ft in diameter. By reviewing Figure 2-1, it is obvious that to accommodate such a large waste heat tunnel would involve redesigning the uptakes, oven walls, and sole flues.

The key advantages of the heat recovery design are negative pressure and complete combustion. The waste heat tunnel is a key component of the heat recovery design. Testing of the current heat recovery design by EPA led to its designation as MACT, primarily based on low emissions of HAPs, but also taking into account low emissions of CO, volatile organic

compounds (VOCs), and NO_x. Changing the sole flues, walls, and uptakes to accommodate a large round tunnel represents a radical change to the heat recovery oven design.

The waste heat tunnel serves as the final combustion chamber for the offgas generated during the process, and this proven design provides good mixing and combustion. The radical changes required with this option are technically infeasible since they represent major changes to the coke oven design, with an unknown effect not only on the process but also on emissions of VOCs, NO_x, CO, and HAPs.

5.2.1.2.3 Additional HRSGs and Larger Waste Heat Tunnel

This option incorporates the largest tunnel that the ovens could accommodate with HRSGs to accommodate displaced gas when any one HRSG is taken offline. This option assumes that the HRSGs are the same size as those in the current design. The additional HRSGs would be equipped with ducting, dampers, and controls identical to the HRSGs planned for the current design. The limitations on tunnel size previously discussed require that the number of HRSGs be increased from five to eight, to allow any individual HRSG to be shut down without opening the waste heat stack.

This option will require the following equipment:

- Larger waste heat tunnel;
- Three additional common tunnel “Tees,” waste heat stacks, stack lids, and peripherals;
- Three additional HRSGs;
- Additional hot duct, isolation knife gates, and expansion joints; and
- Additional steel ductwork and flow control dampers.

The option for adding HRSGs allows the use of the same primary air pollution control system and is considered technically feasible.

5.2.1.3 Coking – FGD Maintenance

The FGD system will be bypassed as part of routine, preventive maintenance program to promote optimum performance and maximum effective service life of all components. Since the ovens cannot be shutdown, the only option for completely controlling emissions during FGD maintenance would be to install a redundant FGD system. A redundant system would require:

- Spray dryer/baghouse with instrumentation and
- Steel ductwork with dampers.

The option for installing a redundant FGD system is technically feasible.

5.2.1.4 Selection of BACT for PM/PM₁₀ – Coking Process

This section presents those technologies that were identified as technically feasible for controlling PM and PM₁₀ emissions from coking. There are three operating modes – typical operation, which represents 310 days/year; HRSG maintenance, which represents 50 days/year; and spray dryer/baghouse maintenance, which represents 5 days/year.

5.2.1.4.1 Top-Down Evaluation of Technically Feasible Controls – PM/PM₁₀, Primary System

This section presents the top-down evaluation of controls from the primary system. The options for treatment of planned emissions during maintenance include the combination of these emissions with those treated in the primary system or the treatment of these emissions via redundant control technologies. For this reason, the evaluation of controls for the treatment of planned emissions from maintenance activities is presented separately in Section 5.2.1.4.2 using the results of the selected control as presented in this section.

Following the “top-down” BACT approach, the highest ranked control technology or combined technology option that is technically feasible is evaluated further for BACT. If this option is economically feasible and does not have unacceptable energy and/or adverse environmental impacts, the option is deemed BACT. Otherwise, the next ranked control option is

evaluated. This evaluation process continues until a control option is found that meets all the BACT requirements. Once an option is determined as BACT, it is unnecessary to evaluate any remaining options.

Generic control efficiencies for typical PM devices are listed in Table 5-2. This hierarchy also applies to PM₁₀ and PM_{2.5}. Therefore, the top PM control systems for the MCC coking process are fabric filters and electrostatic precipitators. Consideration should also be given to the fact that the complete control system must also control SO₂ emissions from the process. Control options that are available and present similar levels of control for SO₂ include dry scrubbing and wet scrubbing. The dry scrubber is the preferred option, due to its manageable waste stream. The calcium sulfite (CaSO₃), calcium sulfate (CaSO₄), and unreacted lime solid wastes can be disposed of in a nonhazardous solid waste landfill or used for acid mine water neutralization. The wet scrubber, however, generates both solid waste and a liquid waste stream containing soluble sulfur-containing salts. This liquid waste stream would require treatment either on-site or at the publicly-owned treatment works. Thus, not only is an additional waste stream generated, but additional energy requirements and costs (e.g., piping and treatment costs) result from the need to treat this additional waste stream.

Table 5-2
Typical PM Control Efficiencies for Air Pollution Control Devices

Device	Efficiency
Mechanical collector (e.g., multicyclone)	70%
Low energy wet scrubber	60%
High energy wet scrubber	97%
Electrostatic precipitator	99+%
Fabric filter (baghouse)	99+%

Reference: Information on particulate control devices in *Air Pollution Engineering Manual*, Second Ed., Wayne T. Davis Editor, Air and Waste Management Association, John Wiley & Sons, Inc. 2000.

Dry scrubbing, with the final filtering being either baghouse or ESP, provides better PM controls than wet scrubbing. For PM/PM₁₀ controls, as noted in Section 5.2.1.1, data for ESPs applied to coal-fired sources show fractional collection efficiencies greater than 99% for fine (less than 0.1 micrometer) and coarse particles (greater than 10 micrometers). These data show a reduction in collection efficiency for particle diameters between 0.1 and 10 micrometers.

Although ESPs, wet scrubbers, and mechanical collectors are technically feasible, fabric filters offer the “top” or most effective control option and will be the technology considered as BACT.

5.2.1.4.2 Top-Down Evaluation of Technically Feasible Controls – PM/PM₁₀, HRSG and FGD Maintenance

This section presents the top-down evaluation of PM/PM₁₀ controls during the 10 potential days of annual maintenance on each HRSG and from the main stack during the 5 days of maintenance on the FGD system. The options incorporate additional equipment to allow the waste gases to be treated during these periods.

Following the “top-down” BACT approach, the highest ranked control technology or combined technology option that is technically feasible is evaluated further for BACT. If this option is economically feasible and does not have unacceptable energy and/or adverse environmental impacts, the option is deemed BACT. Otherwise, the next ranked control option is evaluated. This evaluation process continues until a control option is found that meets all the BACT requirements. Once an option is determined as BACT, it is unnecessary to evaluate any remaining options.

The assumptions used in determining economic, energy, and environmental impacts for the technically feasible control options in this BACT analysis for MCC are consistent with the methodology used in EPA’s *New Source Review Workshop Manual* (1990), *Estimating Costs of Air Pollution Control* (Vatavuk 1990), and *EPA Air Pollution Control Cost Manual* (2002).

In the case of PM/PM₁₀ controls for HRSG and FGD maintenance, the “top” control options present similar removal efficiencies. Table 5-3 presents those technologies that were identified as technically feasible for controlling emissions during maintenance. This table also summarizes the expected emission levels associated with these controls. The costs and estimating methodology contained in the *EPA Air Pollution Control Cost Manual* are directed toward the “study” estimate of ±30% accuracy, as opposed to an “order-of-magnitude” estimate (less accurate), a “budget authorization” estimate (more accurate), a “definitive” estimate (very accurate), or a “firm” or “contractor’s” estimate (most accurate). EPA’s Manual states,

Study-level estimates are acceptable for regulatory development because they represent a compromise between the less accurate order-of-magnitude and the more accurate estimate types. The former is too imprecise to be of much value, while the latter are not only very expensive to make, but require detailed site and process-specific knowledge that most Manual users will not have. (p. 2-4)

Table 5-3

Technically Feasible Controls for PM/PM₁₀ Reductions During Maintenance

Control Technology	Control Level for BACT Analysis	Expected Emission Level (tons/year)
Options for HRSG maintenance		
Individual spray quenches	0.005 gr/dscf	1.3
Addition of HRSGs and larger waste heat tunnel	0.005 gr/dscf	1.3
Uncontrolled baseline	0.049 gr/dscf	12.6
Option for FGD maintenance		
Redundant FGD system	0.005 gr/dscf	0.6
Uncontrolled baseline	0.049 gr/dscf	6.3

BACT = Best Available Control Technology

FGD = Flue Gas Desulfurization

HRSG = Heat Recovery Steam Generator

PM = Particulate Matter

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

This cost estimate is a factored cost estimating method. Equipment costs were obtained from vendor quotes. Installation, indirect, and operating costs were derived through factors that were applied against the estimated capital cost of equipment. The cost factors that were used for evaluating PM/PM₁₀ control options are provided in Appendix D, along with the calculations used to evaluate the options. These cost factors were taken from the EPA *Air Pollution Control Cost Manual* (2002) and *Estimating Costs of Air Pollution Control* (Vatavuk 1990).

5.2.1.4.3 Economic Impacts

The costs for this analysis were calculated in annualized dollars per year, and the emission rates were calculated in tons per year. The result is a cost-effectiveness number in dollars per ton of pollutant removed. In establishing the baseline emissions that are used to calculate the amount of pollutants removed, emissions from the lower polluting process were used. EPA's *New Source Review Workshop Manual* (1990) states,

When calculating the cost effectiveness of adding post process emission controls to certain inherently lower polluting processes, baseline emissions may be assumed to be the emissions from the lower polluting process itself. In other words, emission reduction credit can be taken for use of inherently lower polluting processes. (p. B.37)

The baseline emissions for HRSG maintenance were established at 12.6 tons/year PM/PM₁₀, which is equivalent to the emissions from all five individual waste heat stacks over five 10-day periods of operation. The baseline emissions for FGD maintenance were established at 6.3 tons/year PM/PM₁₀, which is equivalent to the maximum potential uncontrolled emissions for five days. These are the total potential PM/PM₁₀ emissions that could occur during maintenance and inspection of the HRSGs and the FGD system.

Table 5-4 summarizes the economic impacts. Appendix D provides details on the calculation of values presented. All the options would be very expensive. The lowest cost option for controlling emissions during HRSG maintenance was the system that used a spray quench to cool the flue gas, bypassing an HRSG for treatment in the primary FGD system. The capital cost of this additional control was \$17,936,000 and the cost-effectiveness was \$259,000 per additional ton of PM/PM₁₀ removed.

The option for controlling emissions during FGD maintenance was a redundant FGD system. This option would be even more expensive. The capital cost of this additional control was \$43,416,000 and the cost-effectiveness was \$1,185,000 per additional ton of PM/PM₁₀ removed.

5.2.1.4.4 Environmental Impacts

An examination of the possible environmental impacts for the identified technically feasible control technologies shows the options do not present any significant environmental impact.

Table 5-4

Summary of Top-Down BACT Impact Analysis Results for PM/PM₁₀ for Maintenance Emissions

Control Alternative	Emissions		Economic Impacts			Environmental Impacts		Energy Impacts
	Emission Rate (tons/year)	Emission Reduction (tons/year)	Installed Capital Cost	Total Annualized Cost	Cost-Effectiveness (\$/ton)	Toxics Impact (yes/no)	Adverse Environmental Impacts (yes/no)	Incremental Increase Over Baseline (MW-hour/year)
Options for HRSG maintenance								
Individual spray quenches	1.29	11.31	\$17,936,000	\$2,934,000	\$259,000	No	No	217
Addition of HRSGs and larger waste heat tunnel	1.29	11.31	\$35,521,000	\$6,013,000	\$531,000	No	No	None
Uncontrolled baseline	12.60							
Option for FGD maintenance								
Redundant FGD system	0.64	5.66	\$43,416,000	\$6,705,000	\$1,185,000	No	No	421
Uncontrolled baseline	6.30							

BACT = Best Available Control Technology

FGD = Flue Gas Desulfurization

HRSG = Heat Recovery Steam Generator

PM = Particulate Matter

PM₁₀ = Particulate matter less than 10 micrometers in diameter

5.2.1.4.5 Energy Impacts

Application of the spray quench option or the redundant FGD system would require an increase in plant energy usage. This is either in the form of electricity associated with pumping, atomization air production, or increased fan power associated with increased flow. The energy impact of the option for the addition of HRSGs has no increased energy usage.

5.2.1.5 PM/PM₁₀ Top-Down BACT Summary – Coking

A baghouse, the top option, was selected as BACT for the primary system for control of PM/PM₁₀. The level of control is more stringent than recent BACT determinations listed in the RBLC database.

With a cost-effectiveness of \$259,000 to \$1,185,000 per ton of additional PM/PM₁₀ removed, all options for controlling emissions during HRSG or FGD maintenance are cost prohibitive. These options also have additional energy impacts. Therefore, all add-on equipment options to control emissions during HRSG and FGD maintenance were rejected. BACTs for controlling PM/PM₁₀ emissions during maintenance are:

- Minimizing emissions from waste heat stacks during HRSG inspection and maintenance by bringing only one HRSG offline at a time so that 80% of the waste gases will go through the primary system;
- Limiting HRSG maintenance to no more than 2.7% of the operating hours (10 days/year per HRSG);
- Limiting spray dryer/baghouse inspection and maintenance to no more than 1.4% of the operating hours (5 days/year) by using appropriate personnel and scheduling the work to be performed in the shortest possible time; and
- Overall, treating 96% of the waste gases generated by the ovens in the FGD system.

The ambient effects of these BACT selections are acceptable as demonstrated by the air quality impacts analysis.

5.2.2 Charging

Oven charging takes approximately 4 minutes. Air flows into the oven through the open door during charging, and virtually all the charging emissions are captured and sent to the sole flues and common tunnel during the first 3 minutes. During the last minute, as the ram retracts, some of the charging emissions escape the oven. A traveling hood and baghouse control these emissions. As previously discussed, a baghouse is generally recognized as a “top” control device for PM/PM₁₀. These controls are consistent with the MACT standards for charging nonrecovery coke oven batteries in 40 CFR 63, Subpart L, National Emission Standards for Coke Oven Batteries. As previously discussed, a baghouse is generally recognized as a “top” control device for PM/PM₁₀.

5.2.3 Coke Crushing and Screening

For the coke crushing and screening operations, a baghouse is used as the control device. These operations are performed within an enclosed building. As previously discussed, a baghouse is generally recognized as a “top” control device for PM/PM₁₀.

5.2.4 Pushing

Flat car pushing will be used to remove the coke from the oven at the end of the cycle. Flat car pushing is much different than conventional pushing. With conventional pushing, the coke bed falls into a hot car where it breaks apart and produces the traditional large hot pushing plume. The plume may be collected by either a mobile shed or by a large stationary coke side shed. With flat car pushing, the coke bed is pushed onto a flat car with a hood that encloses the bed on the sides and top. Air from this hood is ducted to an air pollution control device, fan, and stack on a mobile car. The hood and air pollution control device will travel from the oven to the quench tower. The coke bed will be transferred, intact, to a quench car and quenched in a conventional wet quench tower. The advantage of flat car pushing is that the coke bed stays intact and there is no large thermal plume.

Worker safety is also improved in several ways with the flat car push. With flat car pushing, visibility is improved since operators are not working inside a dark shed. With a zero fall height, operators do not have to work on an elevated bench. Without the large thermal plume, operators are less exposed to emissions and heat.

The air pollution control device used with flat car pushing must be chosen with two considerations. First, a close-capture hood will be used. The coke bed is approximately 2,000°F, and at times the gases exiting the hood will be extremely hot. Second, the mobile system must be short enough to pass below the hot ducts that take the gases from the common tunnel to the HRSGs (approximately 20 ft) and narrow enough to fit on a rail car.

The air pollution control device must also meet the PM emission limit in the MACT for Pushing, Quenching, and Battery Stacks (40 CFR 63, Subpart CCCCC). The limit is 0.04 lb PM/ton coke for filterable PM if a mobile control device that captures emissions during travel to the quench tower is used.

5.2.4.1 Belt-Sealed Ducts

Moveable hoods that use a belt-sealed duct to convey pushing emissions to a stationary pollution control device are commonly used at byproduct facilities. However, a belt-sealed duct system is not feasible for a heat recovery facility because (1) the moveable hood height must be shorter than the hot ducts, (2) a heat recovery battery is much longer than a byproduct battery (at least twice as long), and (3) high-temperature excursions associated with a close-capture hood would ultimately destroy the belt. Belt-sealed ducts are not feasible for heat recovery batteries that use flat car pushing.

5.2.4.2 Fabric Filters

A fabric filter, or baghouse, removes dust by passing the gas stream through a porous fabric. Many natural and synthetic fabrics are used. Most baghouses used to control pushing emissions use polyester bags. Polyester bags have a temperature limit of approximately 275°F. The fabrics most often used for high-temperature applications are Teflon, Nomex, carbon fibers,

and fiberglass. Fiberglass can be used at temperatures up to 500°F. Ceramic and metal filters have been used in a few high-temperature specialty applications, but with the large surface area needed for this type of application, they are not practical. A baghouse system could be designed to cool the gases to 500°F. However, even a short temperature excursion would destroy the bags. The high temperature and the potential for high-temperature excursions are technical hurdles for using a baghouse in this application. Another consideration is that, since the hot car and its air pollution control device will travel to the quench tower, it will periodically catch water droplets and steam, which typically cause bag blinding.

Baghouses are typically large air pollution control devices because, in order to work effectively, the velocity at the fabric face must be orders of magnitude slower than in the ductwork conveying the gases to the baghouse. Another obstacle is designing a baghouse system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. With the gas temperature, moisture, and size constraints, a baghouse is not a technically feasible choice for this application.

5.2.4.3 Electrostatic Precipitators

An ESP charges particles in a gas stream so that they are attracted to, and collected by, neutral or oppositely charged collector plates. A major factor in the performance of an ESP is resistivity of the particles – it must be within a certain range. With high resistivity, it is difficult to charge the particles. With low resistivity, the particles are not held tightly to the collector plates and reentrainment can be severe. Resistivity is strongly affected by temperature, moisture, gas composition, particle composition, and surface characteristics. The resistivity of pushing emissions from heat recovery coking is not known.

High temperatures are not as much of an obstacle with ESPs as with baghouses since ESPs are usually constructed out of metal. As with baghouses, ESPs are typically large because the gas stream velocity traveling through the ESP must be low enough to avoid reentrainment. Another difficulty is designing a system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. An ESP is not a technically feasible choice for this application.

5.2.4.4 Wet Scrubbers

Wet scrubbers collect particles by contacting or scrubbing gases with a liquid, usually aqueous. The primary removal mechanisms are inertial impaction and Brownian diffusion. To be effective on small particles, wet scrubbers must produce a high pressure drop. For a heat recovery system, this would require a large motor (at least 700 hp). The design of a heat recovery battery prevents mounting and supplying power to such a large motor on the hot car track. Stationary systems have generally replaced mobile scrubber cars at byproduct facilities because of the size and complexity of the wet systems.

Another obstacle with wet scrubber systems is handling and disposal of the collected wet sludge. One advantage of the heat recovery technology over the byproduct technology is that there is no wastewater to discharge. Use of a wet scrubber would not only require a wastewater treatment system but would add something new to the technology – the need for a wastewater discharge. Other concerns include the effect on materials and worker safety from the low level release of a hot saturated plume. Therefore, a wet scrubber is not a technically feasible option for a heat recovery facility.

5.2.4.5 Mechanical Collectors

Mechanical collectors use inertial separation to remove particles from gas streams. Large cyclones are generally not very efficient on small particles because the inertial force is inversely proportional to the diameter (or turning radius) of the device. Cyclones are optimized for high collection efficiency by using small diameters, long cylinders, and high inlet velocities. A number of small cyclones may be operated in parallel for high efficiency and large gas volumes. These are referred to as multi-tube cyclones, or multicyclones. High temperatures are not as much of an obstacle with mechanical collectors since they are typically constructed out of metal. Multicyclones can tolerate moist gas streams. Since the individual cyclones are small, a multicyclone can be configured to meet the size criteria of the heat recovery battery. A multicyclone is a feasible option for flat car pushing.

5.2.4.6 BACT Selection for Pushing

A multicyclone is the only air pollution control device that is technically feasible considering the hot gases from the close-capture hood, ability to handle moisture, and size constraints of the heat recovery coke oven design. Flat car pushing with a multicyclone is appropriate from an environmental perspective since it will result in a 98% reduction in uncontrolled PM/PM₁₀ emissions from conventional pushing using pollution prevention and a multicyclone. Flat car pushing will meet the emission limit of 0.04 lb PM/ton coke for filterable PM in the MACT standard.

The MACT standards also require the work practice of physically looking into each oven prior to pushing. This is possible because of the negative pressure design. If the coke bed has stopped gassing and no smoke is observed, the oven is deemed coked out and can be pushed.

5.2.5 Quenching

Conventional wet quenching is the most common quenching technique used in the coke industry and is accomplished by directly cooling a hot car of coke with a deluge of water. In other countries (e.g., Japan and Russia), some facilities use a dry quenching process.

5.2.5.1 Dry Quenching

In the dry quenching process, 2,000°F coke is lifted and dumped into the top of stationary vessels. Coke descends to the bottom over several hours before discharging at 200–300°F. The coke is cooled by recirculated nitrogen gas traveling from the bottom to the top of the vessel. The heated nitrogen gas then enters an HRSG, followed by a “dedusting” system and fan before reuse in the dry quench vessel. The dry quench process provides the opportunity to recover heat from the hot coke in the form of steam. Although no water is consumed in the process, nitrogen losses must be replaced.

The dedusting system may be controlled with a baghouse. Fugitive emissions are much higher with dry quenching because the material handled is dry.

The capital and operating costs of dry quenching systems are substantial.

5.2.5.2 Wet Quenching

In the wet quenching process, water is used to cool the 2,000°F coke. The intact coke bed from the flat push is moved directly into the quench tower where water is dumped onto it. A portion of the water evaporates and travels upward through a tower before exhausting to the atmosphere. The majority of the water used for quenching drains from the hot car into a settling basin where solids settle out and are periodically dredged from the basin. Water from the settling basin is recirculated to the quench tank and used in subsequent quenches. Make-up water must be added to the basin to replace evaporative losses. In addition, dissolved solids from the quench water may become entrained in the steam plume rising from the tower. The typical control is to install baffles in the quench tower to reduce these emissions. SunCoke uses an improved baffle design – bent steel plates approximately 2 in. apart that impart tighter “turns” to the gas stream compared to conventional rows of wood baffles. This will reduce PM compared to conventional baffles. Another “control” is to use clean water instead of “dirty” water (i.e., water high in solids or other pollutants) to quench the coke.

These controls are consistent with the MACT standards for quenching in 40 CFR 63, Subpart CCCC, NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks; Final Rule.

5.2.5.3 BACT Selection for Quenching

One advantage of the SunCoke technology is use of flat push to remove coke from the oven. The coke is not tumbled into a hot car prior to quenching. From a product standpoint, the heat recovery technology with flat push produces coke that has significant advantages of stability and blast furnace efficiency. It is not known what the effect would be of dumping the flat bed into the buckets used to transport the coke to the dry quench vessel. Therefore, the technical feasibility of dry quenching with the heat recovery coking and flat push technology is not known.

The dedusting vent in a dry quench may be controlled with a baghouse. However, the overall environmental impacts are not clear since fugitive emissions are likely to be much higher with dry quenching due to handling dry materials and the multiple transfer operations required to place the coke into the dry quench vessel.

SunCoke obtained cost estimates for a dry quench system that could quench 170 tons coke per hour. The capital cost of the systems range from \$47,000,000 to 65,000,000 with operating costs of \$2,700,000/year. These costs compare to a capital cost of a wet system of \$2,000,000 with an operating cost of \$125,000/year. The cost differences are potentially higher since the proposed schedule at MCC is 270 tons coke per hour.

Although dry quenching systems may be operated safely, wet quenching is inherently safer because there is no possibility for a gas explosion (due to incompletely carbonized coke) or worker exposure due to ground level releases of CO.

Although dry quench systems can be operated reliably, they are typically built with wet quench backup systems. Wet quench systems are more reliable and require no backup system.

The quenching process used at all facilities in the United States, a wet system with baffled tower and water with controlled TDS, was selected as BACT. The dry quench system was rejected because all aspects of the technical feasibility are not known, the environmental advantage is questionable, and the cost is much higher.

5.2.6 Selection of BACT for PM/PM₁₀

Following the “top-down” BACT approach, the highest ranked control technology or combined technology option that is technically feasible is evaluated further for BACT. If this option is economically feasible and does not have unacceptable energy and/or adverse environmental impacts, the option is deemed BACT. Otherwise, the next ranked control option is evaluated. This evaluation process continues until a control option is found that meets all the BACT requirements. Once an option is determined as BACT, it is unnecessary to evaluate any remaining options.

In the case of PM controls for the MCC coking process, the “top” technically feasible options previously discussed are economically feasible and are recommended as BACT. To summarize, these technologies are listed in Table 5-5. Note that the BACT information is based on “filterable” PM.

No substantial energy or environmental impacts result from the application of these control technologies.

**Table 5-5
Summary of Recommended BACT for PM/PM₁₀ Control**

Control Technology	Proposed PM Limit	Proposed PM₁₀ Limit
Fabric Filter on Waste Gas Stream (Coking Process)	0.005 gr/dscf	0.005 gr/dscf
Optimize Combustion (Coking Process during HRSG Maintenance)	0.049 gr/dscf	0.049 gr/dscf
Flat Car with Multicyclone for Pushing	0.04 lb/ton coke	0.04 lb/ton coke
Oven Negative Pressure + Fabric Filter with Traveling Hood for Charging	0.0081 lb/ton dry coal	0.0081 lb/ton dry coal
Fabric Filter for Coke Crushing/Screening	0.008 gr/dscf	0.008 gr/dscf
Baffles and Water With Controlled TDS for Quenching	0.12 lb/ton coal	0.044 lb/ton coal

BACT = Best Available Control Technology
dscf = dry standard cubic foot
HRSG = Heat Recovery Steam Generator
PM = Particulate Matter
PM₁₀ = Particulate matter less than 10 micrometers in diameter

5.2.7 BACT Selection for Fugitive Particulate Matter

Fugitive PM emissions will be produced from coal unloading, coal processing and storage, coke handling and storage, and coke load-out. These emissions represent approximately 10% of the total PM/PM₁₀. MCC evaluated measures to control PM from the coal piles in the RBLC database for coal-fired boilers and coke plants and for all coal piles in the Ohio EPA BAT database. The measures proposed for MCC, a berm for wind reduction and wet suppression to control moisture, were as stringent as any found in those databases as of March 2009. PM emissions will be controlled as shown in Table 5-6. These control technologies are considered BACT and BAT.

Table 5-6
BACT and BAT for Fugitive PM

Emission Unit	Control Technology
Coal unloading	Enclosure, wet suppression
Coal piles	Berm around piles, radial stacker, wet suppression
Blended coal storage	Enclosed silo
Coal conveyors	Enclosed (except where prohibited for safety), wet material
Coal crushing	Enclosure of rotary crusher, wet material
Coke conveyors	Enclosed (except where prohibited for safety), wet material
Coke crushing/screening	Enclosure, fabric filter
Coke pile	Stacker conveyor load-in, load-out with front-end loader, wet material
Roadways	Paving, watering as needed

BACT = Best Available Control Technology

BAT = Best Available Technology

PM = Particulate Matter

5.3 Carbon Monoxide for Coking and Related Activities

Consistent with the “top-down” methodology, CO controls were evaluated in the BACT analysis for the coking process and related activities. Related activities include charging and pushing.

Two BACT determinations were identified for heat recovery coke ovens in the RBLC database and are presented in Table 5-7.

CO is produced as a product of incomplete combustion. Although a BACT analysis of VOCs is not required, this discussion applies to VOCs due to the similarity in approach for control of these emissions during the coking process and related activities. CO and VOC emissions are potentially generated during the conversion of coal to coke and during pushing activities. The concentrations of CO and VOCs are less than 5 parts per million (ppm) in the charging emissions. No additional controls are technically feasible for charging.

5.3.1 Coking Emissions

In a byproduct coke oven, the volatile fraction of coal is recovered instead of burned. In the heat recovery process, volatile matter is released from the coal bed and combusted within the

Table 5-7

RBLC Database Search Results for BACT CO Limits at Nonrecovery Coke Facilities

RBLC ID	Facility Name	Last Updated	Process Name	Control Description	Emission Limit	Efficiency
OH-0297	FDS Coke	6/6/2008	Coke oven batteries (2) with 168 ovens, battery stack	Combustion optimization	20 ppm	NA
			Coke oven batteries (2), HRSG bypass (6)	NA	No standard limit	NA
			Coke oven batteries (2) with 168 ovens, charging	NA	No standard limit	NA
			Coke oven batteries (2) with 168 ovens, pushing	Work practices	No standard limit	NA
OH-0305	Haverhill North Coke Company	6/23/2008	Batteries A&B, charging	Combustion optimization	0.0028 lb/ton	NA
			Batteries A&B, pushing	Combustion optimization	0.077 lb/ton	NA
			Batteries A&B, coke oven batteries	Combustion optimization	20 ppm	NA
			Batteries A&B, HRSG bypass vent	Bypass of controls	No standard limit	NA
			Batteries C&D, charging	Combustion optimization	0.0028 lb/ton	NA
			Batteries C&D, pushing	Combustion optimization	0.077 lb/ton	NA
			Batteries C&D, coke oven batteries	Combustion optimization	20 ppm	NA
			Batteries C&D, HRSG bypass vent	Bypass of controls	No standard limit	NA

BACT = Best Available Control Technology

CO = Carbon Monoxide

HRSG = Heat Recovery Steam Generator

NA = Not Applicable

ppm = parts per million

RBLC = RACT/BACT/LAER Clearinghouse

coke oven. Heat that is generated drives the coking process. The design of the heat recovery process is to have complete combustion and thereby release all the available heat. This approach naturally produces low emissions of CO and VOCs. The gases remain in the sole flues and common tunnel approximately 7 seconds where they are exposed to oxidizing conditions and temperatures from 1,600 to 2,500°F. HRSG maintenance and FGD maintenance have no effect on CO and VOC emissions. The emissions are the same whether exhausted from the main stack or the vent stacks.

These operations will also meet MACT for HAPs. Specific requirements for heat recovery batteries are 0% leaks for doors and daily monitoring of negative pressure in each oven or in a common battery tunnel. As previously discussed, the heat recovery ovens proposed for MCC will be operated under negative pressure. This will meet the requirements of the MACT rule and is also the method to ensure the 0% door leakage standard is met. HRSG maintenance has no effect on oven pressure. The ovens will operate under negative pressure in either case.

The destruction of VOCs and CO is expected to be in the 98–99% range for the coke ovens. This destruction is inherent to the coking process, which aims to liberate all heat within the oven.

5.3.2 Pushing Emissions

An advantage of the heat recovery coking process is that “green” pushes can virtually be eliminated. Green pushes result when coke is pushed that has not been fully carbonized. The uncarbonized material ignites when the oven is pushed. Standard work practice for heat recovery ovens is for the operator to look in the oven to determine whether carbonization is complete prior to pushing the oven. When carbonization is complete, the operator can clearly see the door on the opposite side of the oven. This is only possible with a negative pressure design. This same mechanism also ensures minimal CO emissions.

These controls are consistent with the MACT standards for pushing in 40 CFR 63, Subpart CCCC, NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks; Final Rule.

5.3.3 Selection of BACT and BAT for CO

Following the “top-down” BACT approach, the highest ranked control technology or combined technology option that is technically feasible is evaluated further for BACT. If this option is economically feasible and does not have unacceptable energy and/or adverse environmental impacts, the option is deemed BACT. Otherwise, the next ranked control option is evaluated. This evaluation process continues until a control option is found that meets all the BACT requirements. Once an option is determined as BACT, it is unnecessary to evaluate any remaining options.

In the case of CO and VOC controls for MCC coking process, the “top” technically feasible options are combustion optimization for waste gases and work practices for pushing. These control technologies are precombustion controls to prevent CO and VOC formation. The economic impacts of these control alternatives are negligible since combustion optimization and the work practice for observing the oven are inherent to the heat recovery process. No substantial energy or environmental impacts result from the application of these control technologies.

5.4 H₂SO₄ for Coking and Related Activities

H₂SO₄ is formed as a small fraction (approximately 5%) of the sulfur oxides produced when sulfur in the coal is oxidized. The RBLC Database did not contain any previous determinations for H₂SO₄ from nonrecovery coke plants. The control technology and practices that satisfy LAER for SO₂ (Section 8.0), a lime spray dryer followed by a baghouse, will remove greater than 95% of the H₂SO₄ and are selected as BACT and BAT. The economic impacts of this control alternative are acceptable. No substantial energy or environmental impacts result from the application of this control technology.

5.5 Summary of Proposed BACT and BAT

BACT for the waste gases from coking is use of combustion optimization, a baghouse on the main stack, and work practices with a limitation on hours during HRSG and FGD maintenance. BACT for oven charging is a traveling hood with a baghouse. BACT for pushing is

flat car pushing with a multicyclone. BACT for quenching is a tower with improved baffles and use of water with controlled TDS. BACT for H₂SO₄ is use of a spray dryer/baghouse to control SO₂. The controls and emission levels are summarized by pollutant in Table 5-8.

**Table 5-8
Summary of BACT/BAT Selection**

Pollutant	Emission Unit	BACT Determination	Emission Level
PM/PM ₁₀	Coking – main stack	Spray dryer and baghouse	0.005 gr/dscf
	Coking – HRSG maintenance	Work practices	0.049 gr/dscf
		Limit HRSG maintenance to one HRSG at a time	
		Limit annual HRSG maintenance to <2.7% of operating hours (10 days/HRSG)	
	Coking – FGD maintenance	Work practices	0.04 lb/ton coke
		Limit annual FGD maintenance to <1.4% of operating hours (5 days/year)	
	Pushing	Flat push with multicyclone	0.0081 lb/dry ton coal
	Charging	Traveling hood with baghouse	0.008 gr/dscf
Coke crushing/screening	Enclosure and baghouse	PM: 0.12 lb/ton coal PM ₁₀ : 0.044 lb/ton coal	
Quenching	Improved baffles and water with controlled TDS		
CO	Coking – main stack	Combustion optimization	20 ppm
	Coking – HRSG and FGD maintenance	Combustion optimization	20 ppm
	Pushing	Work practices	0.063 lb/ton coal
H ₂ SO ₄	Coking – main stack	Spray dryer and baghouse	NA
	Coking – HRSG and FGD maintenance	Work practices	NA

BACT = Best Available Control Technology
 BAT = Best Available Technology
 CO = Carbon Monoxide
 dscf = dry standard cubic foot
 FGD = Flue Gas Desulfurization
 H₂SO₄ = Sulfuric Acid Mist
 HRSG = Heat Recovery Steam Generator
 PM = Particulate Matter
 PM₁₀ = Particulate matter less than 10 micrometers in diameter
 ppm = parts per million

6.0 AMBIENT AIR IMPACTS

6.1 Summary

As part of the planned construction, MCC will install and operate equipment that releases regulated air pollutants to the atmosphere. Most of these emissions will exceed thresholds that require review under Prevention of Significant Deterioration (PSD) permitting regulations as administered by the Ohio EPA. These regulations can include assessment of air quality impacts to the local and regional area, as well as an examination of additional impacts from the project.

Further, HCl emissions will exceed the 1 ton/year Ohio EPA threshold for toxic air pollutants, which also requires a dispersion modeling assessment of potential ambient air impacts. Ohio EPA also requested that MCC model mercury emissions from MCC sources.

MCC has conducted dispersion modeling required and requested by Ohio EPA for the regulated pollutants exceeding threshold values. The results uniformly suggest that ambient air quality is protected in the vicinity of the proposed MCC facility. The modeling included:

- Modeling of operational scenarios where pollution control systems are out of service for maintenance
 - Facility operation during HRSG maintenance
 - Facility operation during SD/BH maintenance
- Modeling of regulated criteria pollutant emissions based on maximum averaging period value assumptions, and
- Modeling of two toxic air pollutants (HCl and mercury) during typical HRSG maintenance and during maintenance and inspection of the spray dryer and baghouse.

Using procedures consistent with PSD guidance, the modeling was completed using AERMOD (version 07026) with representative meteorological data processed in AERMET using a receptor grid beginning at the MCC boundary and receptor heights determined using AERMAP. Short-term emissions during the respective HRSG and SDA/BH maintenance period were modeled as if occurring each day of the year. The resulting concentrations were compared with the significant impact levels to determine whether additional PSD increment and National

Ambient Air Quality Standards (NAAQS) modeling was required. HCl and mercury concentrations were compared to maximum acceptable ground-level concentrations (MAGLCs).

The results show that:

- **Some criteria pollutant (CO and NO_x) impacts are insignificant,**
- **Neither toxic air pollutant exceeds the MAGLC, and**
- **The remaining MCC pollutants (PM₁₀ and SO₂) comply with PSD increment limits, both federal and Ohio’s more stringent one-half increment, and the NAAQS.**

6.2 Ohio EPA Required Modeling for MCC

The PSD regulations can include a need to demonstrate compliance with applicable ambient air quality standards and increments for any regulated criteria pollutant emitted in sufficient quantity from a quantifiable project. As detailed in prior sections of the application, the emissions from the MCC facility are provided in Table 6-1. A number of operations are associated with a heat recovery coke facility that include hot exhaust stack gases as well as materials handling and fugitive sources. MCC’s design allows for much of the hot coke oven gases to be reutilized in HRSG units.

**Table 6-1
Heat Recovery Coke Plant Annual Emissions (tons/year)**

	PM₁₀	SO₂	NO_x	CO	VOC	Lead	H₂SO₄
Heat Recovery Coke Plant	127.4	1,152.3	483.7	129.5	31.4	0.28	36.3

CO = Carbon Monoxide
H₂SO₄ = Sulfuric Acid Mist
NO_x = Nitrogen Oxides
PM₁₀ = Particulate matter less than 10 micrometers in diameter
SO₂ = Sulfur Dioxide
VOC = Volatile Organic Compound

MCC typically will operate with all flue gases from the coke ovens going through the spray dryer and baghouse and exhausted through the main stack. However, when maintenance is performed at the facility, other operating modes can change the location and amount of released pollutants. These were considered for the dispersion modeling and are described below as Cases 1 through 3.

- Case 1 – One of the five individual waste heat stacks may be open up to 10 days/year for maintenance of the HRSG. Coke ovens are charged with 50 tons coal and up to 50 ovens are charged per day.
- Case 2 – Typically, 50 of the 100 ovens are charged with coal each day. If equipment problems cause delays, fewer than 50 ovens may be charged one day and more than 50 ovens may be charged the next day. Case 2 emissions correspond with maximum production, HRSG maintenance, and charging 75 ovens/day. As a conservative approach, short-term SO₂ was modeled at 550 lb/hour.
- Case 3 – The spray dryer/baghouse system may need to be offline for maintenance up to 5 days/year. During these days, stack gases are bypassed directly to the main stack. Case 3 corresponds with maximum production, spray dryer/baghouse maintenance, and charging 75 ovens/day.

Short-term averaging period impacts were based on maximum emission cases for each pollutant. Annual averaging period impacts were based on the collective schedule previously described and the aggregate emissions based on operating periods. For example, NO_x was modeled on an annual basis assuming that both HRSG maintenance and spray dryer/baghouse maintenance occurred during the year.

HCl and mercury were modeled in the HRSG maintenance mode with maximum production (Case 1) and the spray dryer/baghouse maintenance mode with the maximum charging situation (Case 3).

The modeled MCC emissions inventory is tabulated in Table 6-2. The maximum short-term emission rates shown in Table 6-2 were based on the few days per year period when maintenance and inspection of the spray dryer/baghouse system require coke oven flue gases to be exhausted to the atmosphere, bypassing the baghouse and spray dryer. Maintenance is conducted when needed and not on a routinely scheduled basis; therefore, it could occur at any time of the year. To simulate this type of activity and the unknown schedule, modeling for this short-term event was conducted as if it could happen each day of the year so that each 24-hour period is evaluated similarly and a worst-case short-term impact can be evaluated.

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**Table 6-2
MCC – Modeled Source Parameters**

Source Description	Model ID	Type	Location (UTM)			Exhaust Parameters				Emission Rates (g/s)			
			X (m)	Y (m)	Z (m msl)	Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)	CO	NO _x	PM ₁₀	SO ₂
Main Stack	mainabc	POINT	723661	4372312	200	64	464	17.8	3.96	2.7	13.1	13.2	226.0
Individual Waste Gas Stacks 1	waste11	POINT	723792	4372300	200	25.3	1311.1	21	2.74	0	0	0	0
Individual Waste Gas Stacks 2	waste12	POINT	723712	4372344	200	25.3	1311.1	21	2.74	0	0	0	0
Individual Waste Gas Stacks 3	waste13	POINT	723627	4372392	200	25.3	1311.1	21	2.74	0	0	0	0
Individual Waste Gas Stacks 4	waste14	POINT	723506	4372459	200	25.3	1311.1	21	2.74	0	0	0	0
Individual Waste Gas Stacks 5	waste15	POINT	723425	4372504	200	25.3	1311.1	21	2.74	0	0	0	0
Pushing	pushabc	POINT	723581	4372455	200	6.1	478	21.22	1.52	1.2	0.4	0.6	1.93
Charging (stack)	chargabc	POINT	723598	4372485	200	7.83	422.2	20.76	1.37	0.06		0.1	0.006
Coke Screening	cokecrsh	POINT	723620	4372283	200	10	-6	18.3	1.28			0.4	
Quench Tower	qunchabc	POINT	723576	4372422	200	30.5	342	4.2	11.9			0.9	
Coal Unloading	fug1	point	722852	4372719	200	0	0	0.01	0.1			1.57E-03	
To Unloader Conveyor	fug2	point	722851	4372714	200	0	0	0.01	0.1			7.87E-04	
Coal Transfer #1	fug3	point	722838	4372654	200	5	0	0.01	0.1			7.87E-04	
Transfer to Stacker Conveyor	fug5	coalfug	722891	4372567	200	2	0	0.01	0.1			1.57E-02	
Transfer to Stacker	fug6	coalfug	722891	4372567	200	15	0	0.01	0.1			1.57E-02	
Coal Storage Pile #1 In	fug7	coalfug	722936	4372581	200	15	0	0.01	0.1			7.87E-03	
Coal Storage Pile #1 (Dead Pile)	fug8	coalfug	722936	4372581	200	7.5	0	0.01	0.1			1.59E-02	
Coal Storage Pile#2 Out	fug9	coalfug	722936	4372581	200	2	0	0.01	0.1			7.87E-03	
Coal Transfer from Storage Pile #1 to Storage Pile #2	fug10	coalfug	722921	4372529	200	2	0	0.01	0.1			7.87E-03	
Coal Storage Pile In	fug11	coalfug	722844	4372563	200	15	0	0.01	0.1			7.87E-03	
Coal Storage Pile #2 (Live Pile)	fug12	coalfug	722844	4372563	200	7.5	0	0.01	0.1			1.72E-02	
Coal Storage Pile Out	fug13	coalfug	722844	4372563	200	0	0	0.01	0.1			7.87E-04	
Stacker (Front End Loadout)	fug14	coalfug	722880	4372522	200	2	0	0.01	0.1			3.15E-03	
Transfer to Stacker Reclaim Hopper	fug15	coalfug	722880	4372522	200	2	0	0.01	0.1			3.15E-03	
Transfer to Coal Crushing Tower	fug18	point	723342	4372416	200	15	0	0.01	0.1			7.87E-04	
Coal Crushing	fug19	point	723342	4372418	200	9	0	0.01	0.1			1.58E-02	
Transfer to Silo Feed Conveyor	fug20	point	723347	4372436	200	4	0	0.01	0.1			7.87E-04	
Transfer to Silo	fug21	point	723388	4372620	200	40	0	0.01	0.1			7.87E-04	
Transfer to Batch Bin	fug22	point	723388	4372620	200	20	0	0.01	0.1			7.87E-04	
Transfer to tripper conveyor	fug23	coalfug	723640	4372478	200	2	0	0.01	0.1			1.57E-02	
Tripper point 1	fug24	coalfug	723598	4372485	200	7	0	0.01	0.1			1.57E-02	
Tripper point 2	fug25	coalfug	723598	4372485	200	7	0	0.01	0.1			1.57E-02	
Tripper point 3	fug26	coalfug	723598	4372485	200	7	0	0.01	0.1			1.57E-02	
Coke from Hot Car to Quench Car	fug27	point	723577	4372446	200	2	0	0.01	0.1			5.64E-03	
Coke from Quench Car to Wharf	fug28	point	723576	4372422	200	0	0	0.01	0.1			1.13E-02	
Transfer to Wharf conveyor	fug29	point	723572	4372400	200	0	0	0.01	0.1			1.13E-02	
Coke Transfer #1	fug30	cokfug	723524	4372319	200	2	0	0.01	0.1			5.64E-04	
Coke Transfer (Stacking Conveyor)	fug31	cokfug	723524	4372319	200	2	0	0.01	0.1			1.69E-03	
Coke emergency storage pile in	fug32	cokfug	723473	4372318	200	14	0	0.01	0.1			1.13E-02	
Coke emergency storage pile wind	fug33	cokfug	723473	4372318	200	7	0	0.01	0.1			8.63E-03	
Coke emergency storage pile out	fug34	cokfug	723473	4372318	200	2	0	0.01	0.1			1.13E-02	
Unloading to Coke Reclaim Hopper	fug35	cokfug	723542	4372351	200	2	0	0.01	0.1			1.13E-02	
Coke Transfer (Plant Feed Conveyor)	fug36	cokfug	723524	4372319	200	20	0	0.01	0.1			2.03E-03	

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**Table 6-2
(Continued)**

Source Description	Model ID	Type	Location (UTM)			Exhaust Parameters				Emission Rates (g/s)			
			X (m)	Y (m)	Z (m msl)	Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)	CO	NO _x	PM ₁₀	SO ₂
Transfer to Screening Station	fug37	cokfug	723620	4372283	200	25	0	0.01	0.1			2.03E-03	
Transfer to Recirculating Conveyor	fug38	cokfug	723620	4372283	200	12	0	0.01	0.1			3.38E-04	
Recirculating Transfer to Plant Feed Conveyor	fug39	cokfug	723527	4372317	200	12	0	0.01	0.1			3.38E-04	
Transfer Breeze to Bunker	fug40	cokfug	723620	4372283	200	5	0	0.01	0.1			1.05E-04	
Breeze loadout at bunker	fug41	cokfug	723620	4372283	200	5	0	0.01	0.1			1.05E-04	
Emergency Breeze Pile In	fug42	cokfug	723556	4372331	200	2	0	0.01	0.1			7.00E-04	
Emergency Breeze Pile	fug43	cokfug	723556	4372331	200	2	0	0.01	0.1			5.64E-03	
Emergency Breeze Pile Out	fug44	cokfug	723556	4372331	200	2	0	0.01	0.1			7.00E-04	
Transfer to coke product conveyor	fug45	cokfug	723620	4372283	200	12	0	0.01	0.1			1.69E-03	
Coke Transfer #2	fug46	cokfug	723782	4372222	200	12	0	0.01	0.1			5.64E-04	
Transfer to screened coke stacker conveyor	fug47	cokfug	723782	4372222	200	12	0	0.01	0.1			1.69E-03	
Emergency Screened coke storage pile in	fug48	cokfug	723749	4372254	200	12	0	0.01	0.1			1.06E-02	
Emergency Screened coke storage pile	fug49	cokfug	723749	4372254	200	6	0	0.01	0.1			1.73E-03	
Emergency Screened coke storage pile out	fug50	cokfug	723749	4372254	200	2	0	0.01	0.1			1.06E-02	
Unloading to Screened Coke Reclaim Hopper	fug51	cokfug	723791	4372228	200	2	0	0.01	0.1			1.13E-02	
Coke Transfer #3	fug52	point	723908	4372321	200	9	0	0.01	0.1			5.64E-04	
Coke Transfer #4	fug53	point	724197	4372317	200	9	0	0.01	0.1			5.64E-04	
Coke Rail Loadout Transfer #1	fug55	point	723347	4372322	200	9	0	0.01	0.1			5.64E-04	
Coke Rail Loadout Transfer #2	fug56	point	723051	4372344	200	9	0	0.01	0.1			5.64E-04	
Coke Rail Loadout Transfer #3	fug57	point	723048	4372308	200	9	0	0.01	0.1			5.64E-04	
Transfer to coke loadout conveyor	fug59	point	723618	4372278	200	9	0	0.01	0.1			1.69E-03	
Coke Rail Loadout	fug60	point	723048	4372308	200	9	0	0.01	0.1			1.69E-03	
Charging fugitive	fug61	point	723598	4372485	200	9	0	0.01	0.1			1.59E-02	
Lime Silo	fug62	point	723592	4372355	200	22	0	0.01	0.1			3.88E-03	
FGD Silo	fug63	point	723611	4372321	200	37	0	0.01	0.1			2.68E-04	
Coal Handling Fugitive Sources 4-16	coalfug	areapoly	722990	4372654	200								
	coalfug	2.84E-06	7.7	4	2								
	AREAVERT	coalfug	722990	4372654									
	AREAVERT	coalfug	723047	4372634									
	AREAVERT	coalfug	722893	4372360									
	AREAVERT	coalfug	722844	4372394									
Coke Handling Fugitive Sources 30-51	cokfug	areapoly	723529	4372404	200								
	cokfug	2.22E-06	7.8	6	2								
	AREAVERT	cokfug	723529	4372404									
	AREAVERT	cokfug	723605	4372324									
	AREAVERT	cokfug	723703	4372320									
	AREAVERT	cokfug	723750	4372264									
	AREAVERT	cokfug	723620	4372264									
	AREAVERT	cokfug	723445	4372344									
Vehicle Roadway Dust Fugitive Emissions	fug64	areapoly	723308	4372704	200								
	fug64	7.695E-08	1	4	2								
	AREAVERT	fug64	723308	4372704									
	AREAVERT	fug64	723857	4372354									
	AREAVERT	fug64	723738	4372244									
	AREAVERT	fug64	723173	4372294									

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As shown in Table 6-2, emissions of the majority of pollutants are confined to a few emission points, whereas PM₁₀ emissions associated with coal and coke handling as well as traffic dust extend across the MCC facility. To better characterize these fugitive emission sources, many of the nearby and same-type handling operations were grouped into area sources using the AERAPOLY approach. The fugitive emissions grouped into these modeled sources are shown in Table 6-2 in the third column, which indicates whether the source was modeled as a point source or was part of a combined source by a particular name (e.g., coalfug). The dimensions of these combined emission sources were based on the area of the physical activity. The emission rates calculated and shown in Table 6-2 for the area sources are per unit areas (g/s/m²), and the release parameters were based on average release heights.

The location of these sources is shown in Figure 6-1 with the area source boundaries also depicted. As shown in Figure 6-1, the area sources combine nearby, like-type emissions.

6.3 AERMOD Model Input Parameters and Results

The proposed location of MCC as shown in Figure 2-5, highlights a nearby fenced boundary, which is determined the beginning of ambient air, or that portion to which the general public has access. This boundary is also shown in Figure 6-1.

A discrete grid of receptors beginning at this ambient air boundary was used to calculate ground-level ambient air concentrations for comparison with standards and increment levels. The receptor grid spacing is nominally 25 m at the boundary and 100 m outward of that. Beyond the 100-m grid, receptors are spaced at 250 and 500 m out to 3 km. The receptor grid used is shown in Figure 6-2. Receptor heights were determined using AERMAP and available digital elevation model (DEM) data as obtained from the U.S. Geological Survey.

The DEM model data used are depicted as shaded relief images with the grid overlaid as shown in Figure 6-3.

Five years of representative meteorological data as determined by Ohio EPA were used and included the 5-year period (1987–1991) of surface data from the Cincinnati/Covington

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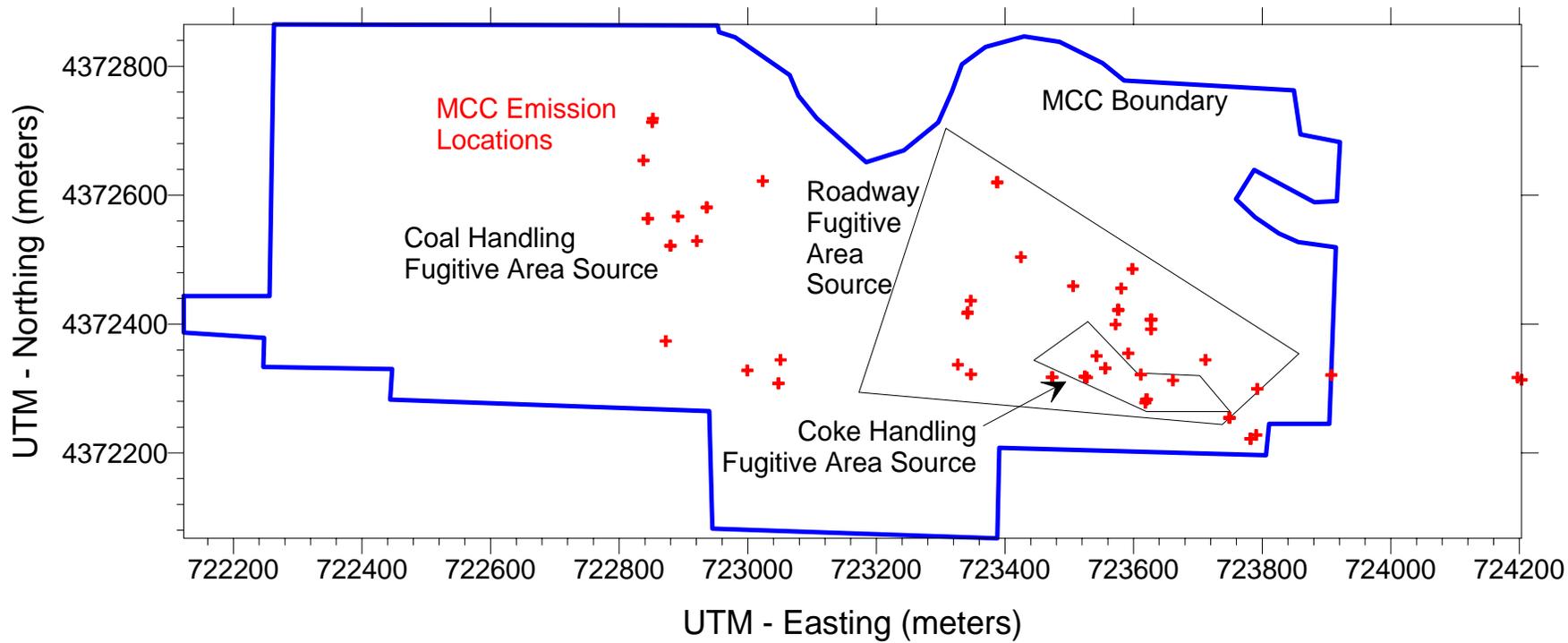


Figure 6-1. MCC Emission Locations and Area Source Combinations

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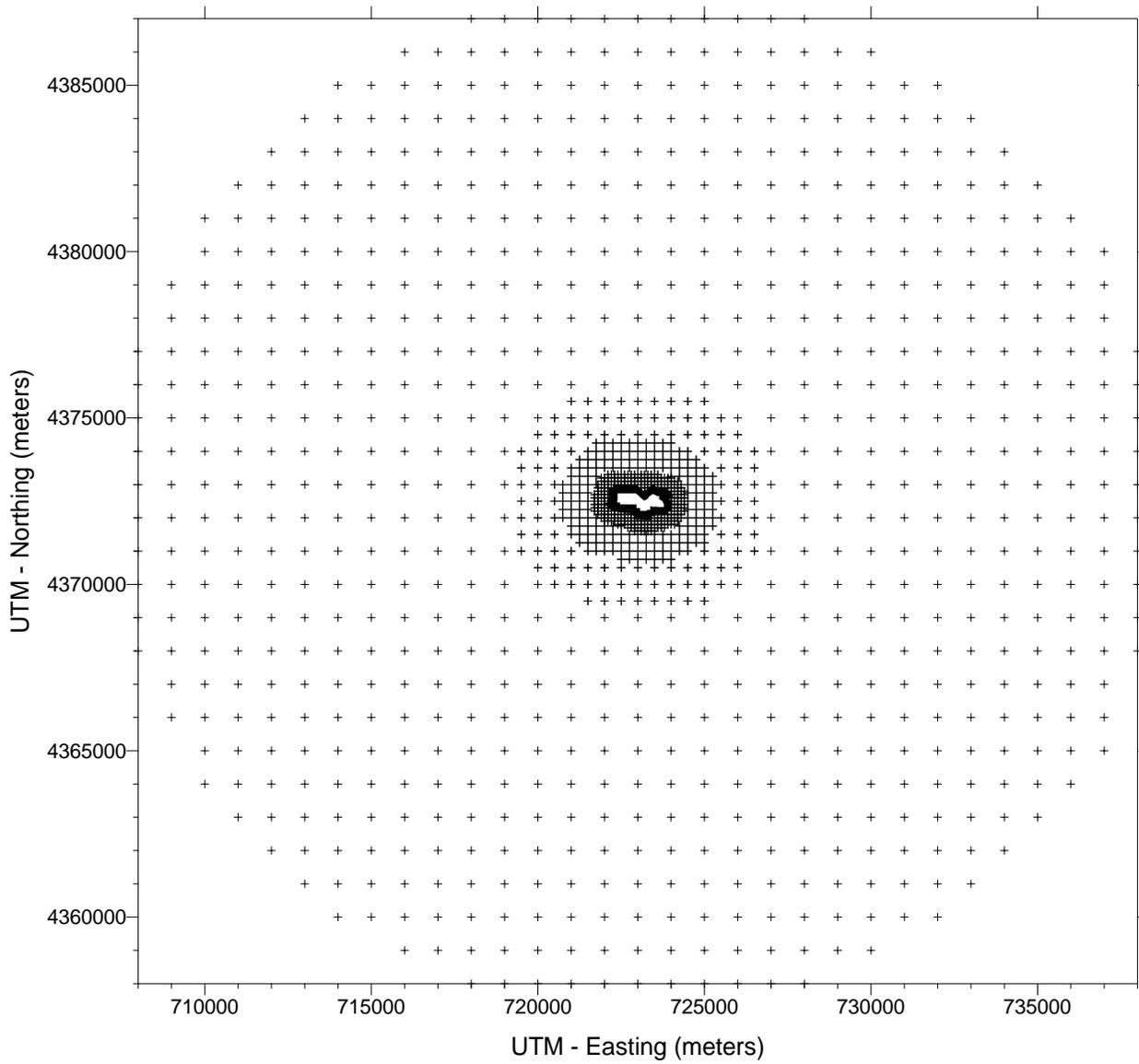


Figure 6-2. MCC Receptor Grid and Source Locations

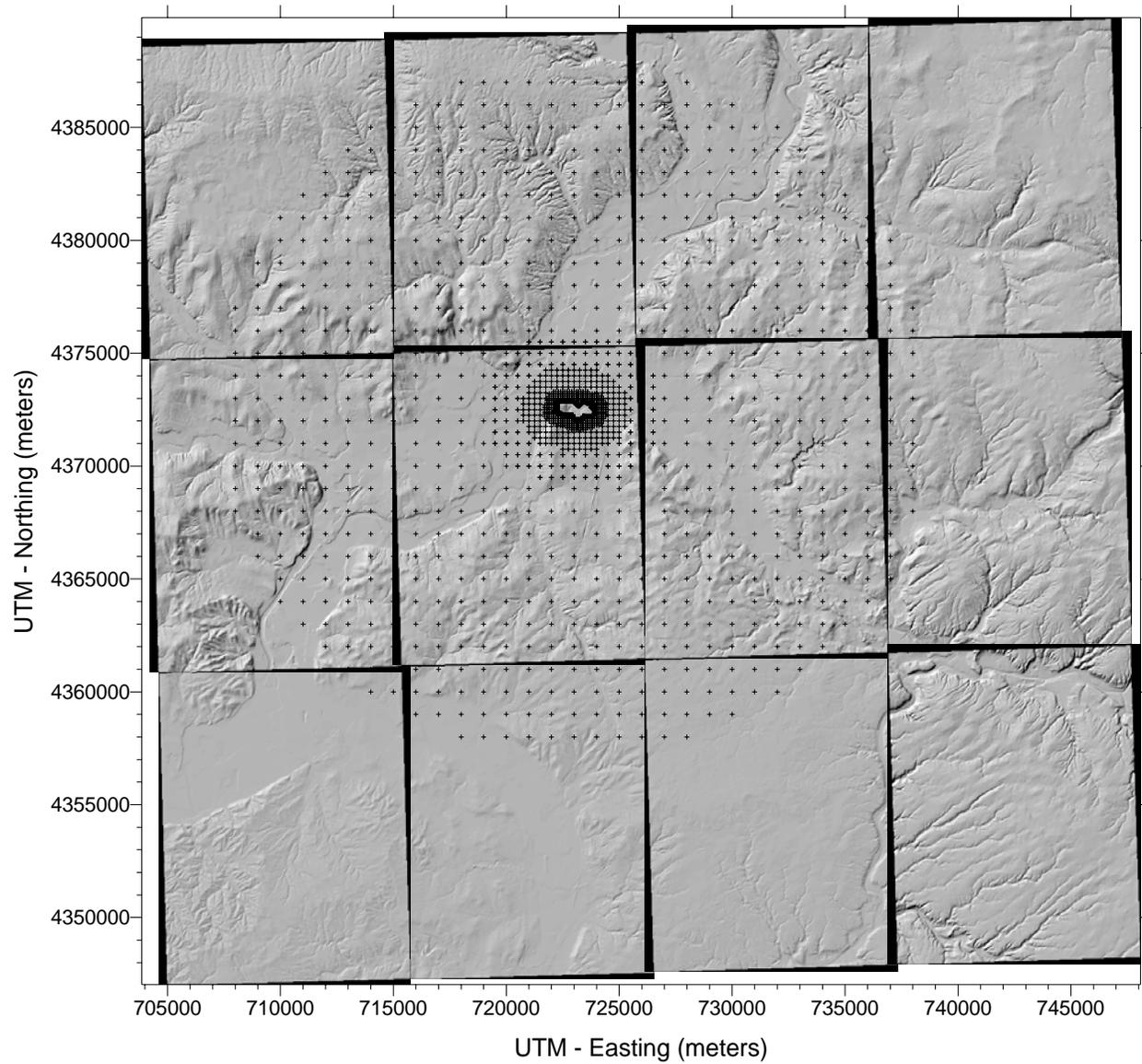


Figure 6-3. MCC Receptor Grid and Shaded Relief of Surrounding Terrain

airport along with Dayton upper air. These data were processed in AERMET using the surface geophysical parameters as shown in Table 6-3. These parameters were determined to be appropriate for the airport measurement site. A wind rose is shown in Figure 6-4. Processing of the AERMET data was done using AERSURFACE and the 1992 land use data.

Table 6-3

AERMET – Geophysical Parameters Used in Meteorological Data Processing by Sector and Season (Spring, Summer, Fall, Winter)

Sector Number and Orientation	Albedo	Bowen Ratio	Surface Roughness
Sector 1 0-180	0.17	0.8	0.052
	0.17	0.8	0.04
	0.17	0.8	0.025
	0.17	0.8	0.046
Sector 2 180-230	0.15	0.5	0.06
	0.15	0.5	0.05
	0.15	0.5	0.035
	0.15	0.5	0.059
Sector 3 230-280	0.17	0.45	0.066
	0.17	0.45	0.058
	0.17	0.45	0.044
	0.17	0.45	0.082
Sector 4 280 –360	0.17	0.79	0.06
	0.17	0.79	0.051
	0.17	0.79	0.036
	0.17	0.79	0.073

Note: 0 and 360 are degrees north. Parameters reflect measurement site.

Direction-specific downwash values were determined based on Building Profile Input Program (bpip) files as analyzed by the PRIME version of bpip. The files were also used to satisfy that none of the proposed stacks exceeds good engineering practice (GEP) stack heights.

These ancillary inputs were provided to AERMOD in support of the MCC modeling assessment. Using these inputs and the emission inventory shown in Table 6-2, the AERMOD model was run for each pollutant and year of meteorological data.

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The modeling results for solely MCC's project emissions are shown in Table 6-4. As the table indicates, the MCC facility will meet Ohio's one-half increment standard for all pollutants. The applicable Ohio PSD increment standard for a project's emissions is set at half the federally mandated standard.

Table 6-4 also shows that only the impacts of PM₁₀ and SO₂ potentially exceeded the significant impact threshold values, requiring additional modeling. While the significant impact area (SIA) associated with SO₂ was well beyond the MCC facility boundary, because of the number of fugitive emissions and the generally poorer dispersive capacity of these types of sources, the SIA for PM₁₀ was found to be much nearer the MCC facility as depicted in Figure 6-5.

Because these pollutant impacts could conceivably "cause or contribute" to a violation on an increment or NAAQS, further modeling, including assessing contributions from an off-site inventory, was done. To complete this additional modeling, Ohio EPA provided representative background concentrations for both pollutants as suitably characterizing the background air quality of the MCC project area. Therefore, no preconstruction monitoring was required for the MCC project.

Along with appropriate background monitoring values, Ohio EPA provided an emission inventory of increment consuming sources, which was also modeled. The results of the increment modeling (MCC emissions and off-site inventory) are shown in Table 6-5. As shown, compliance with the federal increment levels is demonstrable. The values shown in Table 6-5 represent the combined impacts of MCC and the off-site source inventory. The direct MCC increment impacts are shown in Table 6-4 and can be compared with the combined increment levels in Table 6-5. As previously described, the Ohio increment standards are set at half the federally mandated levels, and as shown by the results in Table 6-4, the MCC impacts do not exceed the Ohio EPA half-increment levels for both PM₁₀ and SO₂.

An NAAQS inventory was also obtained from Ohio EPA for both pollutants. The relative locations of these NAAQS inventory sources compared with MCC is shown in Figure 6-6. The results of the NAAQS modeling are provided in Table 6-6.

Table 6-4
MCC – Maximum Modeled Pollutant Concentrations and Comparison with Thresholds

Pollutant	Averaging Period	MCC Only Maximum Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Ohio Acceptable Increment ($\mu\text{g}/\text{m}^3$)	Does MCC Exceed One-Half Ohio Increment?	Location of Maximum Modeled Concentration			Threshold Levels ($\mu\text{g}/\text{m}^3$)	Does MCC Impact Exceed Threshold for Additional Modeling?
					X (m)	Y (m)	Z m msl		
CO	1-hour	36.5	10,000	No	723811	4372245	206	2,000	No
	8-hour	12.1	2,500	No	723906	4372294	204	500	No
NO ₂	Annual	0.51	12.5	No	724200	4373000	200	1	No
PM ₁₀	24-hour	14.3	15	No	723774	4372618	192	5	Yes
	Annual	3.2	8.5	No	723759	4372594	193	1	Yes
SO ₂	3-hour	139.2	256	No	724400	4372300	196	25	Yes
	24-hour	28.5	45.5	No	724200	4372900	199	5	Yes
	Annual	4.3	10	No	724200	4372800	198	1	Yes
HCl	1-hour	94.4			724100	4372200	209	122.8	No
Mercury	1-hour	0.0113			724100	4372200	209	0.595	No

Notes:

NO₂ modeled concentration converted using 0.75 ARM ($0.69 \mu\text{g}/\text{m}^3 \text{NO}_x * 0.75 \text{ ARM} = 0.51 \mu\text{g}/\text{m}^3 \text{NO}_2$).

HCl MAGLC calculated from TLV of $7.0 \text{ mg}/\text{m}^3$ ($7.0 \text{ mg}/\text{m}^3 = 7000 \mu\text{g}/\text{m}^3 * 0.737 * 4 / (24*7) = 122.8 \mu\text{g}/\text{m}^3$).

Hg MAGLC calculated from TLV of $0.025 \text{ mg}/\text{m}^3$ ($0.025 \text{ mg}/\text{m}^3 = 25 \mu\text{g}/\text{m}^3 * 4 / (24*7) = 0.595 \mu\text{g}/\text{m}^3$).

CO = Carbon Monoxide

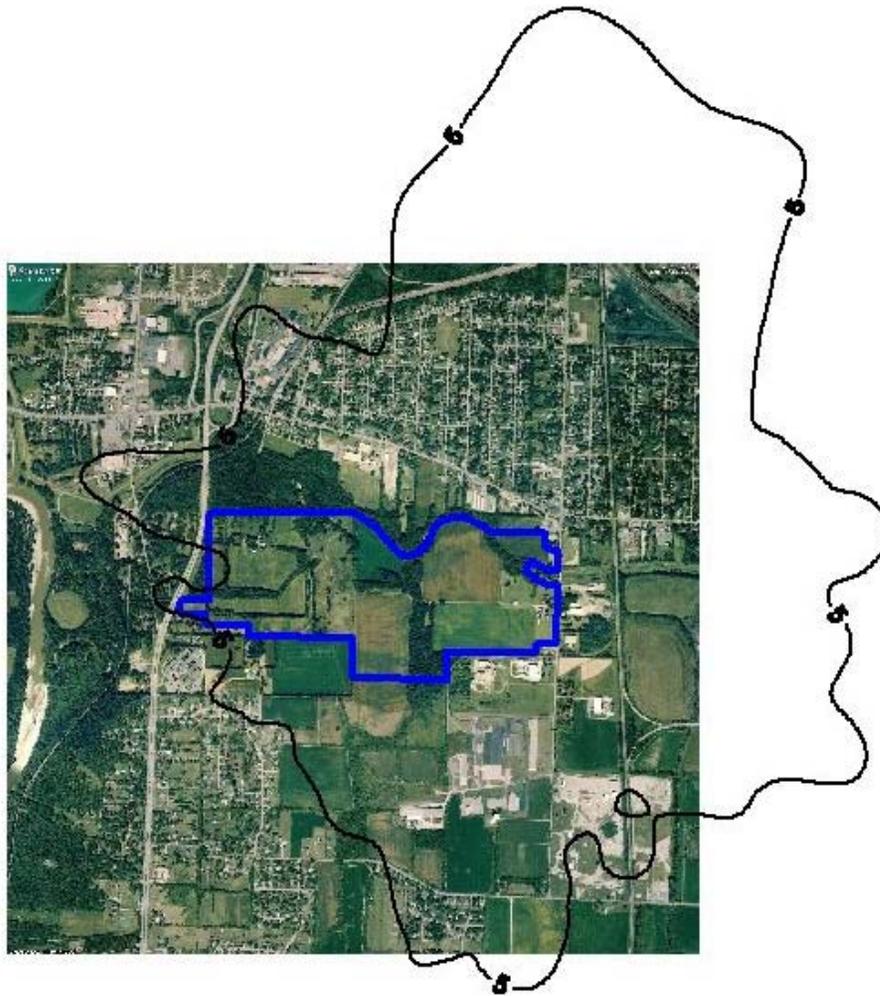
HCl = Hydrogen Chloride

MCC = Middletown Coke Company

NO₂ = Nitrogen Dioxide

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

SO₂ = Sulfur Dioxide



**Figure 6-5. MCC – PM₁₀ 24-hour Significant Impact Area Atop Aerial
(MCC Boundary shown in blue, SIA shown in black, aerial photograph is 3.3 km long)**

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Table 6-5
Maximum Modeled MCC and PSD Increment Inventory Impacts

Pollutant	Averaging Period	MCC and Off-Site Source Inventory Maximum Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Location of Maximum Modeled Concentration		Federal PSD Increment ($\mu\text{g}/\text{m}^3$)	PSD Increment Exceeded?
			X (m)	Y (m)		
SO ₂ – All	3-hour	171.5	724300	4372900	512	No
	24-hour	59.5	724300	4372700	91	No
	Annual	8.5	724200	4373000	20	No
PM ₁₀ – All	24-hour	27.3	723910	4372394	30	No
	Annual	6.6	723759	4372594	17	No

Notes: Short-term values are highest-second-highest concentrations.

MCC = Middletown Coke Company

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

PSD = Prevention of Significant Deterioration

SO₂ = Sulfur Dioxide

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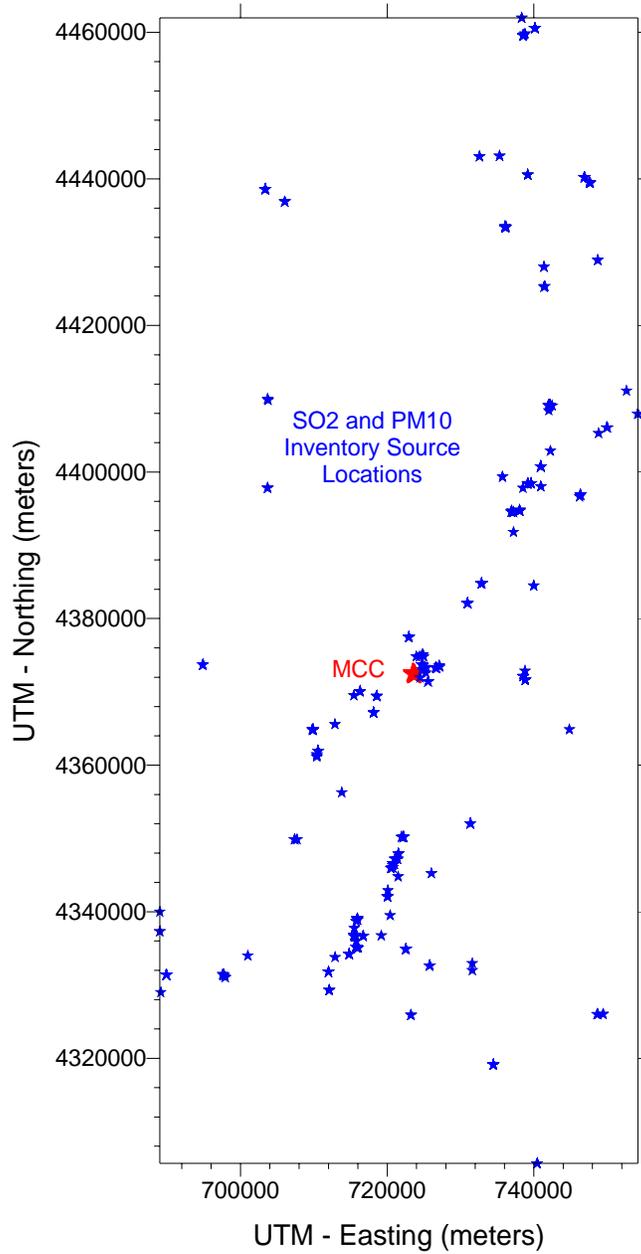


Figure 6-6. MCC – Location of Off-site Inventory Modeled Sources

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Table 6-6

Maximum Modeled MCC and Off-site Inventory Impacts

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Location of Maximum Modeled Concentration		Ambient Background Concentration ($\mu\text{g}/\text{m}^3$)	Total Impact ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)
			X (m)	Y (m)			
SO ₂ – All	3-hour	636.3	727000	4359000	151.96	788.3	1,300
	24-hour	184.6	728000	4358000	49.78	234.4	365
	Annual	40.3	711000	4363000	10.7	51	80
PM ₁₀ – All	24-hour	294.2	725500	4373000	47	341.2	150
PM ₁₀ - AKS	24-hour	292.4	725500	4373000	47	339.4	150

Notes: AKS is the 24-hour concentration due to AK Steel sources only. Short-term values are highest-second-highest concentrations.

MCC = Middletown Coke Company

NAAQS = National Ambient Air Quality Standards

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

SO₂ = Sulfur Dioxide

As shown, the MCC plus inventory impacts return an aggregate modeled concentration together with ambient background values less than the respective NAAQS. Again, the modeling is conservatively based on the SD/BH maintenance case as if occurring each day of the year. Even so, as shown in Table 6-6, compliance with the NAAQS is demonstrable for SO₂.

However, for short-term PM₁₀ concentrations, the modeled impacts potentially exceed the NAAQS. The impacts of PM₁₀ are primarily due to AK Steel sources and are located at receptors within the AK Steel boundary. Because a source does not need to quantify its impacts at receptors within its boundary, removing the AK Steel impacts from these receptors returns compliant NAAQS values. This was done by examining each 24-hour period for which impacts could exceed 100 µg/m³ (which when added to the background of 47 µg/m³ would be near the standard). These periods were compared with the MCC maximum facility impact to determine whether MCC could cause or contribute to a violation of the NAAQS (i.e., have a significant impact at that receptor and 24-hour period). None were found to occur, and removing the AK Steel impacts from receptors within its boundary returned PM₁₀ 24-hour values in compliance with the NAAQS.

Again, the PM₁₀ modeling used the same assumptions as the SO₂ inventory assessment and therefore is quite conservative.

7.0 ADDITIONAL IMPACT ANALYSIS

The additional impacts analysis is an evaluation of:

- General commercial, residential, industrial, and other growth associated with the modifications;
- The air quality impact projected for the area as a result of the general growth previously described;
- The impairment to visibility, soils, and vegetation that would result from the modifications;
- The air quality impact projected for any nearby Class I areas; and
- The visibility impact on any nearby Class I areas.

Because of the nature of the project area and the level of emissions associated with the MCC project, there will be little additional impact. There will be some construction-related activity limited to short-term and near source-specific areas, but because of the infrastructure nearby and in place, no longer term growth or project associated air quality impacts beyond what has already been described will occur. Because of the localized impacts from the project and because the project is to be located near an existing industrial area, and because impacts are demonstrated to be less than the NAAQS, there will be little project impact to soils or vegetation in the area. Further, given the distance from the project site to the nearest Class I area and because of the reduction in emissions of sulfur and nitrogen compounds, there will likely be no adverse project impacts on Class I areas.

7.1 Growth

The new MCC project sources will be operated by a staff of approximately 75. The project will be located in an area with ready access to existing housing and other services. Given that the existing infrastructure is sufficient to accommodate personnel associated with this new project, there is very limited potential for impacts to the surrounding environment based on “growth.”

Short-term construction emissions and impacts will occur while the coke facilities are being built. PM emissions during construction will be controlled by watering of unpaved roads, flushing of paved roads, and other measures so that short-term daily construction impacts will not likely exceed those already occurring from current nearby activities. Therefore, short-term construction impacts should be minimal.

7.2 Local Visibility and Sensitive Area Impacts

The U.S. Fish and Wildlife Service (USFWS) notes a single endangered species in Butler County (<http://www.fws.gov/midwest/endangered/lists/ohio-cty.html>) with a listing for the Indiana bat. The U.S. Department of Agriculture provides surveys of the surrounding soils and land use suitability for crop and other uses.

The area adjacent the proposed MCC site includes cultivated land for hay and other saleable crops. Soil surveys of the area and land use suitability are shown in Figures 7-1 and 7-2 and suggest that the areas adjacent are suitable, albeit localized for pasture/hayland, but generally not suitable for recreational/playground usage.

Given the location relative to an existing long-term industrial area and the relatively minor impacts of MCC pollutants, it is unlikely that additional impacts to soils, vegetation, or endangered species would occur.

Aesthetically the new buildings and structures are low-profile and few, and therefore, local impact to aesthetic views from the project should be minimal. Steam is a common byproduct of coke and steel production. Because of the location of the MCC project, some steam produced will be visible, but given the existence of nearby industry there should be little impact to visibility.

The MCC project will increase PM and NO_x to the atmosphere, which can cause light scattering and reduced visibility nearby. Many of the activities associated with the project and project affected sources occur at or near ground level and so will not impact visibility as a coherent plume can.

Pasture and Hayland Suitability Group (OH)—Butler County, Ohio

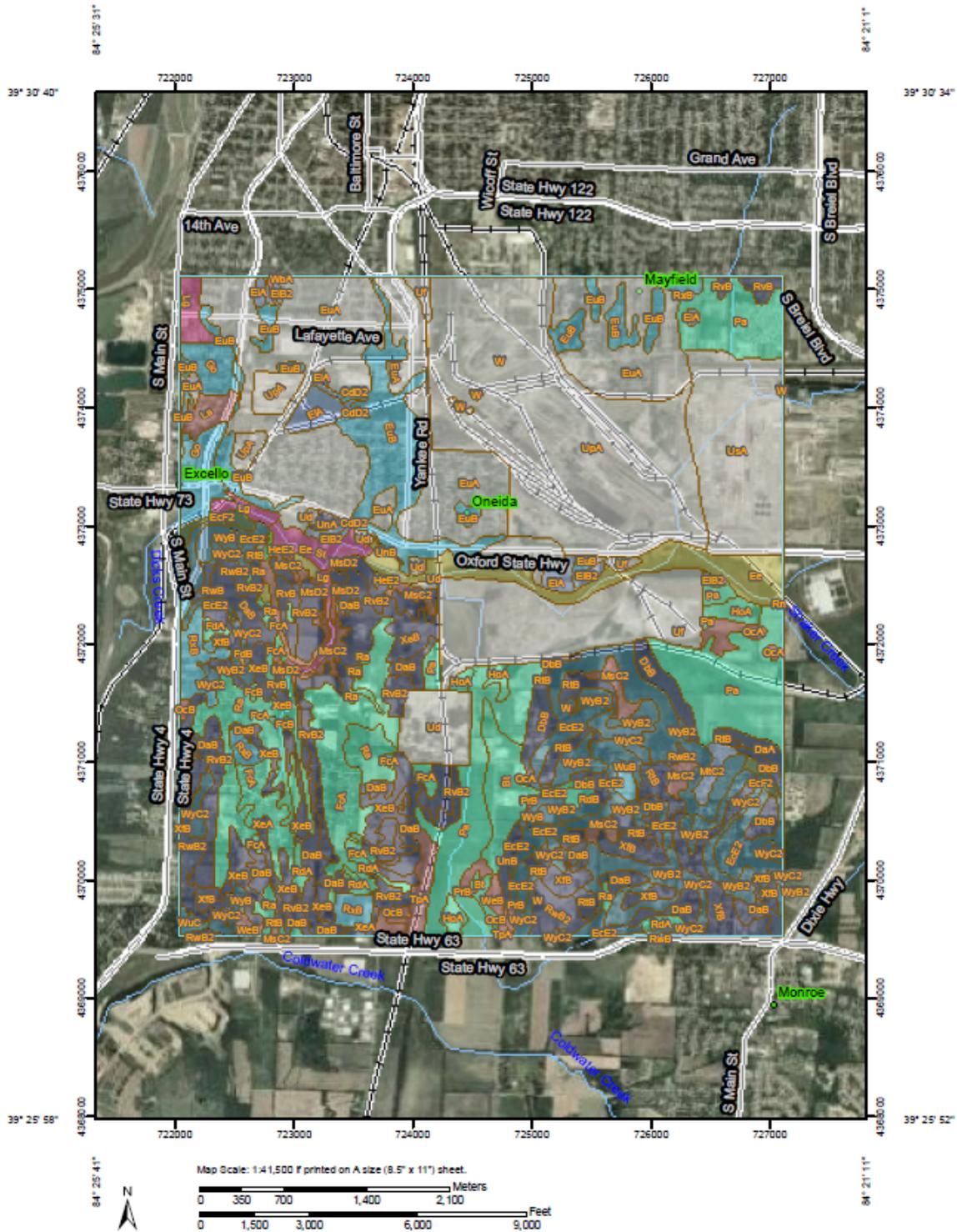


Figure 7-1. MCC – Soil Survey and Pasture and Hayland Suitability Map - USDA

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Playgrounds (OH)—Butler County, Ohio

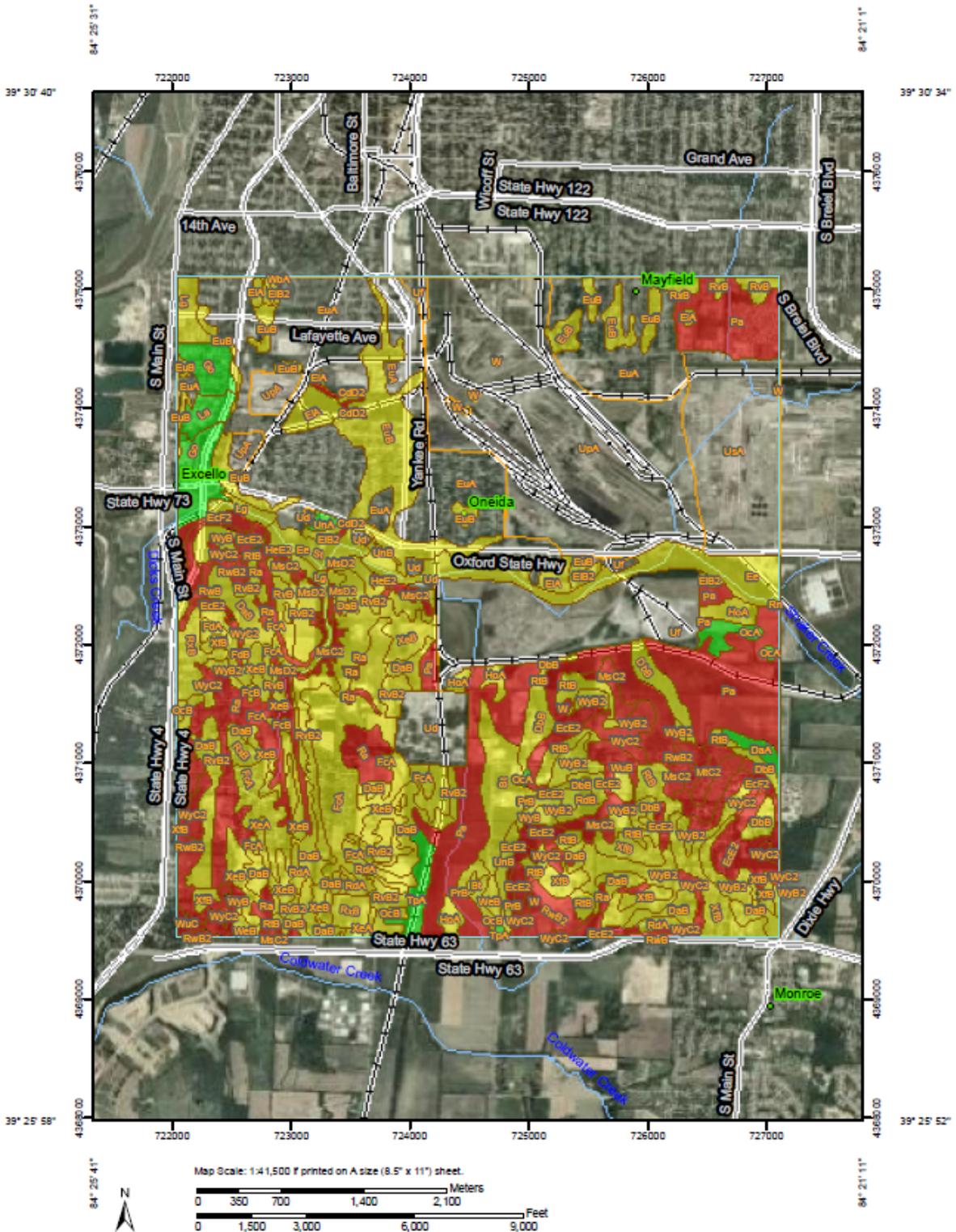


Figure 7-2. MCC – Soil Survey and Playground Suitability Map - USDA
 (Red is very limited; yellow is somewhat limited; green is unlimited)

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To assess the potential effect of the increases in visibility, the VISCREEN model was run for the increased particulate emissions. Using an existing background visual range of 20 km, there is some demonstrated impact to visibility when using conservative assumptions of the model and comparing the levels to Class I or pristine impact thresholds.

It is more likely that, given the nature of the area in which the project is located convert to form particulate capable of scattering light and reducing visibility, the MCC project will have a small, but nearly unperceivable impact to local visibility based on a coherent plume approach.

7.3 Class I Area

The distance rings from the MCC project site to the nearest Class I areas are shown in Figure 7-3. As seen, the nearest area is Mammoth Cave, located over 230 km away. The remaining areas shown are located more than 330 km distant. Federal Land Managers (FLMs) have developed screening criteria to help determine the likelihood of Class I area impacts from a source or project. The FLM screening criteria is an emission/distance ratio that, if in excess of 10, would suggest the need to assess likely impacts.

FLMs have suggested that if Q , which is the total annual emissions of PM_{10} , NO_x , SO_2 , and H_2SO_4 in tons/year, is divided by D , which is the distance in km from the source to the Class I area, and the ratio is less than 10, then no further assessment will likely be needed.

From Table 6-1, Q is 1,800 tons/year and D is 236 km, for a ratio of 7.6, or less than 10. Therefore, no further assessment was completed.

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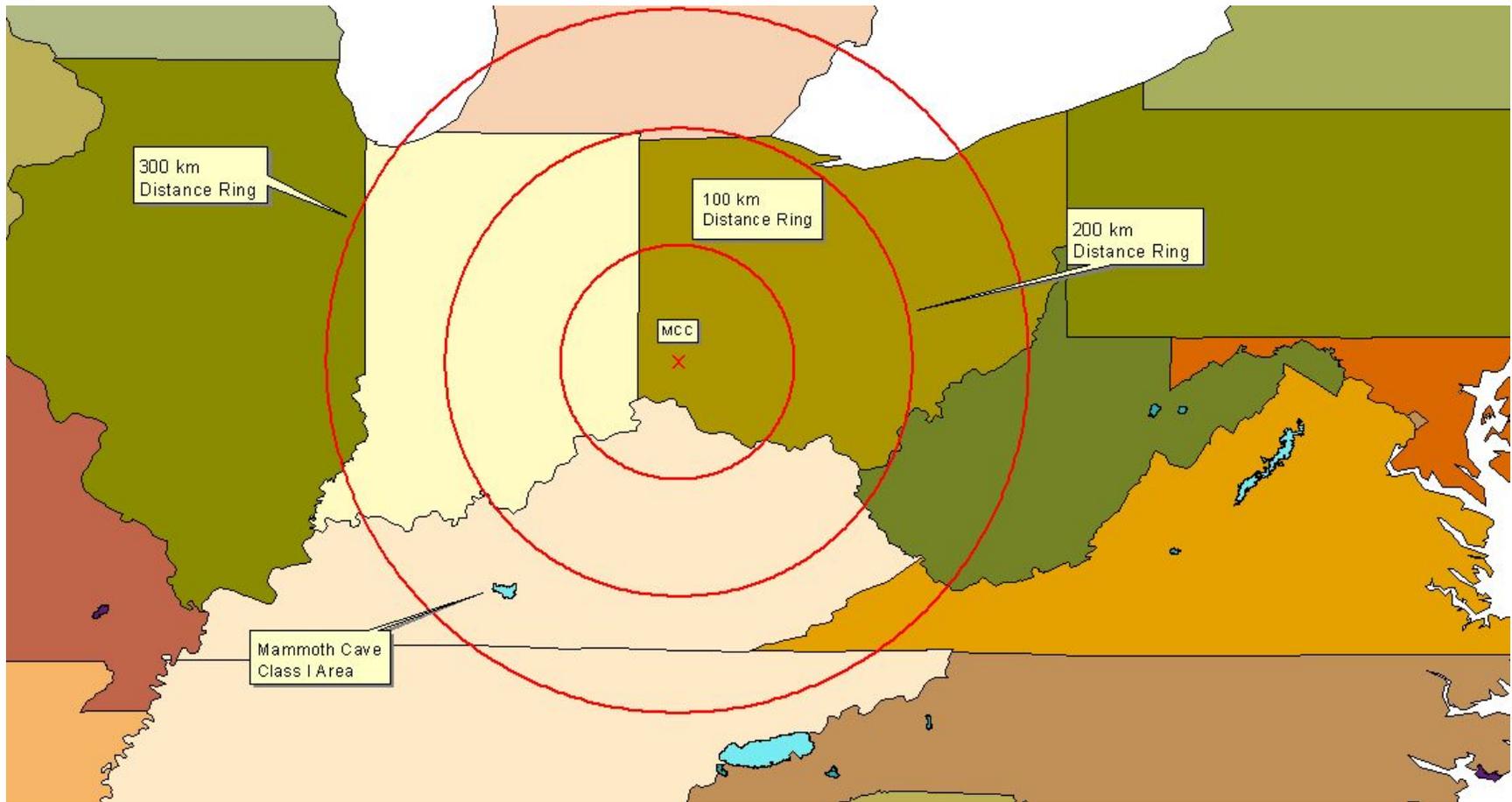


Figure 7-3. Locations of MCC and Class I Areas

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8.0 LOWEST ACHIEVABLE EMISSION RATE ANALYSIS

Ohio Nonattainment Provisions (OAC 3745-31-22) require that major new sources meet LAER for those pollutants that locate in an area that does not meet NAAQS. The facility will be located in Butler County, which is currently designated as nonattainment for ozone and PM_{2.5}. MCC will be a major source of PM_{2.5}, SO₂ (as a PM_{2.5} precursor), and NO_x (as an ozone precursor). Therefore, MCC must demonstrate LAER for PM_{2.5}, SO₂, and NO_x.

8.1 Lowest Achievable Emission Rate

LAER is defined in OAC 3745-31-01 (GGG):

"Lowest achievable emission rate" or "LAER", for any emissions unit, means the more stringent rate of emissions based on the following:

(1) The most stringent emission limitation that is contained in the implementation plan of any state for such class or category of emissions unit, unless the owner or operator of the proposed emissions unit demonstrates that such limitations are not achievable; or

(2) The most stringent emission limitation that is achieved in practice by such class or category of emissions unit. This limitation, when applied to a major modification, means LAER for the new or modified emissions units within the stationary source. In no event shall the application of this term permit a proposed new or modified emissions unit to emit any air pollutant in excess of the amount allowable under applicable new source standards of performance.

The following information sources were reviewed to identify emissions limits to evaluate for LAER:

- Regulations in states with either byproduct or nonrecovery coke plants (Alabama, Illinois, Indiana, Kentucky, Maryland, Michigan, New York, Ohio, Pennsylvania, Virginia, and West Virginia),
- Federal MACT standards,
- Limitations achieved in practice at heat recovery coke making facilities, and
- EPA RBLC emission determination database.

8.2 Limitations in State and Federal Rules

Most limits in the air quality regulations for the different states were written for the byproduct coke making technology. Table 8-1 lists the regulations that have been applied or potentially could apply to the heat recovery coke making technology in Alabama, Illinois, Indiana, Kentucky, Maryland, Michigan, New York, Ohio, Pennsylvania, Virginia, and West Virginia. No charging rules are listed because they specifically apply to the byproduct technology as evidenced by their reference to charge ports, larry cars, lids, and topside areas. The heat recovery ovens are not charged from the top and do not have any of this equipment. Several formats are used for measuring fugitive emissions from pushing. A typical approach is to measure average opacity for four consecutive pushes considering the highest six consecutive readings in each push.

There are no New Source Performance standards for heat recovery coke making pursuant to Section 111 of the CAA. However, standards for nonrecovery coke oven batteries have been established as NESHAP under Section 112 of the CAA. These are generally referred to as MACT standards. Separate byproduct and nonrecovery MACT standards have been issued for charging and the coke ovens. The MACT standards for battery stacks are specific to the byproduct technology. There is some overlap between byproduct and nonrecovery MACT standards for pushing and quenching. The MACT standards applicable to MCC are summarized in Table 8-2.

In the background information for the proposed MACT standards,¹ EPA listed limitations for specific facilities considered prior to establishing the federal standards. Pushing emission limits for facilities with control devices ranged from 0.02 to 0.07 lb PM/ton coke. Some of these limits applied only to pushing coke out of the oven and some applied to both pushing coke into the car and travel to the quench tower. The most stringent limit was 0.04 lb/ton coke, which incorporated emissions from both the push and travel to the quench tower.

¹ *National Emission Standards for Hazardous Air Pollutants (NESHAP) for Coke Ovens: Pushing, Quenching, and Battery Stacks – Background Information for Proposed Standards*, Final Report, EPA-453/R-01-006, February 2001.

Table 8-1

State Requirements Potentially Applicable to Heat Recovery Coke Plants

State	Charging		Pushing				Coke Oven Combustion Stack			Quenching		
	PM Limit	SO ₂ limit (lb/hour)	Fugitives Opacity	Exceptions	Control Device PM Limit (lb/ton coke)	SO ₂ limit (lb/hour)	Stack Opacity	PM Limit (gr/dscf)	SO ₂ limit (lb/hour)	Baffles	TDS Limit (mg/L)	SO ₂ limit (lb/hour)
Alabama (335-3-4-.09 Coke Ovens)			40	1 push/hr/battery			20			Yes		
Alabama Jefferson County Board of Health (6.9 Coke Ovens)			40	1 push/hr/battery			20			Yes		
Illinois (Section 212.443 Coke Plants)	0.02 gr/dscf		20		0.04		30	0.05		Yes	1,200	
Indiana (326 IAC 11-3-2 Emission Limitations for Coke Oven Batteries)					0.04 (Collect 90% of emissions)					Yes	1,500	
Indiana Lake County (326 IAC 6.8-9-3 PM ₁₀ Coke Battery Emission Requirements)			20		0.04					Yes	1,500	
Indiana (326 IAC 7-4.1-8 Indiana Harbor Coke Company Sulfur Dioxide Emission Limitations)		1.57				1.96			1,656 lb/hour (24-hour average waste heat vent stacks plus main stack)			1.232
Kentucky (401 KAR 61:140 Existing by-product coke manufacturing plants)			20	Except for 10% of total number of observation recorded	0.03		20			Yes	750 in make-up water	
Maryland (COMAR 26.11.10 Control of Iron and Steel Installations)					0.1			0.03				
Michigan (R336.1331 Emission of particulate matter; R336.1352 Pushing operation fugitive emissions from coke ovens; R336.1360 Visible emissions from coke oven push stacks)			25 (20% for stack)	1 push of any 8 consecutive observations	0.1			0.095 (lb particulate/lb dry gas)			1,500	
New York (214 By-product Coke Oven Batteries)			20		0.05		20	0.05		Yes	1,600	
Ohio (3745-17 Emissions of Particulate Matter)			20								1,200 (specific source limit)	
Pennsylvania (123.13 Processes; 129.15 Coke pushing operations)			20 (10% for travel)		1			0.04 < 150,000 dscfm 0.02 > 300,000 dscfm				

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**Table 8-1
(Continued)**

State	Charging		Pushing				Coke Oven Combustion Stack			Quenching		
	PM Limit	SO ₂ limit (lb/hour)	Fugitives Opacity	Exceptions	Control Device PM Limit (lb/ton coke)	SO ₂ limit (lb/hour)	Stack Opacity	PM Limit (gr/dscf)	SO ₂ limit (lb/hour)	Baffles	TDS Limit (mg/L)	SO ₂ limit (lb/hour)
Allegheny County, PA (2105.21 Coke Ovens and Coke Oven Gas)			20 (20% for stack and 10% for travel)		0.04		20	0.015 (on or after Jan 1, 1978)		Yes	Water used for quenching should be equivalent or better quality established for nearest stream or river by regulations promulgated by DEP under 35 P.S. 691.1 et seq.	
Virginia (Article 9. Emission Standards for Coke Ovens)	^a		20		*			*	SO ₂ limit = 2.64 X MMBtu/hour			
West Virginia (45-7-3 Emission of Smoke and/or Particulate Matter Prohibited and Standards of Measurement)			20 (10% travel in open car)		0.04			0.06 (non-recovery plant)		Yes	800 (TDS) and 100 (total suspended solids) in make-up water	

^a0.15 lb/hour/ton coal charged for coking, charging, and pushing.

dscf = dry standard cubic foot

PM = Particulate Matter

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

SO₂ = Sulfur Dioxide

TDS = Total Dissolved Solids

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Table 8-2

Federal Rules for Nonrecovery Coke Oven Batteries (MACT Standards)

Emissions Unit	Rule Citation	Rule Summary	Activity
Coke Oven Doors	40 CFR 63.303(b)(1)(ii)	Demonstrate negative pressure	Monitor and record once per day the pressure of each oven or in a battery common tunnel
	40 CFR 63.303(c)(1)	Observe each door for visible emissions	Record oven number from which visible emissions occur
	40 CFR 63.303(c)(2)	Corrective actions for doors with visible emissions	Stop visible emissions within 15 minutes
Charging	40 CFR 63.303(b)(2)	Use emission control system for capture and collection of charging emissions	
	40 CFR 63.303(d)(1)	Visible emissions from charging must be $\leq 20\%$	Observe five consecutive charges/week for each charging capture system
	40 CFR 63.303(d)(2)	PM emissions from control device must be ≤ 0.0081 lb/dry ton coal	
	40 CFR 63.303(d)(3)	Visible emissions from control device stack must be $\leq 10\%$	Operator will observe stack daily for any visible emissions. If any visible emissions are seen, perform visible emissions measurement using EPA Method 9
	40 CFR 63.303(d)(4)	Operating procedures during charging	Operating procedures must address uptake damper operation during charging
Pushing	40 CFR 63.7290(a)(4)	PM limited to 0.04 lb/ton coke from mobile control device that captures emissions during travel	
	40 CFR 63.7290(b)(3)	Establish minimum volumetric flow rate	Establish minimum volumetric flow rate during performance test
	40 CFR 63.7290(b)(3)(i)	Monitor pushing fan amps	Monitor multicyclone fan amps as a surrogate for flow rate. Daily average must be above minimum
	40 CFR 63.7290(b)(4)	Monitor multicyclone pressure drop	Monitor multicyclone pressure drop. Describe in monitoring plan. Daily average must be in range
	40 CFR 63.7293(a)	Visually inspect ovens before pushing	Do not push an oven until operator verifies by looking into the oven that coking is complete
Quenching	40 CFR 63.7295(b)(1)	Quench tower baffle construction requirement	No more than 5% of the quench tower may be open to the sky
	40 CFR 63.7295(b)(2)	Quench tower baffle washing requirement	Baffles must be washed each day unless prohibited by cold temperature
	40 CFR 63.7295(a)(1)(i)	Quench water quality	Verify that the quench water TDS is $\leq 1,100$ mg/L by sampling
	40 CFR 63.7352	Acceptable make-up water	Process water is not acceptable unless it has been treated. Water from a river, lake, or stream; storm water runoff; or water used for non-contact cooling or in water seals is acceptable

CFR = Code of Federal Regulations

EPA = U.S. Environmental Protection Agency

MACT = Maximum Achievable Control Technology

PM = Particulate Matter

TDS = Total Dissolved Solids

EPA also listed limitations for specific facilities for quenching. Most quenching limits were related to requirements for baffles and/or the TDS limit in the quench water. The quench water TDS limits ranged from 750 to 1,600 mg/L. As shown in Table 8-1, some standards apply to make-up water and some to quench water. EPA set the TDS MACT standard at 1,100 mg/L for the quench water applied to the coke.

8.3 Limitations Achieved in Practice

There are three heat recovery coke making facilities in the United States: Jewell Coke Company in Vansant, Virginia (Title V Operating Permit No. SWRO 10200, 10/2/2007); Indiana Harbor Coke Company in East Chicago, Indiana (Operation Permit No. T089-11311-00382, 9/22/2006); and HNCC in Franklin Furnace, Ohio (Permit to Install 07-00511, 1/15/2008). Gateway Energy and Coke Company (GECC) is currently under construction in Granite City, Illinois (Construction Permit 119040ATN, 3/13/2008). GECC is not in operation but the permit was issued under similar circumstances. The facility was considered a major modification of PM₁₀ (as a surrogate for PM_{2.5}) in a PM_{2.5} nonattainment area and LAER was required. The PM limits for these facilities are summarized in Table 8-3. The SO₂ limits are summarized in Table 8-4. The NO_x limits are summarized in Table 8-5.

EPA's RBLC Database was searched in March 2009 to identify any emission units at coke making facilities that had been designated LAER, BACT, or reasonably available control technology (RACT) for PM/PM₁₀ (no limitations are listed for PM_{2.5}), SO₂, and NO_x. Facilities listed with BACT units for PM/PM₁₀ are listed in Table 5-1. There are two heat recovery facilities in the database. One of the heat recovery facilities is SunCoke's HNCC in Franklin Furnace, Ohio.

The other heat recovery facility is FDS Coke. FDS Coke has not been constructed. Consequently, the technology and limits for the FDS facility are not demonstrated and do not represent limitations achieved in practice.

Table 8-3

PM/PM₁₀ Limitations^a Achieved in Practice at Heat Recovery^b Coke Making Facilities

Emissions Unit	Jewell Coke Company (Vansant, Virginia)	Indiana Harbor Coke Company (East Chicago, Indiana)	Haverhill North Coke Company (Haverhill, Ohio)	Gateway Energy and Coke Company (Granite City, Illinois)^c
Coke Oven Doors	Same as MACT	Same as MACT	Same as MACT	Same as MACT
Coal Charging	Same as MACT	MACT 0.03 gr/dscf	Same as MACT	0.016 lb/dry ton coal (filterable and condensable) - LAER; filterable fraction 0.0081 lb/dry ton coal (same as MACT) 0.02 gr/dscf
Heat Recovery Coking - Main Stack	No main stack at Jewell	Filterable plus condensable PM limit - 0.03 gr/dscf (weighted average of main and waste heat stacks)	0.008 gr/dscf 10% opacity	0.008 gr/dscf - LAER; agreed to 0.005 gr/dscf in final permit
Heat Recovery Coking - Individual Waste Heat Stacks	0.92 lb/hour/oven	Filterable plus condensable PM limit - 0.03 gr/dscf (weighted average of main and waste heat stacks)	Equivalent to 0.049 gr/dscf	0.08 gr/dscf (filterable and condensable) - LAER; filterable fraction 0.049 gr/dscf
Coke Pushing	Same as MACT	PM must be ≤0.04 lb/ton coke Fugitive VEs must be ≤20% (3-minute average)	Same as MACT Fugitive VEs must be ≤20% (3-minute average)	0.08 lb/ton coke (filterable and condensable) - LAER; filterable fraction 0.04 lb/ton coke
Coke Quenching	Same as MACT	Same as MACT	MACT 0.05 lb PM ₁₀ /wet ton coal (based on AP-42 emission factor)	MACT 0.044 lb PM ₁₀ /wet ton coal - LAER (based on AP-42 emission factor)
Coke Crushing/Screening	20% opacity	PM limit - 0.03 gr/dscf	PM limit - 0.008 gr/dscf	0.008 gr/dscf - LAER
General - production	45 wet tons coal/oven	6,067.2 dry tons coal/day (equivalent to average 41.7 dry tons coal/oven or 45.3 wet tons coal/oven at 8% moist)	2,400 wet tons coal/day (equivalent to average 48 wet tons coal/oven)	1,100,000 wet tons coal/year (equivalent to average 50 wet tons coal/oven)

**Table 8-3
(Continued)**

Emissions Unit	Jewell Coke Company (Vansant, Virginia)	Indiana Harbor Coke Company (East Chicago, Indiana)	Haverhill North Coke Company (Haverhill, Ohio)	Gateway Energy and Coke Company (Granite City, Illinois)^c
General - use of waste heat stacks	No limit - >90% of flue gases vented through waste heat stacks. No HRSGs or spray dryer/ baghouse	Daily limit - 19% of flue gas through individual waste heat stacks; Annual limit - 14% of flue gas through individual waste heat stacks. Spray dryer/ baghouse maintenance not addressed in permit - handled under Illinois emergency maintenance provisions	HRSG Maintenance – one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months; Spray dryer/ baghouse maintenance not addressed in permit - handled under Ohio emergency maintenance provisions	HRSG Maintenance - one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months. Spray dryer/ baghouse Maintenance - all (6) waste heat stacks open simultaneously ≤5 days.

^aFilterable PM unless otherwise indicated.

^bHeat recovery is same coking technology as nonrecovery.

^cGateway is under construction - limits shown for comparison.

dscf = dry standard cubic foot

HRSG = Heat Recovery Steam Generator

LAER = Lowest Achievable Emission Rate

MACT = Maximum Achievable Control Technology

PM = Particulate Matter

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

Table 8-4

SO₂ Limitations Achieved in Practice at Heat Recovery^a Coke Making Facilities

Emissions Unit	Jewell Coke Company (Vansant, Virginia)	Indiana Harbor Coke Company (East Chicago, Indiana)	Haverhill North Coke Company (Haverhill, Ohio)	Gateway Energy and Coke Company (Granite City, Illinois)^b
Coke Oven Doors	No limit	No limit	No limit	No limit
Coal Charging	No limit	1.57 lb/hour (estimate - no data)	0.0003 lb SO ₂ /wet ton coal (Jewell test data)	0.0003 lb SO ₂ /wet ton coal (Jewell test data)
Heat Recovery Coking - Main Stack	No main stack at Jewell	1,656 lb/hour from main plus waste heat stacks (24-hour average)	Design for 92% removal efficiency 1.6 lb SO ₂ /wet ton coal	Design for 90% removal efficiency
Heat Recovery Coking - Individual Waste Heat Stacks	10 lb/hour/oven	1,656 lb/hour from main plus waste heat stacks (24-hour average)	Equivalent to 20 lb SO ₂ /wet ton coal	Equivalent to 18.2 lb SO ₂ /wet ton coal
Coke Pushing	No limit	1.96 lb/hour (estimate - no data)	0.05 lb SO ₂ /ton coal (1995 AWMA Conference Paper)	0.098 lb SO ₂ /wet ton coal (current AP-42 emission factor)
Coke Quenching	No limit	1.322 lb/hour (estimate - no data)	No limit	No limit
General - production	45 wet tons coal/oven	6,067.2 dry tons coal/day (equivalent to average 41.7 dry tons coal/oven or 45.3 wet tons coal/oven at 8% moist)	2,400 wet tons coal/day (equivalent to average 48 wet tons coal/oven)	1,100,000 wet tons coal/year (equivalent to average 50 wet tons coal/oven)
General - use of waste heat stacks	No limit - >90% of flue gases vented through waste heat stacks. No HRSGs or spray dryer/baghouse	Daily limit - 19% of flue gas through individual waste heat stacks; Annual limit - 14% of flue gas through individual waste heat stacks. Spray dryer/baghouse maintenance not addressed in permit - handled under Illinois emergency maintenance provisions	HRSG Maintenance - one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months; spray dryer/baghouse maintenance not addressed in permit - handled under Ohio emergency maintenance provisions	HRSG Maintenance - one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months. Spray dryer/baghouse Maintenance - all (6) waste heat stacks open simultaneously ≤5 days.
General - maximum coal sulfur	0.88%	No limit	1.30%	No limit

^aHeat recovery is same coking technology as nonrecovery.

^bGateway is under construction - limits shown for comparison.

HRSG = Heat Recovery Steam Generator
SO₂ = Sulfur Dioxide

Table 8-5

NO_x Limitations Achieved in Practice at Heat Recovery^a Coke Making Facilities

Emissions Unit	Jewell Coke Company (Vansant, Virginia)	Indiana Harbor Coke Company (East Chicago, Indiana)	Haverhill North Coke Company (Haverhill, Ohio)	Gateway Energy and Coke Company (Granite City, Illinois)²
Coke Oven Doors	No limit	No limit	No limit	No limit
Coal Charging	No limit	No limit	No limit	No limit
Heat Recovery Coking - Main Stack	No main stack at Jewell	Equivalent to 1.31 lb NO _x /dry ton coal	1.0 lb NO _x /wet ton coal	Equivalent to 1.0 lb NO _x /wet ton coal
Heat Recovery Coking - Individual Waste Heat Stacks	0.94 lb/hour/oven	Equivalent to 1.31 lb NO _x /dry ton coal	1.0 lb NO _x /wet ton coal	Equivalent to 1.0 lb NO _x /wet ton coal
Coke Pushing	No limit	No limit	0.016 lb NO _x /ton coal (Ohio EPA emission factor)	0.019 lb NO _x /wet ton coal (current AP-42 emission factor)
Coke Quenching	No limit	No limit	No limit	No limit
General - production	45 wet tons coal/oven	6,067.2 dry tons coal/day (equivalent to average 41.7 dry tons coal/oven or 45.3 wet tons coal/oven at 8% moist)	2,400 wet tons coal/day (equivalent to average 48 wet tons coal/oven)	1,100,000 wet tons coal/year (equivalent to average 50 wet tons coal/oven)
General - use of waste heat stacks	No limit - >90% of flue gases vented through waste heat stacks. No HRSGs or spray dryer/baghouse	Daily limit - 19% of flue gas through individual waste heat stacks; Annual limit - 14% of flue gas through individual waste heat stacks. Spray dryer/baghouse maintenance not addressed in permit - handled under Illinois emergency maintenance provisions	HRSG Maintenance - one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months; spray dryer/baghouse maintenance not addressed in permit - handled under Ohio emergency maintenance provisions	HRSG Maintenance - one individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤8 days/rolling 12 months. Spray dryer/baghouse Maintenance - all (6) waste heat stacks open simultaneously ≤5 days.

^aHeat recovery is same coking technology as nonrecovery.

^bGateway is under construction - limits shown for comparison.

EPA = Environmental Protection Agency

HRSG = Heat Recovery Steam Generator

NO_x = Nitrogen Oxides

Table 8-6 lists the PM results for the LAER search. All the facilities in Table 8-6 are byproduct plants, and many limitations are specific to the byproduct technology (e.g., lids, offtake piping, underfire emissions). Table 8-7 lists the SO₂ results for the LAER search, which shows only byproduct facilities. There were no facilities with NO_x results for LAER.

8.4 Air Pollution Controls

8.4.1 PM Controls for Filterable Particulate Matter

A BACT analysis for PM/PM₁₀ is presented in Section 5.0. The information about control technologies and work practices in that section also applies to PM_{2.5}. All the stack emissions were assumed to be PM_{2.5} since there is no reliable information on the distribution of PM/PM₁₀/PM_{2.5}. Only approximately 3% of the fugitive emissions are expected to be PM_{2.5}.

8.4.1.1 Selection of PM_{2.5} Controls

The pollution control devices and work practices selected as BACT and BAT also represent LAER.

In addition, the filter material used for the bags in the main baghouse will be selected for improved control of filterable PM_{2.5}. For example, this will include a membrane material, microfiber material, microfiber capped composite material, or other similar filter material that has enhanced performance for collection of fine particulate as compared to conventional woven or felt filter material. The filter material will be selected from those that have been demonstrated to provide greater than 99.99% reduction in emissions of filterable PM_{2.5} as determined by the “Generic Verification Protocol for Baghouse Filtration Products,” as used by EPA’s Environmental Technology Verification program for evaluation of filter materials or ASTM Standard D6830-02, Characterizing the Pressure Drop and Filtration Performance of Cleanable Filter Media, or other equivalent protocol.

Table 8-6

RBLC Database Search Results for LAER PM Limits at Coke Facilities

RBLC ID	Facility Name	Last Updated	Process Name	Control Description	Emission Limit	Efficiency
IL-0015	Granite City Steel (byproduct coke plant)	1/28/2002	Oven, coke pushing	Enclosed quench car/scrub system, work practice: inventory of parts, maintenance procedures	0.04 lb/ton coke	NA
			Battery stack	NA	0.015 gr/dscf	NA
			Lids	Vent from no more than 1% of lids	1% of lids	NA
			Doors	Design and parts inventory, vent from no more than 5% of ovens	5% of ovens	NA
			Charging	Fuel spec: 55 s total for five consecutive charges	No standard limit	NA
			Offtake piping	Vent from no more than 5% of piping	4% of piping	NA
IN-0012	Inland Steel Co. (byproduct coke plant)	12/18/2001	Precarbonization emissions	NA	0.031 gr/dscf	NA
			Underfire emissions	NA	0.1 lb/MMBtu	NA
			Pushing operation	NA	0.02 lb/ton coke	NA
MD-0006	Bethlehem Steel Corp. (byproduct coke plant)	1/28/2002	Charging	NA	0.0005 lb/ton	NA
			Doors	NA	0.05 lb/ton	NA
			Pushing	NA	0.03 lb/ton 0.03 gr/dscf	NA
			Quenching	NA	0.309 lb/ton	NA
			Stand pipes	NA	0.3 lb/ton	NA
			Underfire	NA	0.12 lb/ton 0.015 gr/dscf	NA

dscf = dry standard cubic foot

LAER = Lowest Achievable Emission Rate

NA = Not Applicable

PM = Particulate Matter

RBLC = RACT/BACT/LAER Clearinghouse

Table 8-7

RBLC Database Search Results for LAER SO₂ Limits at Coke Facilities

RBLC ID	Facility Name	Last Updated	Process Name	Control Description	Emission Limit	Efficiency
IN-0012	Inland Steel Co. (byproduct coke plant)	12/18/2001	Underfire emissions	NA	No standard limit	NA
			Coke oven gas desulfurization	NA	0.35 gr/100 cf H ₂ S	NA
MD-0006	Bethlehem Steel Corp. (byproduct coke plant)	1/28/2002	Oven, 80	Fuel spec: sulfur in fuel limit to 1.0% by weight	No standard limit	NA

H₂S = Hydrogen Sulfide

LAER = Lowest Achievable Emission Rate

NA = Not Applicable

RBLC = RACT/BACT/LAER Clearinghouse

SO₂ = Sulfur Dioxide

8.4.2 Sulfur Oxides Controls (SO₂ and H₂SO₄)

The primary sources of sulfur oxides emissions are the waste heat gases. Sulfur from the coal is oxidized to SO₂ and H₂SO₄. Most of the sulfur oxides are SO₂, with about 5% or less as H₂SO₄. Systems that control SO₂ also control H₂SO₄. Consequently, the focus of this section is on SO₂. Although SO₂ is also present in the emissions from pushing and charging, the concentrations are dilute (less than 1 to 30 ppm), intermittent, and emitted from mobile machinery. No SO₂ controls are technically feasible for pushing and charging.

SO₂ is released along with the volatile fraction of the coal as the coking cycle proceeds. Approximately half of the sulfur in the coal remains in the coke product. The emissions are normally released from a primary system that collects cooled flue gas from the discharge side of the HRSGs. During HRSG inspection and maintenance, the same emissions are released from individual waste heat stacks. During primary system maintenance, the emissions are released from the main stack, but the waste gases are not routed through the air pollution control device. Pre-combustion controls are technologies that prevent the formation of pollutants during the combustion process (e.g., low-sulfur coal). The post-combustion controls that were identified are add-on controls that are used to either collect the pollutants or convert the pollutants to another form (e.g., lime added to SO₂ gas to form solid CaSO₃ and CaSO₄). Note that the post-combustion controls also remove PM.

Four options were identified that could potentially be used to control SO₂ from the thermal distillation of coal during the coking process. These are listed in Table 8-8 with a range of potential control efficiencies (AP-42 Section 1.1, Bituminous and Subbituminous Coal Combustion).

Table 8-8

Potential Technologies for SO₂ Control on Waste Gas from Coking Process

Control Technology	Control Efficiency Range for Boilers
Lime Injection and Spray Dryer/Absorber	70–90%
Wet Scrubber	80–95%
Limestone Injection	25–50%
Low-Sulfur Coal ^a	40–50%

^aLow-sulfur coal is inherent to the process.

8.4.2.1 Lime Injection and Spray Dryer/Absorber

In spray dryer FGD systems, a calcium hydroxide slurry (lime mixed with water) is introduced into a spray dryer tower (see Figure 8-1). The slurry is atomized and injected into the gases, where droplets react with SO_2 as the liquid evaporates. This produces a dry product that is collected in the bottom of the spray dryer and in the particulate removal equipment. Figure 8-1 shows how lime and water (calcium hydroxide slurry) are introduced into the spray dryer tower (top center), where they mix with the gas, dry, and react with SO_2 to form CaSO_3 and CaSO_4 . A fabric filter or ESP downstream of the spray dryer removes the ash, CaSO_3 , CaSO_4 , and unreacted lime. The collected solids are either recycled back through the process or used for other offsite applications.

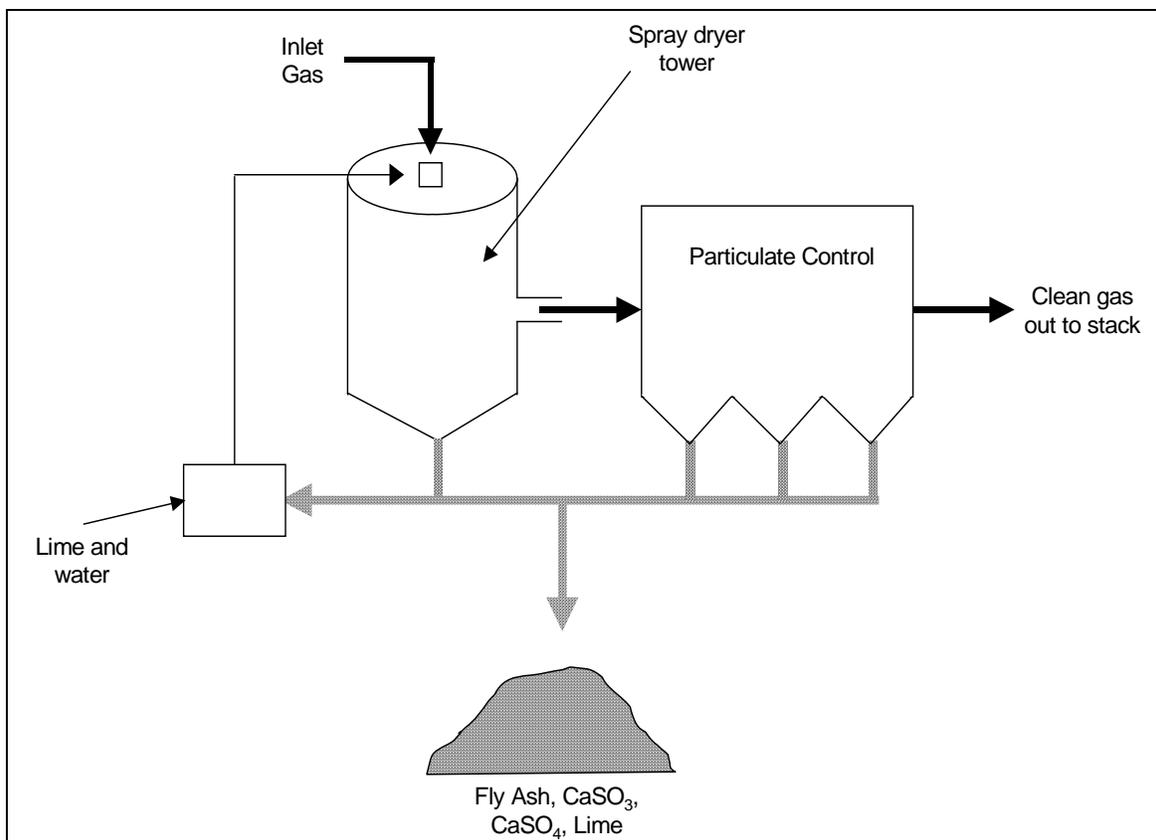


Figure 8-1. Spray Dryer Gas Desulfurization Process

This system is categorized as a “dry” system because the end product of the SO_2 conversion reaction is a dry material. Although termed as a dry system, this air pollution control

system uses water for evaporative cooling and for the SO₂ reaction. Unlike a wet scrubbing system, however, there is no liquid blow-down stream from the dry system. The “dry” system has been used in low-sulfur coal applications to effectively remove SO₂ from a gas stream with removal efficiencies from 70% to 90%.

There is a potentially significant advantage for this technology when considering mercury control. When used with activated carbon injection, the residence time in the spray dryer, followed by the efficient particulate collection of a baghouse, has the potential to effectively remove particulate mercury as well as ionic and vapor phase mercury.

This control technology (lime injection and spray dryer/absorber) is technically feasible for the heat recovery waste gas stream.

8.4.2.2 Wet Scrubber

Figure 8-2 is a simplified process flow diagram of a conventional wet scrubber. In wet scrubbers, the waste gas enters a large vessel (spray tower or absorber), where it is sprayed with water slurry (approximately 10% lime or limestone). The calcium in the slurry reacts with the SO₂ to form CaSO₃. In most utility systems, the liquor in the bottom of the spray tower is sparged with air to oxidize the CaSO₃ to CaSO₄ to enhance settling. A portion of the slurry from the reaction tank is pumped into the thickener, where the solids settle before going to a filter for final dewatering to about 50% solids. The CaSO₄ is usually mixed with fly ash and fixative lime and typically disposed of in landfills.

Note that “mist eliminators” installed at the spray tower outlet or downstream ductwork collect slurry droplets and remove moisture from the gas. In some installations, the gas is reheated to avoid corrosion downstream in the power plant. Many scrubbers have gas bypassing capability, which can be used for gas reheating. The mist that exits the scrubber contains suspended and dissolved solids that produce particles as the droplets evaporate.

Wet scrubbers may be designed for efficiency of 80–95% SO₂ removal in boiler applications. Some disadvantages for using wet scrubbing techniques in many applications are

the requirement to treat wastewater, materials must be constructed from expensive alloys to resist corrosion, and energy use is much higher.

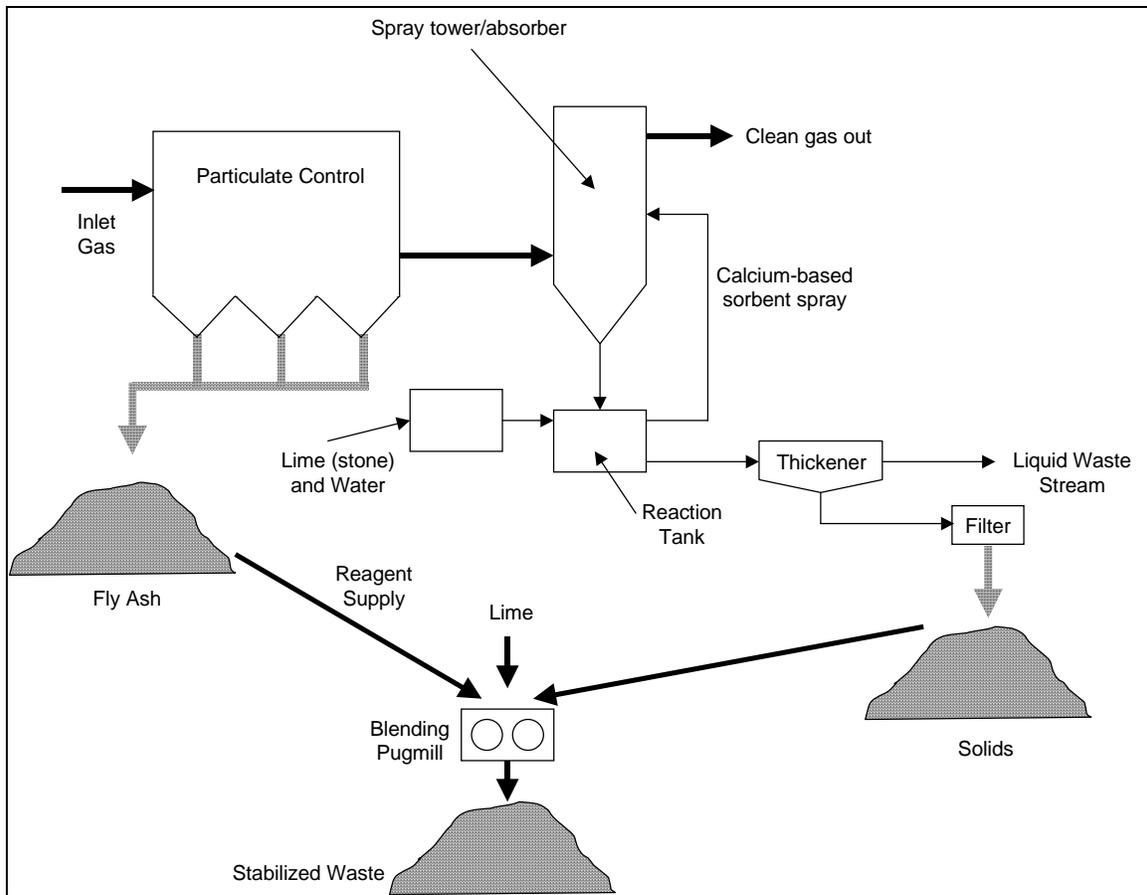


Figure 8-2. Wet Scrubber

A practical issue associated with a wet scrubber system is the complexity of the system. Additional expertise is often needed in specifying, operating, and maintaining such a system, which is more like a chemical plant than a control device. The space required for a wet system is substantial (i.e., large footprint), the systems require more maintenance due to their complexity, and more personnel are required for their operation.

A wet scrubbing system is considered technically feasible for MCC.

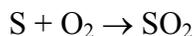
8.4.2.3 Limestone Injection

In boilers, SO₂ may be removed by injecting a sorbent (lime, limestone, or dolomite) into the combustion gases, typically above the burners or in the backpass before the air heater. Furnace sorbent injection involves injection of the sorbent into the boiler above the combustion zone (preferably where the gas temperature is approximately 1,200°C, or 2,200°F) through special injection ports. The sorbent decomposes into lime, which reacts in suspension with SO₂ to form CaSO₄. The CaSO₄, unreacted sorbent, and fly ash are removed at the particulate control device (either an ESP or baghouse) downstream from the boiler. In boilers, SO₂ removal is 30–60% (with a calcium-to-sulfur molar ratio of 2:1) when injected into the combustion zone, but this still must be demonstrated on a large scale.

The heat recovery ovens are not designed for suspension burning. Sorbent injected into the oven would settle onto the coal bed and produce contaminated coke. Similarly, the sole flues and afterburner tunnel are designed for gas combustion, and the sorbent would likely settle out. For these reasons, limestone injection is not technically feasible for the MCC coking process.

8.4.2.4 Low-Sulfur Coal

Emissions of SO₂ from fuel burning sources vary considerably with the nature or origin of the fossil fuel. The overall reaction for the formation of SO₂ from sulfur is simply



A method to reduce SO₂ emissions from fossil fuel combustion is to change to low-sulfur fuels. Stoichiometrically, 2 lb of SO₂ as generated by a typical combustion process (i.e., utility boiler) is equivalent to 1 lb of sulfur. Thus, reducing the sulfur content of the fuel proportionally decreases the generation of SO₂ during this combustion process. For example, replacing a coal containing 2% sulfur with a coal containing 1% of sulfur (i.e., low-sulfur coal) results in a decrease of SO₂ emissions of 50% from a boiler.

The conversion of coal to coke, however, may not directly parallel a boiler when it comes to low-sulfur fuels. Unlike coal-fired boilers, the coal is heated, not burned, during the coking process, and primarily it is the volatilized material from the coal that is combusted. Although approximately half of the sulfur in the coal remains in the coke, the sulfur component of the volatilized material will follow the equation above and produce SO₂.

All the heat recovery coking facilities operated by SunCoke utilize low-sulfur coal (less than 1.5%) as a requirement for the production of coke. SunCoke is the only U.S. company that operates this heat recovery process, so there are no data available on emissions using high-sulfur coal. For this reason, emission estimates incorporate low-sulfur coal, and other technologies are evaluated based on the use of low-sulfur coal in conjunction with the examined technology.

Using low-sulfur coal is technically feasible and is an integral part of the heat recovery coking process.

8.4.2.5 Minimizing SO₂ Emissions During Maintenance

SO₂ emissions can be reduced somewhat by reducing production and limiting coal sulfur. Based on operating experience, a minimum 48-hour charge of approximately 42 tons per oven (depending on ambient conditions) is necessary to provide adequate heat to protect the oven from thermal spalling and irrevocable structural damage. This would require several days to gradually reduce tonnage from typical operation to this level. This could be achieved during SD/BH maintenance due to the advanced planning required for its outage, which in turn will allow for the necessary charge ramp down time. In contrast, HRSG maintenance is generally taken opportunistically with little advance notice and would not allow sufficient time to ramp down the associated ovens. Consequently, reducing oven charge size is not a feasible alternative for decreasing SO₂ emissions during HRSG maintenance.

MCC believes it is possible to obtain acceptable metallurgical coal with a sulfur content of 1.1% for a short term event such as SD/BH maintenance. However, because MCC will not be able to segregate coal blends for individual or groups of ovens (there will only be one coal pile for storage and reclaim of a single coal blend at the Middletown facility), reducing coal sulfur is

not a feasible alternative for HRSG maintenance, which would require isolation of coal for individual ovens.

The combined effect of using lower sulfur coal and reducing coal charge will be to reduce emissions during SD/BH maintenance by approximately 28% compared to uncontrolled levels. For example, this can be accomplished using coal with a sulfur content of 1.1% and a coal charge tonnage of 42.5 tons per oven. This option is technically feasible.

8.4.2.6 Selection of SO₂ Controls

One advantage of the heat recovery coking process is that it produces no process wastewater. A significant advantage of dry scrubbing is that it provides high SO₂ removal without generating wastewater. Another advantage is that a spray dryer/baghouse system is a very effective particulate removal device, which also means minimal emissions of fine particulate (PM_{2.5}) and hazardous metals. A third advantage of the dry scrubbing option is its potential for mercury control. A fourth advantage is that spray dryer systems, when compared with wet scrubbers, typically demonstrate higher removal of acid gases like H₂SO₄ and HCl. The advantage of the wet scrubbing system is that it has potentially higher SO₂ removal.

A spray dryer/baghouse system is the best overall option for the application at MCC. SO₂ is included in this analysis as a precursor of PM_{2.5}, but more importantly, a spray dryer/baghouse has lower direct PM_{2.5} emissions than a wet scrubber. PM_{2.5} emissions will be controlled to a level of 0.005 gr/dry standard cubic foot (dscf) at MCC. In addition, the higher removal of H₂SO₄ (expected to be at least 95%) removes a more direct PM_{2.5} precursor. Even though a wet scrubbing system is theoretically feasible for use with the heat recovery coking technology, it is unknown whether this has been demonstrated. With these considerations, a dry scrubber, with an SO₂ design removal efficiency of 92%, was selected as the primary system for control of sulfur oxides and PM/PM₁₀/PM_{2.5}.

Emissions can be reduced by approximately 28% during SD/BH maintenance by limiting production and using lower sulfur coal during this relatively short (5-day) period.

8.4.3 NO_x Controls

The following sections discuss combustion controls, post-combustion controls (i.e., add-on controls), and their applicability to the heat recovery coking process. Combustion controls discussed are staged combustion and low NO_x burners (LNB). Post-combustion controls discussed are selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR).

8.4.3.1 Staged Combustion

Staged combustion controls NO_x by limiting the oxygen present at temperatures where NO_x formation is likely and/or suppressing peak temperatures that increase NO_x formation during gas combustion. The proposed heat recovery coke ovens use three discrete regions for staged combustion of the coal volatiles. The regions are the crown, the sole flues, and the waste heat tunnel. The crown is the first stage of air addition. This operates in a reducing atmosphere where minimal oxygen is present for NO_x formation.

The sole flues receive secondary air and operate in a reducing or oxidizing atmosphere as dictated by the oven gas rates. NO_x formation is minimized in the sole flues by controlling the temperatures. The final stage is the common tunnel afterburner, which is always operated in an oxidizing mode. NO_x formation is limited in this region by adding enough tertiary air to cool the gases below temperatures where NO_x is formed (1,600–2,000°F).

Staged combustion is an inherent part of the heat recovery process that results in NO_x emissions of 1 lb/ton coal (or approximately 58 ppm at 8% oxygen).

8.4.3.2 Low NO_x Burners

LNBs limit NO_x formation by controlling the stoichiometric and temperature profiles of the combustion process in each burner zone. The burner design of an LNB may create (1) a reduced oxygen level in the combustion zone to limit fuel NO_x formation, (2) a reduced flame temperature that limits thermal NO_x formation, and/or (3) a reduced residence time at peak temperature, which also limits thermal NO_x formation. Typical control efficiencies for boilers

employing LNB range from 40 to 60% (AP-42 Section 1.1, Bituminous and Subbituminous Coal Combustion).

A boiler is different from a heat recovery coke oven. External fuel is burned in a boiler that can be controlled as previously described. In a heat recovery coke oven, the volatile fraction of the coal migrates from the coal bed, and the gases are burned inside the oven system. The coal bed is converted to a coke bed over the cycle and remains in the oven. LNBs are not technically feasible for heat recovery coke ovens because the coal is not burned and there is no external fuel.

8.4.3.3 Selective Non-Catalytic Reduction

SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler. The ammonia or urea reacts with NO_x in the gas to produce nitrogen and water. The chemical reaction for nitric oxide and ammonia is as follows:



Multiple injection locations may be required within several different zones of the boiler to respond to variations in the boiler operating conditions. SNCR technologies can reduce NO_x emissions by 30–60% in coal-fired boilers (AP-42 Section 1.1, Bituminous and Subbituminous Coal Combustion).

The effectiveness of SNCR depends on the temperature where reagents are injected, mixing of the reagent in the gas, residence time of the reagent within the required temperature window, ratio of reagent to NO_x, and the sulfur content of the fuel (i.e., a high-sulfur fuel may create sulfur compounds that deposit in downstream equipment).

In the case of the heat recovery coking process, the required temperature window (i.e., 1,600–2,200°F) is (1) available for a brief period of time during the combustion cycle and (2) may occur anywhere along the coke oven battery. It is thus difficult to inject the reagent into the gas stream that is within the temperature window, since the location is highly variable. If the

injection takes place outside the temperature window, (1) the SNCR will not take place if the temperature is less than 1,600°F or (2) more NO_x will be formed with the addition of the nitrogen-rich reagent at temperatures greater than 2,200°F. For these reasons, SCNR is not technically feasible and has never been used with the heat recovery coking process.

8.4.3.4 Selective Catalytic Reduction

SCR is a post-combustion technique similar to SNCR that involves injecting ammonia into flue gas in the presence of a metal-based catalyst to convert NO_x emissions to elemental nitrogen and water. The catalyst allows SCR systems to operate at much lower temperatures than SNCR; typical temperatures for SCR are 500–800°F, compared with 1,600–2,200°F for SNCR. The optimum temperature range is 700–750°F (*EPA Air Pollution Control Cost Manual*, 2002). Potential NO_x removal in pulverized coal boilers and cyclone furnaces is 75–85% in applications with low sulfur and low fly ash (AP-42 Section 1.1, Bituminous and Subbituminous Coal Combustion).

When used with boilers, SCRs have mainly been applied to electric utilities and large industrial boilers ranging in size from 250 to 8,000 MMBtu/hour. Since boiler outlet temperatures are usually much cooler than 700°F, SCRs are often installed between the economizer and air heater. This ensures that the gases entering the SCR reactor are in the appropriate temperature range. An economizer bypass can be used to divert part of the hot flue gas around the economizer to bring the temperature into the optimum range. The temperature of the gas stream is cooled in the air heater, downstream of the SCR reactor, to the desired outlet temperature.

The HRSGs are designed to cool the waste gas stream from 1,650 to 350°F. At 350°F, the gas temperature is outside the range where SCR may be effective. The HRSGs are small units designed to produce steam from waste heat. Unlike utility boilers with economizers and air heaters, they do not contain sections within the unit where the temperature is in the range where SCR can be used. An additional difference is with the ash from heat recovery coking. The ash is composed of more volatile constituents than coal-fired boiler ash. Consequently, this particulate composition contributes to fouling of the HRSGs. This is the primary reason the HRSGs will

require annual maintenance. Since there is (1) no suitable location in the HRSGs and (2) the ash has high fouling potential, SCR is not feasible and is not known to ever have been used with the heat recovery coking process.

8.4.3.5 Selection of NO_x Controls

Combustion controls to minimize NO_x are feasible for the heat recovery coking technology and can reduce the NO_x concentration to less than 100 ppm. Staged combustion has been demonstrated to produce NO_x emissions of 1 lb/ton coal, which is approximately 58 ppm at 8% oxygen. Also, since staged combustion is a combustion control technology, it applies to coke oven emissions from the main stacks or from the individual waste heat stacks during HRSG maintenance.

Post-combustion controls are not feasible with the heat recovery coking technology. SNCR is not feasible due to the absence of a location with the correct temperature window. SCR is not feasible due to the small size of the HRSGs and their design outlet temperature.

8.5 LAER Demonstration

MCC must meet LAER for the PM_{2.5}, SO₂, and NO_x emission units discussed in this report. LAER was selected from limits in state and federal rules and limits achieved in practice. Some of the limitations are not currently achievable. The only LAER analysis found associated with the heat recovery coke making technology was by Illinois EPA for GECC, which is under construction in Granite City, Illinois.

8.5.1 LAER for PM_{2.5}

The limits proposed for PM_{2.5} are summarized in Table 8-9. These are the most stringent with the following exceptions:

- The proposed annual limit for HRSG maintenance is 10 days. The HNCC facility has an annual limit of 8 days based on one annual outage. However, experience at HNCC

has shown that two 5-day outages each year are required to adequately maintain the HRSGs. As discussed in Section 2.0, this is expected to (1) decrease the likelihood of HRSG malfunctions and (2) reduce the opportunity for corrosion in the spray dryer, baghouse, and ductwork. Decreased corrosion in the FGD system reduces the likelihood of having to take the FGD system offline for extensive repairs.

- Five days for maintenance of the FGD system is proposed. Before HNCC was constructed, it was envisioned that all FGD maintenance could be performed with the system online. However, some nonroutine activities, such as the need to inspect the inside of the spray dryer and the internal components in the baghouse, cannot be performed safely without temporarily shutting down the FGD system. This is allowed in the GECC permit but is performed at other facilities by (1) requesting permission to bypass the FGD system to prevent a malfunction or (2) shutting down the FGD system to address a malfunction. This annual maintenance is crucial to long-term viability of the air pollution control equipment. If adequate preventive maintenance is not performed, the equipment will fail, either gradually or catastrophically.

8.5.2 LAER for SO₂

MCC's emissions of SO₂ will be affected by the both the short- and long-term availability and quality of metallurgical coal after the facility begins operation. Unfortunately, the availability and quality of metallurgical coals has been subject to a number of trends and events that make the prediction and control of coal sulfur content very challenging, not just in the long but also the short term.

First, the supply of metallurgical coal in the United States has exhibited significant volatility in the last few years. Availability of coal has been impacted by several force majeure events at major U.S. metallurgical coal mines. During these events, the limited availability of alternative supplies has generally led to higher sulfur contents for replacement coals. For example, there are numerous metallurgical grade coals available in the market that have sulfur contents in the range of 1.3–1.5% and even up to 2.0%.

Second, the coal quality of existing U.S. metallurgical mines, especially with regard to sulfur, has exhibited a deteriorating trend as reserves deplete. Because of this overall market drift toward higher sulfur coal, any permit limitations regarding sulfur should be reflective of this reality.

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Table 8-9

Comparison of PM Emission Limitations Applied to Heat Recovery Coke Ovens

Emissions Unit	Proposed Control Device	MACT Standard for Nonrecovery ^a Coke Ovens	Achieved in Practice	More Stringent State Rule	More Stringent LAER/BACT Determination	Work Practice		Filterable PM/PM ₁₀ Limits ^b	
						Proposed Limit	Proposed Limit Most Stringent?	Proposed Limit	Proposed Limit Most Stringent?
Coke Oven Doors	Negative pressure design	Demonstrate negative pressure daily in each common tunnel	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		Observe each door for VEs - stop within 15 minutes	Same as MACT	None	None	Same as MACT	Yes	NA	NA
Coal Charging	Traveling hood with fabric filter	Fugitive VEs must be ≤20% (observe 5 consecutive charges/ week/system)	Same as MACT	None	None	NA	NA	Same as MACT	Yes
		Filterable PM must be ≤0.0081 lb/dry ton coal	Same as MACT	None	None	NA	NA	Same as MACT	Yes
		Stack VEs must be ≤10%	Same as MACT	None	None	NA	NA	Same as MACT	Yes
Heat Recovery Coking - Main Stack	Fabric filter, common tunnel afterburner, and lime spray dryer	None	Filterable PM limit - 0.008 gr/dscf (Haverhill)	None	None	None	None	Filterable PM limit - 0.005 gr/dscf	Yes
Heat Recovery Coking - Emissions during HRSG maintenance	Common tunnel afterburner	None	Daily limit - one individual waste heat stack open; Annual limit - each waste heat stack open for ≤8 days	None	None	One individual waste heat stack open at a time; Annual limit - each waste heat stack open for ≤10 days	No but 10 days required by experience at Haverhill	0.049 gr/dscf	Yes
Heat Recovery Coking - Emissions during spray dryer/ baghouse maintenance	Common tunnel afterburner	None	Spray dryer/baghouse bypassed for maintenance to prevent malfunction under state provisions	None	None	Spray dryer/baghouse bypassed for ≤5 days.	Same term is included in permit to construct Gateway Energy and Coke Company in Granite City PM _{2.5} Nonattainment area	0.049 gr/dscf	Yes
Coke Pushing	Hot push flat car and traveling hood with multicyclone	PM must be ≤0.04 lb/ton coke from mobile device that captures emissions during travel	Same as MACT	None - some appear more stringent but do not consider emissions during travel	None - some appear more stringent but do not consider emissions during travel	NA	NA	Filterable PM must be ≤0.04 lb/ton coke	Yes
		Inspect each oven before pushing	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		Fugitive VEs must be ≤20% (3-minute average)	Same as MACT	None	None	NA	NA	Same as achieved in practice	Yes
Coke Quenching	Baffles, water with controlled TDS	No more than 5% of the tower may be open to the sky	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		Wash baffles daily	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		TDS ≤1,100 mg/L in quench water	Same as MACT	None	None	Same as MACT	Yes	NA	NA
			0.05 lb PM ₁₀ /wet ton coal	None	None	NA	NA	0.044 lb PM ₁₀ /wet ton coal	Yes

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**Table 8-9
(Continued)**

Emissions Unit	Proposed Control Device	MACT Standard for Nonrecovery ^a Coke Ovens	Achieved in Practice	More Stringent State Rule	More Stringent LAER/BACT Determination	Work Practice		Filterable PM/PM ₁₀ Limits ^b	
						Proposed Limit	Proposed Limit Most Stringent?	Proposed Limit	Proposed Limit Most Stringent?
Coke Crushing/Screening	Fabric filter	None	0.008 gr/dscf	None	None	NA	NA	0.008 gr/dscf	Yes

^aSame as heat recovery.

^bNo limits found for PM_{2.5}.

BACT = Best Available Control Technology

dscf = dry standard cubic foot

HRSG = Heat Recovery Steam Generator

LAER = Lowest Achievable Emission Rate

MACT = Maximum Achievable Control Technology

NA = Not Applicable

PM = Particulate Matter

PM_{2.5} = Particulate Matter less than 2.5 micrometers in diameter

PM₁₀ = Particulate Matter less than 10 micrometers in diameter

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Figure 8-3 illustrates the increase and variability in coal sulfur at HNCC over the last 3 years.

Another parameter that affects SO₂ emissions is the fraction of sulfur that reports to the flue gas compared to the amount that stays in the coke. Information available when HNCC was being permitted indicated that 42–43% of the sulfur went to the flue gas (57–58% stayed in the coke). While this level is generally achievable over the course of a year, experience at HNCC has shown that up to 50% of the sulfur can go to the flue gas during shorter periods such as a day or a week. The impact of less sulfur staying with the coke is higher SO₂ levels at the inlet of the spray dryer and higher SO₂ emissions during maintenance activities.

The impact of these two variables (coal sulfur content and the percent of SO₂ to the flue gas) on the controlled emission factor for the main stack is illustrated in Figure 8-4. As the figure demonstrates, these variables can have significant affects on both controlled and uncontrolled SO₂ emissions, especially over short term periods.

Despite these challenges, MCC has proposed SO₂ limits that meet or exceed LAER for controlled emissions. Excluding planned FGD and HRSG maintenance periods, MCC will meet an annual limit of 700.8 tons/year, which is equivalent to an average of 160 lb SO₂/hour, or 1.54 lb/ton coal. This limit reflects a 92% removal efficiency for the spray dryer/baghouse system and is comparable to the annual SO₂ limit and removal efficiency at each group of 100 ovens at HNCC. The annual SO₂ limit of 1.54 lb/ton coal at MCC for the main stack is more stringent than the 1.60 lb/ton coal at HNCC and represents LAER. In addition, MCC has proposed a 24-hour emission limit of 192 lb SO₂/hour, which also represents a 92% removal efficiency, reflecting the short-term variability of coal sulfur content and the fraction of sulfur reporting to the flue gas.

The other limits proposed for SO₂ are summarized in Table 8-10. These are the most stringent with the following exceptions:

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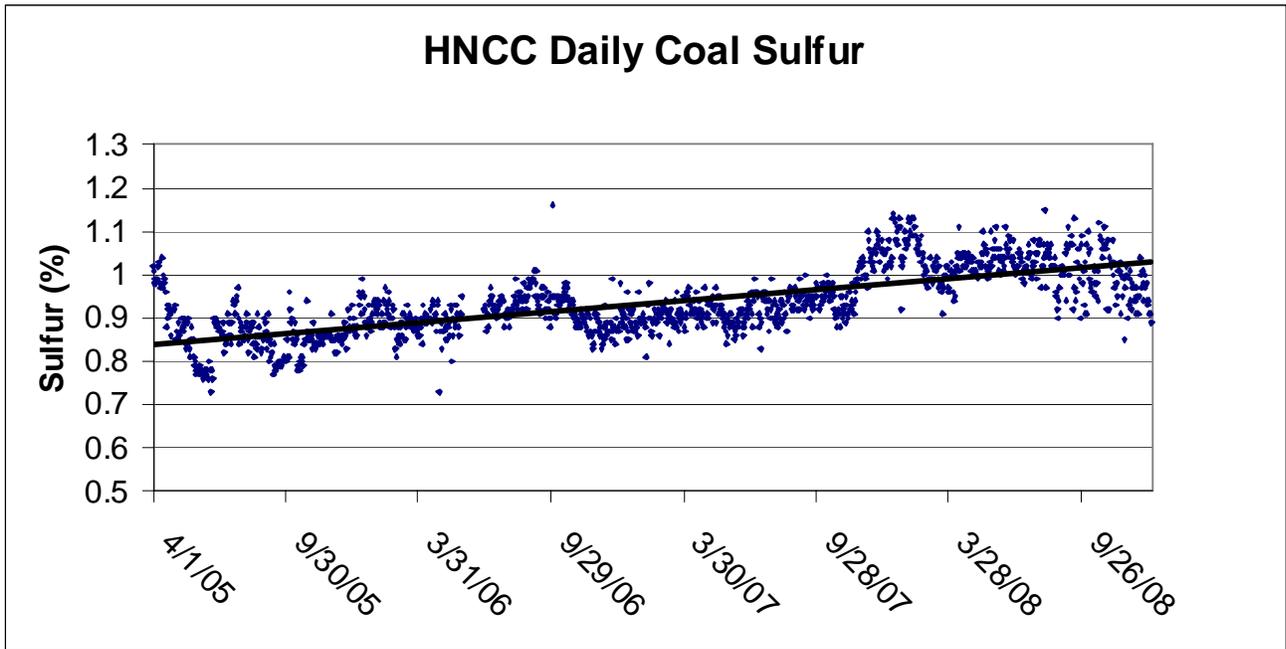


Figure 8-3. Daily Coal Sulfur Measurements at HNCC

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SO₂ Emission Factor and Fraction of Sulfur to Flue Gas (at 92% Removal)

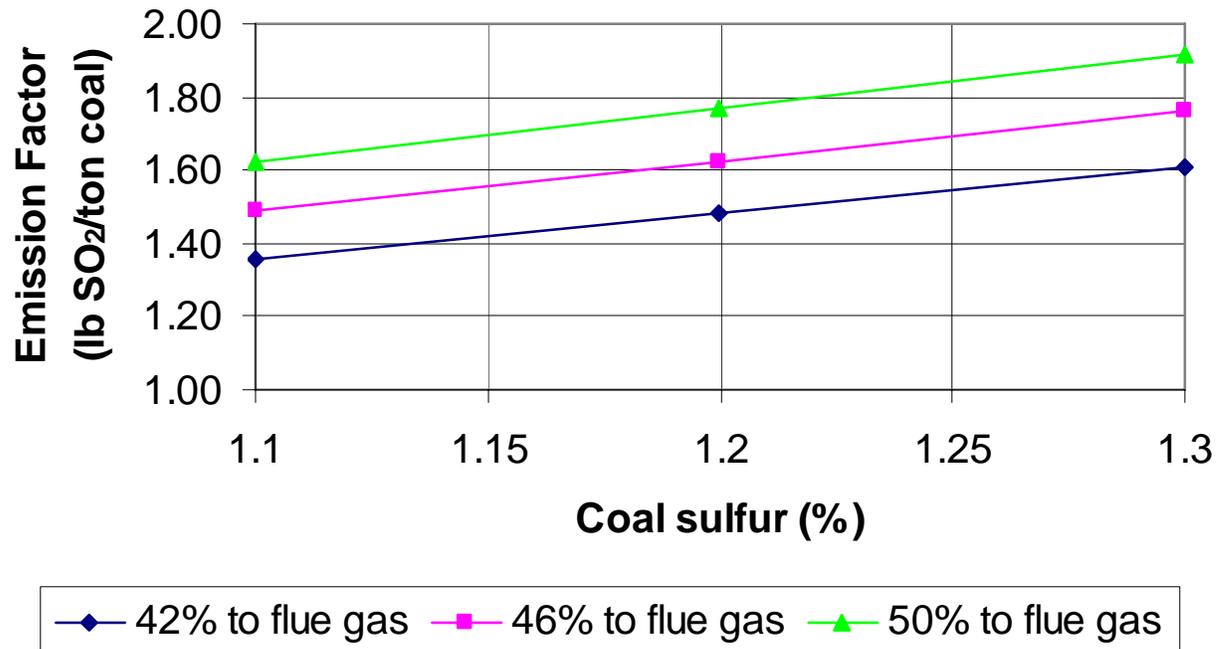


Figure 8-4. SO₂ Emission Factor and Fraction of Sulfur to Flue Gas

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Table 8-10

Comparison of SO₂ Emission Limitations Applied to Heat Recovery Coke Ovens

Emissions Unit	Proposed Control Device	MACT Standard for Nonrecovery ^a Coke Ovens	Achieved in Practice	More Stringent State Rule	More Stringent LAER/BACT Determination	Work Practice		SO ₂ Limits	
						Proposed Limit	Proposed Limit Most Stringent?	Proposed Limit	Proposed Limit Most Stringent?
Coke Oven Doors	Negative pressure design	Demonstrate negative pressure daily in each common tunnel	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		Observe each door for VEs - stop within 15 minutes	Same as MACT	None	None	Same as MACT	Yes	NA	NA
Coal Charging	Traveling hood with fabric filter	None	0.0003 lb/wet ton coal	None	None	NA	NA	0.0003 lb/wet ton coal	Yes
Heat Recovery Coking - Main Stack	Fabric filter, common tunnel afterburner, and lime spray dryer	None	Design for 92% removal efficiency	None	None	None	None	Design for 92% removal efficiency	Yes
			1.6 lb SO ₂ /wet ton coal	None	None	None	None	1.54 lb/wet ton coal (annual average)	Yes
Heat Recovery Coking - Emissions during HRSG maintenance	None	None	20 lb/wet ton coal	None	None	None	None	23.92 lb/wet ton coal	No - Higher emission factor due to short-term variability and long-term degradation of metallurgical coal supply (see text)
Heat Recovery Coking - Emissions during spray dryer/baghouse maintenance	None	None	Spray dryer/baghouse bypassed for maintenance to prevent malfunction under state provisions	None	None	Spray dryer/baghouse bypassed for ≤5 days	Same term is included in permit to construct Gateway Energy and Coke Company in Granite City PM _{2.5} Nonattainment area	Reduce emissions by 28% by minimizing coal production and coal sulfur	This activity has been performed but not previously permitted
Coke Pushing	Hot push flat car and traveling hood with multicyclone	None	Limited data - estimated or based on emission factor	None	Yes - based on old emission factor	NA	NA	0.098 lb/wet ton coal (current AP-42 emission factor)	No - previous limit based on old emission factor
Coke Quenching	Baffles, water with controlled TDS	None	Limited data	None	None	NA	NA	None - not listed in AP-42	Yes
General - maximum coal sulfur	None	None	0.88%	None	None	NA	NA	1.30%	No – proposed limit based on short-term variability and long-term degradation of metallurgical coal supply (see text)

^aSame as heat recovery.

BACT = Best Available Control Technology
 HRSG = Heat Recovery Steam Generator
 LAER = Lowest Achievable Emission Rate
 MACT = Maximum Achievable Control Technology
 NA = Not Applicable
 PM_{2.5} = Particulate Matter less than 2.5 micrometers in diameter
 SO₂ = Sulfur Dioxide

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- The expected maximum coal sulfur content at MCC is 1.3%. The Jewell facility has a limit of 0.88%. However, Jewell owns and is co-located with metallurgical coal mines that produce a coal blend with this very low sulfur content. As previously discussed, the proposed maximum coal sulfur at MCC is based on operations experience at SunCoke facilities over the past 3 years and is reflective of the short-term variability and long-term quality degradation observed in metallurgical coal markets.
- The expected vent stack emission rate during HRSG maintenance is 23.92 lb/wet coal ton. The HNCC facility has a limit of 20 lb/wet coal ton. However, since the permitting of the HNCC plants, additional operational data, as previously discussed, has demonstrated the substantial short-term variability in the fraction of sulfur that goes to flue gas. Consequently, the emission factors for MCC represent performance based on current experience at HNCC and which is expected to continue.
- There are limited data on SO₂ emissions from pushing. The proposed emission factor is the current AP-42 value. Other limits have been applied based on obsolete emission factors.

8.5.3 LAER for NO_x

The limits proposed for NO_x are summarized in Table 8-11. These are the most stringent with the following exception:

- There are limited data on NO_x emissions from pushing. The proposed emission factor is the current AP-42 value. Other limits have been applied based on obsolete emission factors.

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Table 8-11

Comparison of NO_x Emission Limitations Applied to Heat Recovery Coke Ovens

Emissions Unit	Proposed Control Device	MACT Standard for Nonrecovery ^a Coke Ovens	Achieved in Practice	More Stringent State Rule	More Stringent LAER/BACT Determination	Work Practice		NO _x Limits	
						Proposed Limit	Proposed Limit Most Stringent?	Proposed Limit	Proposed Limit Most Stringent?
Coke Oven Doors	Negative pressure design	Demonstrate negative pressure daily in each common tunnel	Same as MACT	None	None	Same as MACT	Yes	NA	NA
		Observe each door for VEs - stop within 15 minutes	Same as MACT	None	None	Same as MACT	Yes	NA	NA
Coal Charging	Traveling hood with fabric filter	None	No limit	None	None	NA	NA	No limit	Yes
Heat Recovery Coking - Main Stack	Fabric filter, common tunnel afterburner, staged combustion, and lime spray dryer	None	1.0 lb/wet ton coke	None	None	None	None	1.0 lb/wet ton coke	Yes
Heat Recovery Coking - Emissions during HRSG maintenance	Staged combustion	None	1.0 lb/wet ton coke	None	None	None	None	1.0 lb/wet ton coke	Yes
Heat Recovery Coking - Emissions during Spray dryer/baghouse maintenance	Staged combustion	None	1.0 lb/wet ton coke	None	None	None	None	1.0 lb/wet ton coke	Yes
Coke Pushing	Hot push flat car and traveling hood with multicyclone	None	Limited data - estimated or based on emission factor	None	Yes - old emission factor	NA	NA	0.019 lb/wet ton coal (current AP-42 emission factor)	No - previous permit with old emission factor
Coke Quenching	Baffles, water controlled with TDS	None	No limit	None	None	NA	NA	No limit	Yes

^aSame as heat recovery.

BACT = Best Available Control Technology
 HRSG = Heat Recovery Steam Generator
 LAER = Lowest Achievable Emission Rate
 MACT = Maximum Achievable Control Technology
 NA = Not Applicable
 NO_x = Nitrogen Oxides

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