RECEIVED

FEB 2 8 2008

ALLEGHENY COUNTY HEALTH DEPT.
AIR QUALITY PROGRAM

Prepared for:
United States Steel Corporation
Clairton Plant
Clairton, PA 15025

Installation Permit Application for the Proposed C Battery Project

ENSR Corporation
January, 2008
Document No.: 06975-355-300

ENSR | AECOM

Prepared for:
United States Steel Corporation
Clairton Plant
Clairton, PA 15025

Installation Permit Application for the Proposed C Battery Project

Prepared By

Reviewed By

ENSR Corporation
January, 2008
Document No.: 06975-355-300

ENSR | AECOM

Contents

List of Appendices

List of Tables

List of Figures

1.0 Introduction

1.1 Project Overview

The United States Steel Corporation, Clairton Plant operates 12 coke batteries at full capacity utilization produces up to 13,000 tons of coke per day from the destructive distillation (carbonization) of more than 18,000 tons of coal. During the carbonization process, approximately 225 million cubic feet of coke oven gas are produced. The volatile products of coal contained in the coke oven gas are recovered in the by-products plant. In addition to the coke oven gas, daily production of these by-products include 145,000 gallons of crude coal tar, 55,000 gallons of light oil, 35 tons of elemental sulfur, and 50 tons of anhydrous ammonia.

Clairton Plant is located approximately 20 miles south of Pittsburgh on 392 acres along 3.3 miles of the west bank of the Monongahela River. The plant was built by St. Clair Steel Company in 1901 and bought by U.S. Steel in 1904. The first coke batteries were built in 1918. The coke produced is used in the blast furnace operations in the production of molten iron for steel making. Most of the coke is used by sister plants with a portion sold in the commercial market.

The Clairton Plant is a major source of CO, NO_X, PM, PM_{10}, $PM_{2.5}$, SO_2, VOCs and Hazardous Air Pollutants (HAPs). The emission sources at the plant can be divided into four general categories

- Coke oven batteries and related equipment
- Coke By-Products and Desulfurization Plant
- Coal and coke handling facilities
- Miscellaneous facilities

United States Steel is proposing two projects that will replace some of the old coke oven batteries with new batteries. In the first project a new Battery C will replace existing Batteries 7 - 9. In the second project a new D Battery, (subject of a separate permit application), will replace Batteries 1 - 3. The new batteries will contain the latest emission control technology and will emit less air pollution per ton of coal charged and per ton of coke produced than the old batteries. The project will reduce total emissions at the facility. Due to the emission reductions, the projects will not trigger review under the Prevention of Significant Deterioration (PSD) regulations and Nonattainment New Source Review (NNSR).

1.2 The Applicant

The Applicant for this Project is United States Steel Corporation, Clairton Plant. The primary contact person with overall responsibility for the Project and this Application is:

Anton Lukac

General Manager

United States Steel Corporation, Mon Valley Works

P.O. Box 878

Dravosburg, PA 15034

Tel: (412) 675-2600

The applicant retained ENSR Corporation to prepare this application and perform supporting analyses. The primary contact person at ENSR responsible for preparation of this document is:

David Shea
ENSR Corporation
2 Technology Park Drive
Westford, MA 01886
Tel: (978) 589-3113

The Project will require an Installation Permit from the Allegheny County Health Department (ACHD). This document constitutes the permit application for the Battery C Replacement Project. **Section 2** of this document contains a detailed project description. **Section 3** presents a regulatory review, including a demonstration that the Project will not trigger review under the PSD regulations and will not trigger NNSR for $PM_{2.5}$ and ozone. **Section 4** presents the Best Available Control Technology (BACT) analysis for the new Battery C. The following appendices are included:

Appendix A	Allegheny County Health Department (ACHD) Installation Permit Forms
Appendix B	Process Flow Diagrams, Site Layout Drawings and Project Specification Sheets
Appendix C	Emission Calculations
Appendix D	Literature on the PROven® System
Appendix E	Best Available Control Technology (BACT) Backup
Appendix F	Fugitive Dust Control Plan
Appendix G	ACHD Permits List
Appendix H	U.S. Steel Compliance History

2.0 Project Description

2.1 Overview

United States Steel Corporation plans to replace existing Batteries 7, 8, and 9 at its Clairton Plant. The Project will result in a return to full production of coke while using less coke oven gas (COG) in the coking process. The table below shows past actual coal charged, COG consumed and coke produced for Batteries 7 - 9. The table compares these values with design values for Battery C. Battery C will produce more coke than currently produced on Batteries 7 - 9 while using approximately 11% less COG. A reduction in the amount of coke oven gas burned, fewer but larger ovens and installation of a low NO_X heating system will result in lower air pollutant emissions from COG combustion.

Comparison of Batteries 7 - 9 and Proposed Battery C Coke Production

	Batteries 7 – 9 (Current Actual during comparison time period)	**Battery C (Future Potential)**
No. Ovens	192	84
Coal Charged (TPY)	1,229,551	1,253,690
Coke Produced (TPY)	896,420	1,005,528
COG Consumed (MMcf/yr)	6690.00	6,123.2

The new Battery C will be located adjacent to but slightly south of the existing B Battery. The site layout in Appendix B shows the proposed location of Battery C. Battery C will utilize existing coal unloading, handling and conveying equipment. Coke produced from Battery C will be sent to the existing No. 3 coke screening station for rail car loading and offsite transport. Minor modifications will be made to No. 3 screening station to accommodate load out for an additional rail car.

Clairton Plant is located in a special $PM_{2.5}$ non-attainment area. The area is also designated as a nonattainment area for the 8-hour ozone standard and is within the Northeast Ozone Transport Region (NOTR). The Pennsylvania Department of Environmental Protection (PADEP) has submitted a request to the EPA to re-designate the Project area as attainment for the 8-hour ozone standard. For air permitting purposes, Allegheny County is treated as a moderate ozone nonattainment area. This Project will significantly reduce direct $PM_{2.5}$ emissions as well as reduce emissions of SO_2 and NO_x at Clairton, which are precursors to $PM_{2.5}$. Emissions of VOC and NO_X, which are precursors to ozone, will also be reduced. Emissions of CO and hazardous air pollutants (HAPs) will be reduced as well.

Emission reductions at the plant will be accomplished through two means: more efficient emissions control technology on Battery C and a more efficient coking process that requires less coke oven gas to be burned per ton of coal charged and ton of coke produced. A low NO_x heating system will be installed for burning COG during coking. Battery C will more effectively capture coke oven pushing emissions through use of a hood integrated with the door machine. Hot car quenching emissions will be reduced by a highly efficient dual baffle system and a taller quench tower that provides greater draft. No. 3 coke screening station emissions will be reduced using enclosures and a more efficient baghouse than currently exists. An application to install this baghouse has previously been submitted to the ACHD.

As part of the Battery C Project, United States Steel will install the PROven® system, developed by Uhde Corporation, the engineer for this project. The PROven® system (Pressure Regulated Oven) regulates pressure within each oven chamber where the collector main operates under a negative pressure during coking in order to almost eliminate fugitive emissions from the ovens during charging and coking.

The three existing underfire (or combustion) stacks are the largest sources of SO_2, NO_x and CO in Batteries 7 - 9 and the third largest emitters of particulate matter. In Battery C there will be only 84 ovens compared to the 192 ovens in Batteries 7 - 9. Although the Battery C ovens will be larger and the amount of coke produced higher than current levels, the amount of coke oven gas burned in Battery C will be 11% less per ton of coal charged due to better combustion efficiencies with the larger ovens.

Comparison of 7-9 Battery with Battery C Emission Controls

The following text presents a comparison of operations and emissions controls for Batteries 7 - 9 and Battery C.

2.1.1 Coal Handling

The general procedure for coal handling involves the transfer of coal from barges or trucks onto several conveyor belts which in turn transfer the coal into mixing bins or surge bins where the coal is stored until needed in the process. Figure B-2 in Appendix B is a flow diagram of the process. As required, the coal is transported from the surge bins into pulverizers where it is pulverized to a pre-selected size after which it is blended with a wetting agent (oil or water) to regulate the bulk density of the mixture. This mixture is stored in bunkers until a larry car picks up a specific mass (or volume) of the mixture before charging it to the ovens.

Coal is delivered presently to Clairton Plant via barges and trucks.

1. Coal from barges is unloaded using a 3-strand unloader, consisting of 47 buckets each, into an apron feeder. The apron feeder delivers the coal to a conveyor (conveyor No. 12A) which in turn delivers the coal to another conveyor (12C).

2. The coal from storage is loaded into trucks which deliver the coal to a hopper feeding a conveyor (12B) which in turn transfers the coal onto conveyor 12C.

The coal from both means (barges and trucks) finally meets at conveyor 12C after which conveyor 12D receives and transfers the coal onto shuttle conveyors 12E and 12F. Conveyors 12E and 12 F are movable conveyors which drop the coal into four silos intended for storing coal.

Each silo is equipped with two weigh belt feeders. The weigh belt feeders on the east deliver a weighed mass of coal onto conveyor 12K. Conveyor 12K delivers the coal into the primary pulverizer for Batteries 1 - 3 and 7-9. The pulverized coal drops onto a reversing conveyor 12U which transfers the coal onto conveyor 1A which then transfers the coal onto 1B.

From conveyor 1B, the coal splits into two streams; the first stream goes onto shuttle conveyor 1C to the coal bunkers for Batteries 7, 8 and 9. The second stream goes onto conveyor 1D which transfers it to shuttle conveyor 1E.

The west weigh belt feeder conveys the coal to conveyor 12P which delivers it to conveyor 12S. Conveyor 12S discharges the coal into a secondary pulverizer which pulverizes coal for the feed stream to the B Battery. The pulverized coal is transferred to the B Battery coal bunkers using seven different conveyors.

It is worthwhile to note that barring the conveyors 1A, 1B, 1C, 1D and the coal bunkers for Batteries 1 - 3 and 7-9, all the equipment is enclosed signifying controlled emission points.

The Battery C project will include new coal handling equipment in the form of a new bunker and conveyors. The future D Battery will also use this equipment. However, the shutdown of Batteries 7 - 9 will result in a significant reduction in the mass of coal conveyed to conveyors 1A, 1B, 1D, 1E and the existing coal bunkers used by Batteries 7 - 9.

The new bunker and conveyors will be similar to the existing bunkers and conveyors used on B Battery. C Battery will have the capability of using the B Battery coal handling equipment. Fugitive dust emissions from coal handling are expected to increase slightly as a result of increased use of coal.

2.1.2 Charging Coal to Ovens

The Clairton Plant operates 12 by-product coke oven batteries. By-product coke ovens are designed and operated to permit collection of the volatile material evolved from coal during the coking process. Each battery contains from 61 to 87 ovens. Coal is charged through openings in the top of the ovens. Emissions from the coke batteries during coal charging are controlled by:

- volumetric controls to ensure the proper amount of coal is charged to the oven (extra coal would block gas passages);
- stage charging, wherein not all of a larry car's hoppers are emptied at once so the exhaust system is not overwhelmed; (Larry cars receive coal from coal storage bins and are equipped with four hoppers that discharge a measured volume of coal to the oven. They move along rails on top of the battery.)
- currently in Batteries 7 - 9, steam aspirators are used in the battery offtakes to create exhaust suction to draw emissions into the collecting main;
- automatic lid lifters, where available, on newer batteries minimize the time that lids remain open;
- dual collector mains on existing Batteries 7 - 9, and
- after charging is completed, the charging holes are lidded and sealed and steam aspirators are turned off.

Batteries 7 – 9 operate as follows. A specific amount of coal (stored in the coal bunkers) is discharged from the bunker into a larry car. A larry car is an electrically operated vehicle that is capable of carrying the coal over the entire length of the battery. The process of charging begins with the positioning of the larry car over the coke oven, known as spotting. At this time, the lids on the charging ports are removed and coal is dropped from the larry car into the oven.

Steam aspiration is used to suck the gases generated in the oven chamber into the collector mains, thus reducing charging emissions. Once the larry car has passed over and dropped coal into the oven chamber, a leveling bar evens the coal out to create a uniform free space above the coal charge. This assists in the unobstructed flow of offtake emissions through the collector main to the by-product plant. In the case of Batteries 7 - 9, the ovens are maintained at a slight positive top pressure throughout the coking cycle due to the rapid evolution of gas, which may result in charging emissions and leaks from doors and lids.

With the installation of Battery C, a screw feed larry car will allow for more controlled charging of coal into the ovens. Steam aspiration will no longer be used to suck the gases into the collector main. Instead, charging emissions are expected to decrease as a result of the use of the PROven® system installed in the gas offtake of each oven system. Figure B-3 in Appendix B shows the arrangement of Battery C. The Pressure Oven

Regulated system or the PROven® system is an electronic control system that individually controls the pressure in each individual oven depending on the stage of coking that each oven is experiencing. The collector main is also maintained at a negative pressure to draw the off gases released during charging and coking thus reducing emissions. The high spikes in oven pressure currently experienced will be eliminated. A complete description of the PROven® system is provided in Appendix D.

2.1.3 Coking Process

Once the ovens have been charged with coal, the coking process begins. The walls of the ovens contain heating flues, of which half burn COG and the other half transport the residual heat from the combustion flues to a heat exchanger called a regenerator. The waste gases coming out of the heat exchanger are discharged from the combustion stack. The average coking time depends on oven conditions and the coke quality and quantity specifications of customers. Oven conditions can affect the ability of an oven to produce at the desired quality level at the design coking rate. At Clairton Plant, the coking time varies between 18 hours and 22 hours depending on demand as well as on oven conditions and the quality of coal being charged. The destructive distillation of coal produces raw coke oven gas, which is cleaned and used as a fuel in the heating flues. To prevent the entry of air into the oven during coking, a slight positive pressure is maintained in the oven. The by products of coking (gases) are carried through the offtake system to the byproduct recovery plant. At the conclusion of the coking cycle, the doors are removed and the incandescent coke is pushed by a ram into the hot car.

Atmospheric emissions during coking result from fugitive emissions (charging, offtake, door and lid leaks) and from point sources (combustion stack). Emissions from soaking and decarbonization are included in the totals for the coking process as well. Soaking refers to emissions directed to the atmosphere for a short period when the oven is disconnected from the collector main just before the doors are removed in preparation of the push, i.e., the standpipe caps are opened to the atmosphere. Coke that is still "green" would emit pollutants to the atmosphere through the stand pipes. Decarbonization emissions occur after pushing and after the doors have been replaced. The lids are kept cracked or off and the oven left empty for 20-30 minutes to burn off excess wall or roof carbon.

With the installation of Battery C and the PROven® system, the leaks from doors and lids, emissions from soaking due to poor seal between the oven and collector main, and offtake leaks will be minimized since the emissions will be conveyed to the collector main which is maintained at a negative pressure. (Refer to Figure B-3 in Appendix B).

Battery C will also burn 11% less COG per ton of coke produced currently than Batteries 7 - 9. NO_x emissions will be controlled using a low NO_X heating system. These emission reductions are a significant part of the Project.

The Battery C design production rate will be 30.67 tons of coal charged per oven for a design coking time of 18 hours to produce 23.98 tons of blast furnace coke per push. There would be 112 pushed ovens per day. A total of 3,435 tons of coal would be charged per day to produce 2,686 tons total coke per day.

2.1.4 Pushing

The existing Batteries 7 - 9 consist of 64 ovens per battery for a total of 192 ovens. Batteries 7 - 9 use a moveable hood/fixed duct system to capture pushing emissions. The system consists of a hood that covers the quench car. The hood connects to a duct, which in turn is connected to a baghouse. Coke pushing begins when the coke side door is removed and ends when the hot car enters the quench tower. During the push, gases are drawn from the quench car into the hood where they are channeled to the exhaust duct. The fan capacities on the moveable hood/fixed duct control systems have all been recently increased which has increased their capture efficiencies.

During pushing, air pollutants can be released for a short time into the atmosphere from the open door with no hood above the door. The Pushing Emission Control (PEC) system consists of a moveable hood with a stationary baghouse (PEC BH). Batteries 7 - 9 operate with one hot car that receives the hot coke from pushing, one moveable hood placed over the hot car on the coke side of the oven and two door machines. Pushing typically occurs in the following sequence:

- The door machine removes the coke side door
- The door machine takes the door to the door cleaner in the transfer area
- The hood arrives at the open oven
- The door machine returns to the open oven and lines up the coke guide with the open oven
- The quench (hot) car arrives at the open oven
- The PEC baghouse (PEC BH) is turned on
- The pusher starts pushing coke into the hot car
- When the oven is empty (i.e., all the coke is in the hot car), the hot car moves to the quench tower and the PEC BH is turned off;
- The door machine cleans the door jamb
- The door machine replaces the door

Most of the emissions from the hot coke are captured by the hood (83.6%). These emissions are directed up through the PEC BH, controlled, and the remainder emitted to the atmosphere. The PEC BH emits SO_2, NO_X, PM, VOC, CO and very small amounts of other pollutants. The current PEC BH has a permitted outlet grain loading of 0.030 gr/dscf.

The emissions not captured by the hood are called PEC fugitives.

While pushing is occurring at one oven, the second door machine has moved to another oven, spotted up and gone through the door cleaning. Once pushing at the first oven has been completed, the hood slowly moves to catch up with the door machine at the second oven.

The emissions from the open oven prior to the coke mass beginning to move are part of pushing emissions. The amount of emissions to the atmosphere depends upon the amount of time the door has been removed before the hood is in place. When the hood is in place over the hot car, the PEC BH fans are turned on and coke pushing begins.

Battery C will consist of 84 larger ovens with filling dimensions of 6 meters in height x 18 inches wide (average) x 16.7 meters in length. The PEC system on Battery C will consist of a hood that is integral to the door machine, thus reducing pushing fugitive emissions, that is, whenever a coke oven door is opened, there will be a hood to capture emissions. The hood's capture efficiency is guaranteed at 90%, thus also reducing PEC fugitives. The PEC BH will have an outlet grain loading of 0.005 gr/dscf.

2.1.5 Travel

After receiving the hot coke, the hot car travels to the quench tower. Batteries 7 - 9 all use the same quench tower. During travel the hot car is uncovered. Emissions to the atmosphere consist mainly of SO_2 released as part of the hot air rising from the coke in the car. Smaller amounts of particulates, NO_X, CO and other pollutants are also released.

For Battery C, there will be a new hot car and quench tower. Hot car travel-related emissions will be lower than those from Batteries 7 - 9 for several reasons (see Figure B-4 in Appendix B). There will be fewer trips traveling to the quench tower. Travel distance to the Battery C quench tower will be less, resulting in fewer trip miles per year. Also, the Battery C hot car will be larger than the Batteries 7 - 9. The coke in the larger Battery C hot car will have greater surface area exposed to the atmosphere, thus higher emissions per car. However, the larger hot car will have a smaller surface area to volume ratio, thus emitting less pollutant per volume or per ton of coke in the hot car. The net effect is lower annual emissions from Battery C traveling.

2.1.6 Quench Tower

Incandescent coke, after it is pushed from the ovens, is transported by means of a quench car or hot car to a quench tower. Quenching of coke minimizes it from burning from further exposure to air.

Currently, Batteries 7 - 9 use the quench tower #3. It is equipped with baffles which help capture and remove the entrained water droplets (which contain particulate matter). It is estimated that baffles control up to 87% of the PM emissions from quenching operations. It uses water from the Monongahela River as make-up which is the closest water body to the facility. Approximately 162 gallons of water are lost to evaporation during the quenching of a ton of coke.

As part of the Battery C Project, the quench tower #3 will be shut down along with the B battery auxiliary tower which will be demolished. A new quench tower (ID: P047) will be installed for the Battery C. This new quench tower will also serve as the auxiliary quench tower for the B Battery. This new quench tower will have an exit area of 1406.1 ft^2 and will have a height of 164.2 feet above grade. It will have Kiro-Nathaus baffles installed within it which are more efficient at capturing the entrained water droplets than the baffles in the quench tower currently being used by Batteries 7 - 9. In addition to the new quench tower, the Battery C system will employ a new quench car to transport the coke from Battery C to the new quench tower.

The quench sump for Battery C will be larger than Batteries 7 - 9 quench sump for better settling and thus cleaner recirculation water. It will also have a rake to remove the settled solids.

The Battery B quench tower (exit area = 774.7 ft^2 and height = 131.5 feet above grade) will serve as the auxiliary tower for quenching the coke from Battery C.

2.1.7 Coke Handling

Quenched coke is transferred from the coke wharf to one of three screening stations. No. 1 Screening Station (P034) receives coke from Batteries 1 - 3 and 7 - 9, No. 2 Screening Station (P035) receives coke from Batteries 13-15 and 19 & 20, and No. 3 Screening Station receives coke from B Battery. As part of the Project, Battery C coke will be transferred to No. 3 Screening Station. No. 1 Screening Station will receive coke from Batteries 1 - 3 only as Batteries 7 – 9 will no longer be in use.

After being quenched with water, coke is discharged onto an inclined surface called the coke wharf which allows for the drainage of excess water. The heat transfer during this time also brings the coke to a lower temperature making it safe to handle. After this, the coke is transported via conveyors to screening stations where it is segregated based on size.

At present, the hot car carries the quenched coke over the wharf where the bottom doors of the hot car open up and drop the coke onto the wharf. It is assumed that the coke coming out of the quench tower contains only moisture and no particulates. The coke is held for a period on the wharf so that the moisture attached to it evaporates. The low moisture coke is conveyed off the wharf to the screening station. In the screening station, a metal screen sifts and separates the coke based on size. During this time, a surfactant is added to the coke as a dust suppressant. The large fractions, known as blast furnace coke are dropped from the screening station into a rail car while the small fractions, known as coke breeze are dropped into a bin then into a truck. Additional surfactant is mixed with the coke breeze at this time to prevent particulate emissions during transport.

In the future, the new quench car of Battery C will dump the quenched coke on the wharf where most of the moisture will be evaporated from the coke. The coke will be transferred from the wharf onto the conveyor B1 (currently being used by the B Battery) from where it will drop onto the conveyor B2 which will carry the coke into the No 3 screening station (currently being used by B Battery). The No. 3 screening station will be equipped with a new bag house (fabric filter) for particulate collection. It will also have a two track loadout (similar to No. 1 screening station). The blast furnace coke will be dropped into rail cars and the coke breeze will be dropped into trucks. Since the conveyors B1 and B2 as well as the No. 3 screening station are enclosed, emissions of pollutants are collected and controlled. The coke breeze loadout emissions will be captured by a dedicated dust capture hood. The new bag house will have an outlet grain loading of 0.005 grains per dry standard cubic feet.

2.2 Summary of Emissions

The **Tables 2-1 and 2-2** below present total emissions from Battery C and from Batteries 7 - 9. Emissions for Battery C are the maximum allowable at design capacity. Emissions for Batteries 7 - 9 are baseline actual annual emissions derived from a 2-year period starting May 1, 2002 and ending April 30, 2004. Emissions are presented for each pollutant and component of the processes involved in making coke. The **Tables 2-1 and 2-2** indicate that emission decreases will be achieved for most process components.

Table 2-1 Baseline Actual Emissions for Batteries 7-9, Quenching during May, 2002 through April 2004

	Actual Annual Emissions for BATTERIES 7-9						
PROCESS	**NO_x**	**SO_2**	**VOC**	**PM TOTAL (filt+cond)**	**PM_{10} TOTAL (filt+cond)**	**$PM_{2.5}$ TOTAL (filt+cond)**	**CO**
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140
WITHOUT HOOD							
Pushing Fugitives	0.2	1.3	1.0	5.9	3.2	2.0	0.8
WITH HOOD							
PEC BH	13.5	50.5	3.1	15.2	7.2	3.5	33.9
Traveling	10.9	40.6		23.2	8.7	3.2	8.7
PEC fugitives	0.7	2.6	29.8	169.8	94.5	58.8	22.1
Quenching		10.4	35.5	367.1	297.0	226.9	
STACK TOTAL (from Stacks_2006)	1035.0	102.4	6.7	82.0	100.4	98.5	418.0
Ball Mill				0.015	0.015	0.015	
Soaking	0.6	60.9	3.7	9.2			
Decarbonization							715.6
Fugitives							
Doors			6.8	5.5			3.4
Lids			0.0	0.01			0.01
Charging			0.4	0.4			0.2
Offtakes			0.2	0.2			0.1
TOTAL	**1061.1**	**269.2**	**87.3**	**690.4**	**517.3**	**398.7**	**1203.0**

Table 2-2 Future Allowable Emissions for Battery C, Quenching

PROCESS	Future Allowable Emissions for BATTERY C						
	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.006	0.021	0.004	0.484	0.250	0.234	0.005
WITHOUT HOOD							
Pushing Fugitives	0.2	1.2	0.9	5.5	3.0	1.9	0.8
WITH HOOD							
PEC BH	14.5	54.0	1.4	33.5	14.8	6.1	34.6
Traveling	6.4	24.1		13.8	5.2	1.9	5.2
PEC fugitives	0.8	3.0	18.5	108.0	59.7	36.9	14.7
Quenching		11.6	39.8	98.4	95.9	93.4	
STACK TOTAL (from Stacks_2006)	461.2	105.2	7.2	16.1	15.6	15.3	319.7
Ball Mill				0.016	0.016	0.016	
Soaking	0.3	31.0	1.9	4.7			
Decarbonization							628.9
Fugitives							
Doors			2.6	2.2			1.3
Lids			0.1	0.1			0.04
Charging			0.5	0.4			0.2
Offtakes			0.1	0.1			0.1
TOTAL	**483.4**	**230.1**	**73.1**	**283.2**	**194.5**	**155.8**	**1005.5**

3.0 Applicable Regulations

This section discusses local, state and federal air quality regulations applicable to the proposed Battery C replacement project. The following air regulations have been reviewed for applicability to the Project.

Regulatory Program	Citation	Applicable	Non-Applicable	Comments
Installation Permit	§2102.04	X		Required before commencing construction
Installation Permit for New and Modified Major Sources	§2102.05		X	Not applicable because net emissions change < 0.0 tons per year
New Source Review - Nonattainment Area	§2102.06		X	Netting out of Nonattainment Review
New Source Review - PSD Program	§2102.07		X	Netting out of PSD Review
Title V Operating Permit	§2103.14	X		Modify existing draft Title V permit
Allegheny County Emission Standards	§2104	X		Standards for coke screening, coal pulverizers
Allegheny County Source Operating Standards	§2105	X		Standards for charging, doors, offtakes, pushing, combustion stacks, quenching, COG
NESHAPS	40 CFR 63 Subpart L	X		Leaks from Coke Ovens
NESHAPS	40 CFR 63 Subpart CCCCC	X		Pushing, Quenching, Battery Stack

3.1 Allegheny County Health Department Rules and Regulations, Article XXI Air Pollution Control

This Installation Permit Application document has been prepared in order to address all the requirements outlined in Article XXI of the ACHD regulations.

§2102.04 Installation Permits

This Section requires United States Steel to obtain an Installation Permit (Permit) to install the proposed Battery C project. This section also describes the standards for issuance of the Permit and what must be included in the application. These include:

- Identification of other Permits issued by the Department (see Appendix G)
- Nature and amount of emissions from the sources affected
- Location, design, construction and operation of the sources affected and from associated mobile sources;
- Compliance with NAAQS in attainment areas and no interference with achievement of reasonable further progress in non attainment areas (modeling to be submitted separately)
- Compliance with all applicable emissions limits established by this Article
- Application of Best Available Control Technology (BACT) for new sources;
- Compliance with applicable NSPS, MACT and NESHAPS standards;
- Compliance with all applicable requirements of the Air Pollution Control Act by all existing air pollution sources within the Commonwealth which are required to have operating permits;
- A plan to prevent fugitive dust from becoming airborne during construction (See Appendix F)

§2102.05 Installation Permits for New and Modified Major Source

This Section would apply to the Project if the Project increases the amount of any air contaminant emitted by the source or if the Project results in the emission of any air contaminant not previously emitted.

Requirements of this Section include:

- Interstate notification
- Public hearing and notice

§2102.06 Major Sources Locating in or Impacting a Nonattainment Area

This section applies to any major new sources and to any major modification of an existing source which is located in a nonattainment area or transport region of the County or which will have a significant impact on any nonattainment area or transport region.

The Clairton Plant is located in a $PM_{2.5}$ nonattainment area and within the Northeast Ozone Transport Region (NOTR). However, this Section of the regulations does not apply to the Project because the Project will not be a major modification, that is, it will produce emission increases that are less than the emission rate thresholds specified in 25 Pa. Code §127.203 for PM_{10} (used as a surrogate for $PM_{2.5}$)[1] and less than the proposed emission rate thresholds for direct $PM_{2.5}$ emissions and significance levels for $PM_{2.5}$ precursors SO_2 and NO_X (Federal Register /Vol. 70, No. 210/ Nov. 1, 2005 /Proposed Rules, pp. 66034

---

[1] While EPA finalized certain provisions of the PM2.5 implemented rule on April 5, 2007, EPA has not finalized the PM2.5 implemented rule for NSR.

http://www.epa.gov/pmdesignations/documents/Sep05/PM25_proposed_impl_rule.pdf). The Project will also produce less than significant increases for NO_x and VOC which are precursors to ozone formation. The significance levels that trigger review under §2102.06 are listed in 25 Pa. Code §121.1 and are:

Nonattainment Review Thresholds for $PM_{2.5}$

PM_{10} (surrogate for $PM_{2.5}$)	15 TPY (April 5, 2005 EPA memo from Stephen Page)
Direct $PM_{2.5}$ (proposed)	10 TPY (Federal Register /Vol. 70)
Precursor emissions of SO_2, NO_x	40 TPY SO_2, 40 TPY NO_x (Federal Register /Vol. 70)

Nonattainment Review Thresholds for Ozone in NOTR

NO_x	40 TPY (25 Pa. Code §121.1)
VOC	40 TPY (25 Pa. Code §121.1)

Section 3.2 presents a demonstration that nonattainment New Source Review does not apply to the Project.

At the request of the ACHD, USS Corporation will submit a $PM_{2.5}$ dispersion modeling analysis sometime in February, 2008.

§2102.07 Prevention of Significant Deterioration

This Section adopts the PSD requirements in 40 CFR §52.21. Section 3.2 below presents a demonstration that PSD review does not apply to the Project.

Part C – Operating Permits

§2103.14 allows a company to apply for an administrative Amendment to its current Title V Operating Permit to incorporate the requirements from Installation Permits. U.S. Steel Clairton Plant does not have a Title V permit. The ACHD has issued a draft Title V permit for comment.

Part D – Pollutant Emission Standards

§2104.01 Visible Emissions

This Section limits opacity from any source to an aggregate of 20% within any 3-minute period and a maximum of 60% (instantaneous) never to be exceeded. This Section does not apply to the Battery C but would apply to coal and coke handling and to the Battery C quench tower.

§2104.02 Particulate Mass Emissions

This Section contains limits for particulate matter from the No. 1 and No. 2 coal pulverizers at Clairton Plant. Limits are in grains per ton of coal. This Project will not affect these limits.

This Section also requires an emission control device on No. 3 Coke Screening Station and limits particulate to 2.8 grains/ton of coke at any time. Coke produced by Battery C will use No. 3 Screening Station. This emission limit is in error and is being revised by ACHD to 0.0065 gr/dscf.

§2104.04 Odor Emissions

This Section prohibits off property odors.

§2104.05 Materials Handling

This Section prohibits visible off property emissions generated by material handling.

§2104.07 Stack Heights

This Section incorporates the Federal stack height regulations and prohibits taking dispersion credit for stacks taller than Good Engineering Practice (GEP) height.

§2104.08 National Emission Standards for Hazardous Air Pollutants

This Section incorporates the Federal regulations. See **Section 3.3** below for specific NESHAP applicability to the Battery C Project.

§2105.21 Coke Ovens and Coke Oven Gas.

This Section regulates existing coke oven operations at the Clairton Plant, including visible emissions from charging, visible emissions from doors, charging ports and offtake piping. Pushing operations must have a control device that meets Best Available Control Technology (BACT). Mass emission limits and opacity limits are established for the control device. Particulate emission limits are set for the Battery combustion stacks. Quenching must use clean water and the coke quenching emissions must be vented through a baffled quench tower. Unburned coke oven gas must not be vented into the open air unless the hydrogen sulfide content of the gas meets a specified limit. Testing requirements are listed.

Enforcement Orders and Consent Decrees and Agreements

Section 202.E. Order Requiring Monthly Reports to Determine Compliance with Sections 520 and 530 of Article XX at U.S. Steel Clairton Works, March 28, 1990.

Requires reporting of monthly coke plant operation to the ACHD.

Enforcement Order No. 200 Upon Consent, November 18, 1999.

United States Steel Clairton Plant shall operate and maintain two Claus Plants, the HCN Destruct Unit, Vacuum Carbonate Unit, Heat Exchangers and Pumps, and report the breakdown or unavailability of these pieces of equipment.

Second Consent Order and Agreement

This Order requires quenching emissions to be vented through a baffled quench tower (page 15 in paragraph V.G. of the Order). Required reporting of quenching in violation of paragraph V.G. is referenced on page 38 in paragraph XIII.A.5.

3.2 Prevention of Significant Deterioration and Non-attainment New Source Review Applicability Analysis

This Section presents an analysis demonstrating NSR non-applicability for the proposed Battery C project only. Project design for the D Battery project has not advanced to the point where a non-applicability analysis can be performed. United States Steel recognizes the possibility that splitting the non-applicability analysis could be interpreted as segmentation in order to avoid triggering NSR. Each project separately or as an aggregate will provide a net emission decrease and not trigger NSR.

3.2.1 Regulatory Background

Allegheny County is designated as attaining the National Ambient Air Quality Standards (NAAQS) for SO_2, PM_{10}, CO and NO_2 and non-attaining for $PM_{2.5}$ and ozone. The pollutant SO_2 is considered a precursor of $PM_{2.5}$ and is likely to be treated as a non-attaining pollutant under forthcoming $PM_{2.5}$ regulations. Similarly VOC is a precursor for ozone. NO_x is considered a precursor for both $PM_{2.5}$ and ozone. Both VOC and NO_x are likely to be treated as non-attainment pollutants for purposes of major new source review.

The Prevention of Significant Deterioration (PSD) regulations apply to new major sources and major modifications located in areas that are attaining the NAAQS. As a coke battery, the Clairton Plant is one of the twenty-eight major source categories listed in the PSD regulations (40 CFR 52.21). Existing potential emissions from this facility exceed 100 tons per year for at least one pollutant. Therefore, the coke plant is a major source. For the Battery C Project to be a major modification, that is, for it to undergo PSD review, the net change in emissions due to the Project plus other contemporaneous increases and decreases in actual emissions would have to exceed PSD significance levels for at least one pollutant. U.S. Steel expects that there will be a net decrease in facility-wide emissions due to the project for attaining pollutants (SO_2, NO_2, PM_{10} and CO).

Final rules for implementing the $PM_{2.5}$ regulations for New Source Review in nonattainment areas (NNSR) have not been promulgated. Interim policy is to use PM_{10} as a surrogate for $PM_{2.5}$. ENSR expects that the final $PM_{2.5}$ NNSR rules will be issued in January 2008 and that they will contain procedures for calculating net changes in direct $PM_{2.5}$ emissions and for precursor emissions (SO_2 and NO_x). Therefore, we will calculate net changes in these emissions as well.

In this project, NNSR Nonapplicability analysis for $PM_{2.5}$ will be done in two ways: Alternative 1 will assume that PM_{10} is the surrogate for $PM_{2.5}$ and Alternative 2 will assume that the plant's direct emissions of $PM_{2.5}$ and its precursors NO_x and SO_2 are accounted for in determining NNSR applicability.

3.2.2 *Overview of Emissions Netting Procedures*

In assessing PSD and NNSR applicability, ENSR will use the following procedures described in PADEP's Pennsylvania Code, Subchapter E, § 127.203a.:

1. Calculate the future allowable emissions for the new units; if the future emissions from the new units exceed PSD and/or NNSR significance levels, then
2. Calculate baseline actual emissions for existing units affected by the Battery C Project, that is, existing units that will be shut down and units whose emissions will increase or decrease, and
3. Calculate contemporaneous emission changes associated with minor source permits;
4. Subtract emissions calculated in steps 2. and 3. from those in step 1. to determine the net emissions change resulting from the Project. If the difference is less than the PSD and NNSR significance limits, the project is considered a minor modification and PSD and NNSR will not apply.

3.2.2.1 Calculating Future Allowable Emissions from New Equipment

The Project will involve a complete replacement of Batteries 7, 8, and 9 by Battery C. The following new emission sources will be installed:

- C Coke Oven Battery "C":
    - o Coal charging, including coal bunker and conveyors
    - o Coking
        - Doors
        - lids,
        - offtakes,
        - decarbonization,
    - o soaking
    - o pushing (PEC Baghouse, PEC fugitives, uncontrolled pushing)
    - o travel to the quench tower and,
    - o combustion stack
- Battery C Quench Tower

Some of the future allowable emissions have been provided by Uhde Corporation, the design and construction firm on this project. However, Uhde Corporation was not able to provide guaranteed emission rates for all segments of the process. Therefore, for some segments, U.S. Steel is using its engineering judgment.

3.2.2.2 Calculating Baseline Actual Emissions

U.S. Steel will calculate baseline actual emissions for affected units. These include:

- Coal handling (there will be an increase in coal handling due to the Project)
- Batteries 7-9 (to be shut down)
- #3 Quench Tower serving Batteries 7-9 (to be shut down)
- # 1 and # 3 coke screening station (there will be less use of # 1 Screening Station and greater use of # 3 Screening Station and new air pollution control equipment will be installed on # 3 Screening Station).

Allegheny County Health Department's (ACHD) air pollution regulations are codified in Article XXI Air Pollution Control. These regulations do not include guidance on calculating baseline actual emissions. Therefore, we are using Pennsylvania Department of Environmental Protection (PADEP) guidance contained in Pennsylvania Code, Subchapter E New Source Review, § 127.203a. Applicability (a) (4) (i) which states that

> "for an existing emissions unit, baseline actual emissions are the average rate, in TPY, at which the unit emitted the regulated NSR pollutant during a consecutive 24-month period selected by the owner or operator within the 5-year period immediately prior to the date a complete plan approval application is received by the Department. The Department may approve the use of a different consecutive 24-month period within the last 10 years upon a written determination that it is more representative of normal source operation."
>
> "The average rate includes fugitive emissions to the extent quantifiable and emissions associated with startups and shutdowns; the average rate does not include excess emissions including emissions associated with upsets and malfunctions"
>
> "The average rate is adjusted downward to exclude non compliant emissions...."
>
> "The average rate is adjusted downward to exclude emissions that would have exceeded an emissions limitation with which the facility must currently comply...
>
> "For a regulated NSR pollutant, when a project involves multiple emissions units, the same consecutive 24-month period must be used to determine the baseline actual emissions for the units being changed."

U.S. Steel plans to submit the installation permit application on January 2, 2008. U.S. Steel assumes that ACHD will deem the application complete on or before February 2, 2008. Therefore, the 5-year look back period would begin February 2, 2003 and end February 1, 2008. USS is requesting to use a 24-month period beginning May 1, 2002 and ending April 30, 2004. A total of nine months in this period is prior to the 5-year look back period that begins February 2, 2003. U.S. Steel is requesting a different 24-month period because:

- Coal deliveries were interrupted from December 2003 through February, 2004 and again from December 2004 through February 2005, causing a shortage of coal on site, thus limiting the amount of coal that could be charged to the batteries. Batteries 1 - 3 and 7 – 9 were particularly affected.
- Batteries 7 - 9 are now taking approximately 20-22 hours to produce higher stability coke rather than the design 18 hour period. The longer coking times are required in order to meet customer requirements. Battery C would be able to produce the same higher quality coke in 18 hours. The longer overall coking times in 7 -9 Batteries result in lower coke production than desired.
- The number of ovens available for coke production has been decreasing due to oven conditions and increased oven refractory maintenance.

3.2.2.3 Contemporaneous Emission Changes

Again, the ACHD regulations do not define contemporaneous emission changes. The PADEP regulations [§ 127.203a.(a)(ii)(B)(I)] define contemporaneous emissions changes as follows:

"An increase or decrease in actual emissions is contemporaneous with the increase from the particular change only if it occurs between the date 5 years before construction on the project commences and the date that construction on the project is completed. Construction is planned to start July 1, 2008 and end by June 1, 2011. Therefore, the contemporaneous period for this project begins June 1, 2003 and will end June 1, 2011."

3.2.3 Future Allowable Emissions from New Equipment

New equipment associated with the proposed Battery C project will consist of the proposed Battery C including coal handling and the Battery C quench tower. Modifications will also be made to the existing # 3 coke screening station to accommodate additional coke handling, although no change in the size of the proposed baghouse is expected. Descriptions of the new equipment and equipment modifications are presented in **Section 2.2**

Future allowable emissions are presented in **Table 3-1** for the proposed Battery C including the new quench tower.

3.2.4 Baseline Actual Emissions

Baseline actual emissions were calculated for the period May 1, 2002 through April 30, 2004 as mentioned in **Section 1.2.2**. Baseline actual emissions were calculated for the following affected processes: coal handling, Batteries 7-9, Batteries 7-9 quench tower and # 1 and # 3 coke screening stations.

Table 3-2 presents baseline actual emissions for Batteries 7 - 9 and quenching.

3.2.5 Contemporaneous Emission Changes

The only emission change during the contemporaneous period will be those associated with increased coal handling due to Battery C and emission changes associated with coke handling operations. Table 3-3 presents contemporaneous emission changes for coal and coke handling Coal handling at the Clairton Plant associated with other processes that are not affected by the Project (e.g., coal charged in Batteries 7 – 9) are not included in Table 3-3.

Coal handling emissions will be affected by the Project because additional coal will be offloaded from the barges, pulverized, sent to a surge bin, conveyed to Battery C and charged in Battery C. Less coke will be processed in # 1 screening station because that station will not be used by Battery C. More coke will be processed in # 3 screening station because, in the future, Battery C will also use that station.

Table 3-1 Future Allowable Emissions from Battery C, Quench Tower

PROCESS	Future Allowable Emissions for BATTERY C						
	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.006	0.021	0.004	0.484	0.250	0.234	0.005
WITHOUT HOOD							
Pushing Fugitives	0.2	1.2	0.9	5.5	3.0	1.9	0.8
WITH HOOD							
PEC BH	14.5	54.0	1.4	33.5	14.8	6.1	34.6
Traveling	6.4	24.1		13.8	5.2	1.9	5.2
PEC fugitives	0.8	3.0	18.5	108.0	59.7	36.9	14.7
Quenching		11.6	39.8	98.4	95.9	93.4	
STACK TOTAL (from Stacks_2006)	461.2	105.2	7.2	16.1	15.6	15.3	319.7
Ball Mill				0.016	0.016	0.016	
Soaking	0.3	31.0	1.9	4.7			
Decarbonization							628.9
Fugitives							
Doors			2.6	2.2			1.3
Lids			0.1	0.1			0.04
Charging			0.5	0.4			0.2
Offtakes			0.1	0.1			0.1
TOTAL	**483.4**	**230.1**	**73.1**	**283.2**	**194.5**	**155.8**	**1005.5**

Table 3-2 Baseline Actual Emissions from Batteries 7-9

PROCESS	Actual Annual Emissions for BATTERIES 7-9						
	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140
WITHOUT HOOD							
Pushing Fugitives	0.2	1.3	1.0	5.9	3.2	2.0	0.8
WITH HOOD							
PEC BH	13.5	50.5	3.1	15.2	7.2	3.5	33.9
Traveling	10.9	40.6		23.2	8.7	3.2	8.7
PEC fugitives	0.7	2.6	29.8	169.8	94.5	58.8	22.1
Quenching		10.4	35.5	367.1	297.0	226.9	
STACK TOTAL (from Stacks_2006)	1035.0	102.4	6.7	82.0	100.4	98.5	418.0
Ball Mill				0.015	0.015	0.015	
Soaking	0.6	60.9	3.7	9.2			
Decarbonization							715.6
Fugitives							
Doors			6.8	5.5			3.4
Lids			0.0	0.01			0.01
Charging			0.4	0.4			0.2
Offtakes			0.2	0.2			0.1
TOTAL	**1061.1**	**269.2**	**87.3**	**690.4**	**517.3**	**398.7**	**1203.0**

Table 3-3 Contemporaneous Emission Changes from Coal Handling

COAL HANDLING	Pulverizer				Unloader			Pedestal Crane	Coal Transfer	Boom Conveyor	Bins and Bunkers	Storage Piles	TPY
	#1 Pri	#1 Sec	#2 Pri	#2 Sec	#1	#2	Clamshell					acre*day	
Batteries 7-9 (tons per period)	**2,459,102**	**-**	**-**	**-**	**2,336,147**	**-**	**368,865**	**122,955**	**2,459,102**	**221,319**	**2,459,102**	**24,591**	
Emission Factors (lb/ton coal)													
PM$_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM$_{10}$	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
PM$_{2.5}$	0.18	-	-	-	0.14	-	0.02	0.01	0.20	0.01	0.00	25.57	13.1
PM$_{10}$	0.71	-	-	-	0.42	-	0.07	0.02	0.64	0.04	0.00	25.57	13.7
TSP	3.55	-	-	-	0.91	-	0.14	0.05	1.35	0.09	0.01	56.81	31.4
Battery C (tons per year)	**940,268**	**940,268**			**1,191,006**		**250,738**	**125,369**	**1,253,690**	**150,443**	**1,253,690**	**12,537**	
Emission Factors (lb/ton coal)													
PM$_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM$_{10}$	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
PM$_{2.5}$	0.07	0.12	-	-	0.07	-	0.01	0.01	0.10	0.01	0.00	13.04	13.4
PM$_{10}$	0.27	0.47	-	-	0.22	-	0.05	0.02	0.33	0.03	0.00	13.04	14.4
TSP	1.36	2.37	-	-	0.46	-	0.10	0.05	0.69	0.06	0.00	28.96	34.0

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
PM$_{2.5}$	13.069	13.431	0.362
PM$_{10}$	13.741	14.424	0.683
TSP	31.448	34.048	2.600

Table 3-4 Contemporaneous Emission Changes from Coke Handling

COKE HANDLING	Coke Pile (Load & unload)	Coke Transfer	Screen Stn.	Screening Stn. Loadout	Coke Pile Erosion	TOTAL
					Acre*day	TPY
Batteries 7-9 (tons per period)	**4,124**	**1,792,841**	**1,792,841**	**1,792,841**	**17,570**	
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	6.36	0.24	0.18	4.57	5.7
PM_{10}	0.01	6.36	0.75	0.63	4.57	6.2
TSP	0.03	13.45	1.58	0.90	10.19	13.1
Battery C (tons)	**2,313**	**1,005,528**	**1,005,528**	**1,005,528**	**9,854**	
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	3.57	0.13	0.10	2.56	6.4
PM_{10}	0.01	3.57	0.42	0.35	2.56	6.9
TSP	0.02	7.54	0.89	0.50	5.72	14.7
Note: Emission factors for storage piles are in lb/(acre*day)						

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
$PM_{2.5}$	5.68	6.37	0.69
PM_{10}	6.16	6.91	0.75
TSP	13.07	14.66	1.59

Table 3-5 Results of Emissions Netting Analysis

PSD and NONATTAINMENT NEW SOURCE REVIEW APPLICABILITY ANALYSIS

	Emission Increases due to C Battery			Emission Decreases due to Retirement of 7-9 Batteries			APPLICABILITY ANALYSIS				
Pollutant	Installation of Battery C	Coal Handling Battery C	Coke Handling Battery C	Retirement of Batteries 7-9	Coal handling Battery 7-9	Coke handling Battery 7-9	Net Emission Change (TPY)	PSD Significant Threshold	PSD Applicability?	NA NSR Significant Threshold	NA NSR Applicability?
NO_x	483.4			1061.1			**-577.7**	25	NO	40	NO
SO_2	230.1			269.2			**-39.1**	40	NO	N/A	N/A
VOC	73.1			87.3			**-14.2**	N/A	N/A	40	NO
TSP	283.2	34.0	14.7	690.4	31.4	13.1	**-403.0**	N/A	N/A	25	NO
PM_{10}	194.5	14.4	6.9	517.3	13.7	6.2	**-321.4**	15	NO	N/A	N/A
$PM_{2.5}$	155.8	13.4	6.4	398.7	13.1	5.7	**-241.9**	N/A	N/A	10	NO
CO	1005.5			1203.0			**-197.5**	100	NO	N/A	N/A
Lead	0.011			0.012			**-0.001**	0.6	NO	N/A	N/A
H_2S	134.814			277.289			**-142.5**	10	NO	N/A	N/A
TRS	138.130			300.767			**-162.6**	10	NO	N/A	N/A

N/A = Not Applicable
NOx, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

3.2.6 Results of Emissions Netting Analysis

Table 3-5 presents a summary of the emissions netting analysis. The table indicates that the Battery C Project will produce a net reduction in emissions of all PSD and Nonattainment New Source Review pollutants. The Project will thus net out of PSD and Nonattainment New Source review.

On a pollutant-by-pollutant basis, the largest decreases will occur for Total Particulate matter (PM = TSP) and PM_{10}. Annual PM emissions will be reduced by 825.2 tons per year (TPY). Most of the PM reductions will be associated with better capture of PEC fugitives and more efficient PM capture in the quench tower. Associated PM_{10} emission reductions will be on the order of 680 TPY. CO emissions will be reduced by 90 TPY. The CO reduction will be achieved through an approximate 10% reduction in COG burned in the underfire stack and reductions from decarbonization associated with the PROven® system.

NO_x emissions will decrease by 409.3 TPY and SO_2 emissions will decrease by 40 TPY. The NO_x decreases are mostly due to lower amounts of COG burned at the facility and use of a low NO_x combustion system in Battery C. The SO_2 decreases are due to lower COG combustion, lower travel emissions due to shorter travel distances and lower PEC fugitive emissions due to the combined effect of PROVEN system and better capture of pushing emissions with the integrated hood as well as lower soaking emissions due to the PROven® system.

VOC emissions will decrease by 50.0 TPY, mostly due to lower amounts of COG combusted and better control of PEC fugitives.

The following tables (**Table 3-6 and 3-7**) summarize the netting analysis for the hazardous air pollutants (HAPs) emitted during the various operations of a coke oven battery. The net change in lead is -9.18E-04 TPY and in Total Reduced Sulfur (TRS) is -162.5 TPY. The total net change in HAPs is -20.9 TPY which indicates that there is a net decrease in HAPs from the Battery C replacement project. In conclusion, this project will not trigger PSD review for any HAP.

Table 3-6 Netting analysis for the Main Hazardous Air Pollutants

	Lead		Hydrogen Sulfide		Carbon Disulfide		Total Reduced Sulfur	
7-9 Batteries	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.355E-03			4.200E-05	2.568E-02		2.57E-02
Traveling	1.530E-06	9.355E-04			4.220E-06	2.580E-03		2.58E-03
PEC fugitives	2.509E-06	1.534E-03			5.750E-06	3.516E-03		3.52E-03
Uncontrolled pushing	5.480E-05	1.833E-04			4.800E-05	1.605E-04		1.61E-04
Quenching					5.490E-03	3.357E+00		3.36E+00
7-9 STACK TOTAL					3.150E-03	5.27E-03		5.27E-03
Ball Mill								
Soaking			4.300E-01	2.629E+02				2.63E+02
Decarbonization								
Fugitives			**EF**	**TPY**	**EF**	**TPY**		**TPY**
Doors			0.138	0.138	0.001	0.001		1.72E+01
Lids			4.800E-03	4.800E-03	3.200E-05	3.200E-05		4.83E-03
Offtakes			4.770E-03	4.770E-03	3.200E-05	3.200E-05		4.80E-03
			sec/chg	**tons/year**	**sec/chg**	**tons/year**		**tons/year**
Charging			5.600E-01	1.423E+01	1.180E-01	2.998E+00		1.72E+01
TOTAL		**1.201E-02**		**2.773E+02**		**6.393E+00**		**3.008E+02**
C Battery	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.543E-03			4.200E-05	2.620E-02		2.62E-02
Traveling	9.088E-07	5.668E-04			2.507E-06	1.563E-03		1.56E-03
PEC fugitives	1.530E-06	9.543E-04			5.750E-06	3.586E-03		3.59E-03
Uncontrolled pushing	5.480E-05	1.718E-04			4.570E-05	1.432E-04		1.43E-04
Quenching					5.254E-03	3.277E+00		3.28E+00
C STACK					2.363E-03	7.23E-03		7.23E-03
Ball Mill								
Soaking			2.150E-01	1.348E+02				1.35E+02
Decarbonization								
Fugitives			**EF**	**TPY**	**EF**	**TPY**		**TPY**
Doors			0.069	0.035	0.000	0.000		3.47E-02
Lids			4.320E-03	3.888E-03	2.880E-05	2.592E-05		3.91E-03
Offtakes			4.293E-03	3.864E-03	2.880E-05	2.592E-05		3.89E-03
			sec/chg	**tons/year**	**sec/chg**	**tons/year**		**tons/year**
Charging			5.600E-01	1.717E+01	1.180E-01	2.998E+00		2.02E+01
TOTAL		**1.124E-02**		**1.348E+02**		**3.316E+00**		**1.381E+02**

NET CHANGE (C minus 7-9)		**-7.722E-04**		**-1.425E+02**		**-3.077E+00**		**-1.626E+02**

Table 3-7 Netting analysis for Other Hazardous Air Pollutants

Pollutant	Net Change	PSD Applicability
1,1-Biphenyl	-0.0002	NO
Ammonia	-15.5713	NO
Anthracene	-0.0011	NO
Antimony	-0.2819	NO
Benzo(a) Anthracene	-0.0001	NO
Benzene	-0.2875	NO
Chromium Compounds	-2.8130	NO
Chlorine	-0.0216	NO
Hydrochloric acid	-0.9087	NO
Chrysene	-0.0006	NO
Cobalt	-0.1436	NO
Coke Oven Emissions	-0.0072	NO
Cresols	-0.0089	NO
Cyanide Compounds	-0.0521	NO
Dibenzofuran	-0.0007	NO
Ethylbenzene	0.0000	NO
Ethylene	-0.0209	NO
Fluoranthene	-0.0006	NO
Mercury	-0.0014	NO
Naphthalene	-0.2387	NO
Nickel	-0.3534	NO
Phenanthrene	-0.0013	NO
Phenol	-0.0387	NO
7-PAH	-0.0001	NO
POM	-0.0099	NO
Pyrene	-0.0005	NO
Quinoline	-0.0006	NO
Styrene	0.0000	NO
Toluene	-0.0186	NO
Xylene	-0.0023	NO
TOTAL	**-20.7858**	**NO**

3.3 Federal Regulations

National Emission Standards for Hazardous Air Pollutants for Source Categories

40 CFR Part 63, Subpart L: National Emission Standards for Coke Oven Batteries

Subpart L sets standards for fugitive emissions from coke oven doors, topside port lids, offtake systems, charging and collecting mains. The standard requires the installation of a flare for each battery so that coke oven emissions are not vented to the atmosphere through by-pass bleeder stacks, except through the flare system. It also specifies work practice standards for the operation and maintenance of coke batteries.

40 CFR Part 63, Subpart CCCCC: National Emission Standards for Coke Ovens: Pushing, Quenching, and Battery Stacks (Compliance required by April 14, 2006)

This subpart sets emission standards and work practice standards for coke pushing, coke quenching and coke battery combustion (underfire) stacks. These standards were effective April 14, 2006.

3.4 Commonwealth of Pennsylvania Regulations

Article XXI of the Allegheny County Health Department Rules and Regulations incorporates the General Plan Approvals and Operating Permit requirements of the PA Department of Environmental Quality Board and Department of Environmental protection under the Pa. Air Pollution Control Act at 25 Pa. Code §§ 127.611 through 127.622.

3.5 Summary of Applicable Emission Limits and Work Practice Standards

The following table summarizes ACHD and Federal emission limits and work practice standards applicable to the Project.

Federal and ACHD Article XXI Regulations

Regulatory Citation	*Regulated Pollutant*	*Operation*	*Applicable Standard/Requirement*
40 CFR Part 63 - Subpart L *63.304(b)(2)(iv)*	*Visible Emissions*	*Charging*	*12 seconds / charge log average for 5 charges/30-day rolling average*
40 CFR Part 63 - Subpart L *63.304(b)(3)(i)*	*Visible Emissions*	*Door Leaks*	*4.0% leaking doors per battery/30-day rolling average*
40 CFR Part 63 - Subpart L *63.304(b)(2)(ii)*	*Visible Emissions*	*Lid Leaks (charging ports)*	*0.4% leaking lids/30-day rolling average*
40 CFR Part 63 - Subpart L *63.304(b)(2)(iii)*	*Visible Emissions*	*Offtake Leaks*	*2.5% leaking offtakes/30-day rolling average*
40 CFR Part 63 - Subpart L *63.308(a) through (d)*	*Visible Emissions*	*Collector Mains*	*Monitor Daily, Record the time & date leak is observed, time and date leak was temporarily sealed, Temporary seal within 4 hours, Initiate permanent repair within 5 days, Complete repair within 15 days*
40 CFR Part 63 - Subpart L *63.306*	*Visible Emissions*	*Work Practices*	*Implement after 2 exceedances in 6 mos.* *& then for 90 days*
40 CFR Part 63 - Subpart L *63.307*	*Visible Emissions*	*ByPass / Bleeder Stacks* *(Flare)*	*Install Flares/ Prohibition of venting, flare requirements*
40 CFR Part 63 - Subpart L *63.310*	*NA*	*Startup, Shutdown, Malfunction*	*Startup, Shutdown, Malfunction: operate and maintain battery and equipment consistent with good air pollution control practices to minimize emissions, develop and implement SSM Plan.*
40 CFR Part 63 - Subpart L *63.311*	*NA*	*Reporting & Recordkeeping*	*Perform specified reporting and recordkeeping requirements*

40 CFR Part 63 – Subpart CCCCC 63.7290	*Particulate Matter*	*PEC BH*	*0.02 lb / ton of coke if moveable hood used (EPA Method 5 front half)*
40 CFR Part 63 – Subpart CCCCC 63.7291	*Opacity*	*Ovens*	*Perform specified observations, recording of fugitive pushing emission; corrective action if necessary*
40 CFR Part 63 – Subpart CCCCC 63.7294	*NA*	*Soaking Work Practice*	*Operate according to written work practice plan*
40 CFR Part 63 – Subpart CCCCC 63.7295	*Water Quality*	*Quenching*	*TDS <=1,100 mg/;*
40 CFR Part 63 – Subpart CCCCC 63.7295	*NA*	*Quench Tower Design and Work Practice*	*<=5% of area open to sky; baffle washing & inspection & repair frequency*
40 CFR Part 63 – Subpart CCCCC 63.7296	*Opacity*	*Battery Stacks*	*Daily <=15% normal coking cycle; daily <=20% extended coking cycle*
40 CFR Part 63 – Subpart CCCCC 63.7300	*NA*	*Work Practice*	*Written operation & Maintenance plan; corrective action if bag leak detection system alarm triggered*
40 CFR Part 63 – Subpart CCCCC 63.7320 – 63.7343	*NA*	*Compliance*	*Procedures for initial performance testing and ongoing compliance, recordkeeping, reporting*
2105.21(g)	*NA*	*Quenching*	*Coke must be quenched through a baffled tower and water must be of the same quality as the nearest stream or from the nearest stream*
2105.21(h)(2)	*H2S*	*COG Combustion*	*H_2S must be less than 10 gr/100 dcf*
2108.02(b)	*SO2 & PM*	*Underfire Stacks*	*Conduct biennial testing*
2105.21(a)(1)	*Visible Emissions*	*Charging*	*55 seconds total for 5 charges*
2105.21(b)(4)	*Visible Emissions*	*Door Leaks*	*40% Visible Emissions, at any time 15 minutes after charge*
2105.21(b)(1)	*Visible Emissions*	*Door Leaks*	*5% leaking minus the two door areas of last oven charged and any oven door obstructed from view.*
2105.21(c)(1)	*Visible Emissions*	*Lid Leaks (charging ports)*	*1% leaking lids*

2105.21(d)(2)	*Visible Emissions*	*Offtake Leaks*	*4% leaking offtakes*
2105.21(e)	*PM*	*Pushing*	*Install PEC to reduce emissions (use BACT)*
2105.21(e)(4)	*Visible Emissions*	*Pushing*	*Pushing or PEC outlet - not to equal or exceed 20% at any time*
2105.21(e)(5)	*Visible Emissions*	*Pushing*	*Coke transport - not to exceed 10% at any time*
2105.21(e)(6)	*Visible Emissions*	*Pushing*	*PM-10 SIP Contingency Plan; implement 30 days after notification from ACHD*
2105.21(e)(3)(E)	*PM*	*Pushing - BH Stack*	*0.040 lbs/ton of coke*
2104.05	*Visible Emissions*	*Baghouse Dust Handling*	*No emissions visible at or beyond the property line.*
2105.21(f)(4)	*Visible Emissions*	*Underfire stack*	*60% Visible Emissions at anytime*
2105.21(f)(3)	*Visible Emissions*	*Underfire stack*	*20% Visible Emissions 3 mins/hr*
2105.21(f)(1)	*Particulate*	*Underfire stack*	*0.015 grains/ DSCF*
2104.03(c)	*SO2*	*Underfire stack*	*500 ppm (vol dry) in effluent gas*
2108.03(b)	*NOx*	*Underfire stack*	*Install & operate continuous NOx emission monitor*
2109.03	*Visible Emissions*	*Underfire stack*	*Install & operate Continuous Opacity Monitor*

4.0 Best Available Control Technology Analysis

As stated in **Section 3.1**, among the requirements that must be met to comply with ACHD Installation Permit requirements is a demonstration that the Best Available Control Technology (BACT) will be applied to the emissions units that will be constructed or modified in conjunction with this project. The emissions-generating activities and pollutants for which BACT applies for this project are as follows:

- Battery C Coking Cycle
  COG Combustion..................NO_x, VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$
- Battery C Pushing.................NO_x, VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$
- Battery C Fugitives................NO_x, VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$
- Battery C Traveling ....NO_x, VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$
- Battery C Quench Tower......VOC, SO_2, TSP, PM_{10} and $PM_{2.5}$
- Battery C Coke Handling......TSP, PM_{10} and $PM_{2.5}$

Separate assessments were made for each emissions unit subject to BACT, and each pollutant subject to BACT was considered separately except for particulate matter (TSP, PM_{10}, and $PM_{2.5}$) for which the feasibility, costs, and other considerations pertaining to available control options are the same and which were therefore addressed collectively. It is noted here that in reference to control of $PM_{2.5}$ emissions, PM_{10} emissions are regulated as a surrogate.

A BACT determination analysis was not performed for the following emissions units:

- The emergency flare system that will be associated with the Battery C will be operated and equipped to meet Lowest Achievable Emission Rate (LAER) requirements for emergency flares. The flare is required to apply LAER by virtue of being a new source that is subject to the Maximum Achievable Control Technology (MACT) requirements for coke oven batteries set forth in 40 CFR Part 63, Subpart L, the National Emissions Standards for Hazardous Air Pollutants for Coke Oven Batteries (see §63.307). All new sources that are subject to a MACT standard must apply what USEPA determined represented LAER when the applicable standards were promulgated. A review of the current state-of-the-art for emergency flares was performed, and this showed that current LAER remains as specified in the Subpart L MACT standards. The flare will also be subject and will meet the New Source Performance Standards (NSPS) for flares set forth by USEPA in 40 CFR Part 60, Subpart A (§60.18). Because the emergency flare is required to apply LAER, a BACT determination analysis was not performed for that emissions unit.
- Other process operations at the Clairton Plant that may be tangentially affected by the operation of the proposed new Battery C, including coal handling, wastewater treatment, methanol storage, and, most notably, the byproducts recovery process, are not subject to BACT because there will be no physical change or change to the method of operations of those operations as a result of this project. Since BACT does not apply to these other emissions units, a BACT determination analysis was not performed for them.

To meet the BACT demonstration requirement, on behalf of U.S. Steel, ENSR Corporation (ENSR) performed an air quality engineering analysis to determine BACT for each of the emissions units and pollutants listed above. The approach taken and the findings and conclusions of this analysis are discussed below.

4.1 BACT Assessment Approach

In accordance with USEPA and ACHD guidance, BACT was determined through a "top-down" assessment that started with LAER and proceeded through consideration of progressively lesser levels of control. As permitted by USEPA and ACHD, the determination of BACT took into account energy, environmental, and economic impacts associated with potentially applicable control options.

As indicated above, separate assessments were made for each emissions unit subject to BACT, and each pollutant subject to BACT was considered separately except for particulate matter (TSP, PM_{10}, and $PM_{2.5}$).

4.1.1 Identification of Available Control Technology Options

The first step for these assessments was to identify the emissions control technology options and associated emissions levels to be evaluated. The identification of emissions control technology options included consideration of transferable and innovative control measures that may not have previously been applied to the types of emissions units that will be operated at the project.

In order to identify emissions control technology options for the project, a search of the USEPA's RACT/BACT/LAER Clearinghouse[1] (RBLC) was performed. The information obtained through the RBLC search was supplemented by information obtained from USEPA Region V, the California Air Resources Board Statewide BACT Clearinghouse[2], and permit databases provided to the public by a number of other state agencies. Information obtained regarding recent emissions control technology determinations for the emissions units associated with the project is summarized in information presented in each relevant subsection.

The primary source of information concerning the control of emissions for coke oven batteries was the USEPA's "Background Information for Proposed Standards" (referred to here as USEPA's BID) for the development of the standards under 40 CFR Part 63, Subpart CCCCC, the NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks[3]. Additional information was obtained from a 1983 study conducted by GCA Corporation on behalf of USEPA[4].

The information collected relevant to coke oven battery emissions controls and limits is summarized in **Appendix E.**

4.1.2 Ranking of Technically Feasible Control Technology Options

The second step for these assessments was to compile, based on the findings of the research effort described above, a list of emissions control technology options for each of the emissions units associated with the project. For each option that was identified, an engineering analysis was then conducted to determine the technical feasibility of its application to the specific emissions units associated with the project. Those options that were found to be infeasible for this application were eliminated.

After the elimination of technically infeasible control technologies, the remaining options were ranked in order of the level of control that could be achieved by applying them to the specific emissions units associated with the project, establishing the top-down order for the subsequent analyses.

The ranking of options started with the establishment of the baseline, i.e., the minimum allowable level of control. The minimum allowable level of control is equivalent to the most stringent applicable and relevant federal, state, and local emissions standard. In each subsection, the BACT baseline, consisting of the applicable control requirements and emissions limits under NSPS, NESHAPs, and state and local Reasonably Available Control Technology (RACT) and other emission standards, is summarized for each emissions unit-pollutant identified above.

To go beyond the BACT baseline to determine the ranking of technically feasible emissions control options for Battery C, information was obtained from USEPA's BID, the RBLC, California BACT Clearinghouse, and from other literature obtained by U.S. Steel and ENSR in the research effort described above. Most of the information found was from USEPA's BID, and accordingly, the establishment of a ranking for these assessments took into account the following factors identified in USEPA's BID as those which "most affect[ing] emissions and control costs for pushing, quenching, and battery stacks":

- Overall battery condition
- Non-recovery versus byproduct recovery process
- Foundry versus furnace coke
- Short (less than 5 meters) versus tall (5 meters or more) oven height.

To explain these points further, the differences between non-recovery and byproduct recovery battery designs will translate to significant differences in the technical feasibility, costs, and other impacts applicable to a given control technology option, and therefore controls that were found to be applied only to non-recovery batteries were not generally considered transferable to the proposed Battery C. As discussed in detail in **Section 4.4**, however, consideration was given to employing a non-recovery design as an emissions reduction alternative for minimizing battery fugitives. The differences between the proposed Battery C, which will employ tall ovens to produce furnace coke only, and batteries that produce foundry coke and batteries that employ short ovens, were also considered important in the evaluation of the transfer of technologies. For example, production of foundry coke generally involves a significantly longer coking cycle than is employed to produce furnace coke, and therefore the costs and cost-effectiveness of a control technique applied only to foundry coke batteries will be appreciably different from the economics of that type of control to the proposed Battery C.

In most cases, however, there was no basis found for quantifying the amount of emissions control that could be achieved by the emissions control options that were identified for this specific application to the Battery C. Therefore, the ranking of options for these assessments was generally done on a qualitative, and not quantitative, basis.

Once the top-down order for the assessments was established, the options were assessed following that ranking. In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control (i.e., LAER) was acceptable, no further analysis was required. In other cases, when associated environmental, economic, and/or economic impacts precludes the use of LAER, the top-down order for the analysis was followed until a technology without unacceptable associated impacts was identified.

4.1.3 Environmental Impact Analysis

Except as indicated below, an environmental impact analysis was performed for each technically feasible control technology option. The primary focus of the environmental impact analysis was the assessment of the reduction in ambient concentrations of the air contaminant being controlled. To account for this, judgments (and in some cases, estimates) were made of the increases or decreases in emissions of other criteria or non-criteria air contaminants that may be associated with the control technology options. For example, increased emissions of particulate matter and ammonia associated with post-combustion NO_x emissions controls considered for the coking cycle COG combustion system were judged to be adverse environmental impacts. In addition, consideration was made of non-air impacts, such as the generation by a control technology option of solid waste requiring disposal or wastewater requiring treatment.

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no environmental analysis was performed.

4.1.4 Energy Impact Analysis

Except as indicated below, an energy impact analysis was performed for each technically feasible emissions control technology option. For this assessment, energy impact was defined as the amount of energy that would be consumed by the option itself, i.e., energy consumption by equipment or operating activities that would only be consumed to support the operation of the control technology. The impact of a control option on the energy efficiency of the emissions units could also be considered an energy impact, but this type of quantity was not estimated in this assessment.

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no energy analysis was performed.

4.1.5 Economic Impact Analysis

Except as indicated below, an economic impact analysis was performed for each technically feasible emissions control technology option. Economic impact is defined in terms of overall cost-effectiveness, i.e., the ratio of the potential dollar cost of the option to the number of tons of emissions reduction it will potentially achieve. The cost of option includes both the capital cost of equipment and annual operating costs. The total annualized cost of control is determined by amortizing the total capital cost based on the following parameters (these are values that ENSR has typically employed in estimating economic impact for BACT determinations):

- 20 years economic life
- 8% interest rate

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no economic analysis was performed.

As discussed above, in most cases, it was not possible to quantify the amount of emissions control that could be achieved by the options being evaluated. Consequently, it was not possible to estimate economic impact on a $/ton basis for most of the options that were assessed. In some cases economic impact was either judged based on overall cost or on a qualitative basis only, or was not considered in determining BACT.

4.2 BACT for Battery C Coking Cycle COG Combustion

This section addresses BACT specifically for the coking cycle COG combustion emissions, i.e., the products of the combustion of COG within the heating flues. As discussed in **Section 2.2.3**, during the coking cycle, emissions that are generated also include emissions from charging, soaking and decarbonization, fugitive COG that leaks from coke oven doors, lids, and offtakes. The BACT assessment for the Battery C fugitives that occur during the coking cycle is discussed in **Section 4.4**.

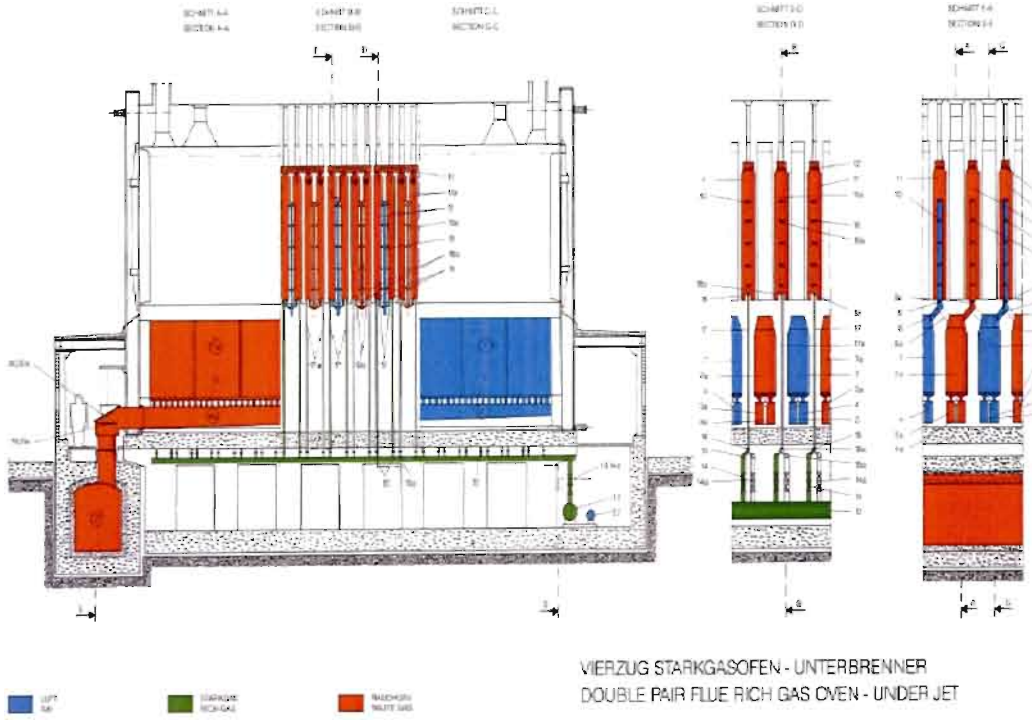
As indicated in **Table 2-1**, COG combustion during the coking cycle is the largest source of emissions associated with coke oven battery operation. A diagram of the proposed combustion system is shown below in **Figure 4-1**:

4.2.1 Proposed Battery C Coking Cycle Combustion Emissions Control Technologies

The proposed approach for the minimization of these emissions includes:

- Emissions of all pollutants will be minimized through the employment of the PROven® system, combined with effective operating and maintenance procedures that will comply with applicable NESHAPs requirements. The PROven® system will be especially effective in minimizing oven-to-flue leakage, thus reducing emissions of VOCs, CO, TSP, SO_2, PM_{10}, and $PM_{2.5}$.

Figure 4-1 Coking Cycle COG Combustion System



Source: Uhde Corporation of America, a company of ThyssenKrupp USA, Inc.

- NO_x emissions will be minimized through the employment of a combination of three technologies. One is the PROven® system, the second is the removal of nitrogen-containing compounds in the Clairton Plant byproduct recovery system, and the third is the staging of combustion in the heating flues.

  The Clairton Plant byproduct recovery system includes a unique cryogenic process that is extremely efficient in removing nitrogen-bearing organic compounds such as pyridine, and a desulfurization process that includes an "HCN Destruct" unit to remove HCN, from the COG. The Clairton byproduct plant has a record of both high reliability and high efficiency.

  The staged combustion system will be similar to an overfire air (OFA) system employed for NO_x emissions minimization in large-sized boilers. Excess oxygen in the combustion zone will be minimized by feeding part of the combustion air to the bottom of the heating flues, resulting in a first stage of combustion in a fuel-rich environment. Combustion will be completed by adding additional combustion air through a series of additional airports at different elevations along the height of the flue. This will enable proper vertical wall temperature distribution together with reduced NO_x levels in the waste gas. A key component of this system design that will contribute to minimizing NO_x emissions will be the regenerators, which are heat exchangers situated beneath the ovens and heating flues that will recover heat from the exhaust gas exiting the heating flues and use it to preheat the combustion air. The staged combustion system that will be employed constitutes, and is therefore described as, low-NOx burner (LNB) technology.

- VOC and CO emissions will be minimized through the employment of the PROven® system in combination with the LNB-staged combustion system, which is the most efficient COG combustion system available.

- SO_2 emissions will be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and the removal of sulfur from COG in the byproduct plant. Because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton process is designed to achieve the highest feasible levels of sulfur removal from the COG. The byproduct plant sulfur removal process yields an average hydrogen sulfide (H_2S) concentration of approximately 10 grains per 100 dry cubic feet (gr/100 dcf) in COG used as fuel for the coke oven heating flues. As noted above, the Clairton byproduct plant has a record of both high reliability and high efficiency.

- TSP, PM_{10} and $PM_{2.5}$ emissions, which are largely attributable to the presence of sulfur compounds in the COG being burned, will also be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and removal of sulfur from COG in the byproduct plant.

4.2.2 BACT Baseline - Applicable Emissions Control Standards for Coking Cycle COG Combustion

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for COG combustion during the coking cycle, which are as follows:

- There are no NSPS applicable to coking cycle COG combustion. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, specifies only limits on visible emissions for coking cycle COG combustion, in §63.7296. It is noted here that since the battery stacks are included in the affected source category definition for Subpart CCCCC, coking cycle COG combustion is not subject to any other NESHAPs, in particular the NESHAPs for Industrial, Commercial, and Institutional Boilers and Process Heaters.

- For NO_x, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO_x RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21. A continuous emissions monitoring system (CEMS) for NO_x is required under ACHD §2108.03(b) and 25 PA Code §§139.101 – 139.111.

- For SO_2, ACHD §2105.21(h)(2) specifies a H_2S emissions limit of 10 gr/100 dcf for coke oven batteries installed, replaced, or reconstructed, or at which a major modification is made on or after January 1, 1978. At actual stack temperature of approximately 440°F, this translates to an SO_2 emissions limit of approximately 276 ppmvd.

- For TSP, PM_{10} and $PM_{2.5}$, ACHD §2105.21(f) specifies a limit of 0.015 grains per dry standard cubic foot (gr/dscf) for coke oven batteries installed, replaced, or reconstructed, or at which a major modification is made on or after January 1, 1978.

The proposed controls for the Battery C will comply in full with all of these applicable requirements.

4.2.3 State-of-the-Art for Emissions Control for Coking Cycle COG Combustion

As presented in **Appendix E-5**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to coke oven battery coking cycle COG combustion emissions control are as follows:

- A total of 57 coke oven batteries were identified that are either currently in operation or, in one case, Chicago Coke, are expected to operate in the future in the United States. This includes 12 non-recovery coke oven batteries, 34 short byproduct recovery coke oven batteries, and 11 tall byproduct recovery coke oven batteries.

- No emissions control technologies for reducing COG combustion emissions were explicitly identified for any of the 45 byproduct recovery coke oven batteries. More specifically, no other battery in the United States was found that employs either an electrostatic precipitator (ESP), baghouse, scrubber, flue gas desulfurization (FGD), selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), oxidation catalyst (OC), or other specific technology such as the PROven® system.

- The only emissions limits identified for any of the 45 byproduct coke oven batteries were for particulate matter and visible emissions. Under §63.7296(a), all batteries in the United States are now required to meet a daily average opacity limit of 15%.

- No emissions limits were found for any other pollutants for any of these batteries. COG sulfur content limits such as the one identified above under ACHD §2105.21(h)(2) are specified, however, for many, though not all, of the byproduct recovery batteries.

- For the 11 tall byproduct recovery coke oven batteries that were identified, the most stringent particulate matter emissions limit found was 0.012 gr/dscf, for the EEC Coke Battery, LLC Battery #5 in Ecorse, Michigan[5]. An examination of the requirements for that battery indicates, however, that the emissions limit is not as stringent as the limit that is being proposed for the Battery C, because the 0.012 gr/dscf value is based on excluding sulfates. As noted on page 13 of a February 7, 2006 report prepared for USEPA by RTI International[6], entitled "Evaluation of $PM_{2.5}$ Emissions and Controls at Two Michigan Steel Mills and a Coke Oven Battery," "EES Coke is one of the few coke plants in the United States that does not desulfurize its coke oven gas before burning it in the underfiring system of the coke oven battery." Because the COG used by the EES battery is not desulfurized, it has an H_2S content limit of 2.64 gr/dscf, which is more than 25 times higher than the H_2S content limit for the Battery C (10 gr/100 dcf). If sulfate particulates were included for the EES battery, its emissions would be far higher than the proposed limit of 0.015 gr/dscf for the Battery C

- The proposed limit of 0.015 gr/dscf for the Battery C is imposed on only two other tall byproduct recovery batteries, one of which is the Clairton Plant B Battery. Eight tall byproduct recovery batteries are subject to either a less stringent limit or no limit at all for particulate matter. Notably this includes the most recently permitted tall byproduct battery, at Chicago Coke, which has been permitted but has not yet built (and thus has not demonstrated compliance with its limits).

- For the 34 short byproduct recovery batteries, the proposed limit of 0.015 gr/dscf for the Battery C is imposed on only five batteries, four of which are Batteries 13, 14, 15, and 20 at the Clairton Plant (the other is Battery #1 at Shenango in Pittsburgh). There are 29 short byproduct recovery batteries that are subject to either a less stringent limit or no limit at all for particulate matter.

In summary, the proposed emissions controls and associated emissions limits for the coking cycle COG combustion emissions from the Battery C will equal the most stringent controls and limits applied to any tall byproduct recovery coke oven battery coking cycle COG combustion emissions in the United States.

4.2.4 Top-Down Assessment of Control Technology Options for Coking Cycle COG Combustion

4.2.4.1 BACT for NO_x Emissions

<u>Identification of Available Control Technology Options</u>

NO_x emissions from coking cycle COG combustion are attributable to the oxidation of nitrogen in the combustion air ("thermal NO_x") and in the COG ("fuel NO_x"). Thermal NO_x is the predominant mechanism for NO_x formation, due to the high combustion zone temperature requirements for coking cycle combustion, and also due to the relatively low nitrogen concentration in the COG being burned. Leakage of untreated COG from the oven into the combustion flues results in fuel NO_x emissions due to the nitrogen content of the untreated COG.

The following NO_x emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant removal of nitrogen-containing compounds
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would either contain a lower nitrogen concentration or would burn at a lower temperature
- Low-NO_x burners (LNBs)
- Flue gas recirculation (FGR)
- Catalytic combustion systems such as XONON™
- Selective catalytic reduction (SCR)
- Selective non-catalytic reduction (SNCR)
- Other post-combustion NO_x emissions control technologies such as SCONOx™, catalytic adsorption, NO_x absorbers, and ozone injection

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower NO_x emissions because it will minimize overall fuel NO_x.

Byproduct recovery plant nitrogen compound removal is technically feasible for this application. This too will directly result in lower NO_x emissions because it will minimize overall fuel NO_x.

Fuel switching to natural gas is technically feasible for this application, but would not result in lower NO_x emissions than will be generated by burning the clean COG produced by the Clairton Plant byproduct recovery process. Combustion of natural gas will actually generate more emissions of NO_x than combustion of the Clairton Plant clean COG because natural gas will contain more nitrogen than the Clairton Plant clean COG (which is in part due to the removal of nitrogen compounds in the Clairton Plant byproduct recovery system). Based on stack testing results for the Clairton Plant boilers, NO_x emissions generated when natural gas is burned are on the order of 0.14 tons per million cubic feet of gas fired. In contrast, when clean COG is burned in those same boilers, NO_x emissions are on the order of 0.054 tons per million cubic feet of gas fired[7].

Fuel switching to blast furnace gas is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the Battery C.

LNBs are technically feasible for this application. As indicated above, the proposed staged combustion system to be employed by the Battery C constitutes an LNB technology.

FGR is not technically feasible for this application. FGR is widely applied to reduce NO_x from conventional boilers, and is also employed in internal combustion engines, but has not been attempted, or based on information in open literature, even studied, for a coke oven battery underfiring system. FGR helps minimize NO_x formation by reducing the primary combustion temperature and decreasing the concentration of oxygen in the combustion zone. The proposed COG combustion system LNB-staged combustion design, represents the optimal balance to ensure proper combustion efficiency, which is essential both for heating in the coking cycle and maintaining compliance with other battery stack emissions regulations. In addition, as discussed by MACTEC Engineering and Consulting, Inc.[8] in the July 2006 "Re-Evaluation of Reasonably Available Control Technology," FGR is not technically feasible for a coke oven battery combustion system, "due to the large volume of gas associated with the underfire system design coupled with the fuel heat input values that are required."

Catalytic combustion systems such as XONON™ are not technically feasible for this application. These types of systems, which have been applied to other types of combustion units such as combustion turbines, have not been attempted, or based on information in open literature, even studied, for a coke oven battery underfiring system. It is unlikely a catalytic combustor would be acceptable for COG combustion due to the sulfur content of the fuel. Although the byproduct plant is designed to maximize the recovery of sulfur from COG produced in the ovens, the sulfur level of the COG burned in the heating flues will still be high enough to present potential catalyst fouling and degradation. Since no research has been done for this type of application, the level and extent of such potential problems are unknown.

SCR is not technically feasible for this application. SCR is reportedly being studied, and was actually applied on a demonstration level basis between 1976 and 1992 at one facility in Japan[9] but is not known to have progressed beyond the demonstration level of development for a coke oven application. There are a number of issues concerning the technical feasibility of SCR for this type of application, as follows:

- First, and most significantly, the temperature of the exhaust gas exiting the heat exchanger section of the oven heating chamber will be approximately 450°F, which at best is at the low end of the temperature range in which the SCR functions (the "SCR temperature window"). Theoretically it is possible to either bypass the regenerator section of the coke oven battery combustion system, or to construct a reheat system to bring the exhaust gas temperature back to within the SCR temperature window, to allow this technology to be employed. However, the recovery of heat from the exhaust gas is a fundamental component of the overall NO_x emissions minimization design of the coke oven. An alteration of this to ensure that the exhaust gas stays in the SCR temperature window may result in an overall reduction in the efficiency of the generation of heat needed for the coking process, which in turn would result in the generation of more emissions, possibly more than would reduced by the SCR. The same issues apply to an exhaust gas reheating system.

- A second issue concerning the technical feasibility of applying SCR to a coke oven combustion system is that the concentration of NO_x in the exhaust gas undergoes significant step changes as the underfiring system reverses. The catalyst activation energy and ammonia feed-forward system will not be capable of handling significant and instantaneous changes in NOx concentration. The result will be periods in which the SCR will not reduce NO_x emissions effectively (or at all) and corresponding increases in ammonia slip emissions. Considering that the underfiring system reverses will occur approximately every twenty minutes, this is a significant issue.

- A third technical feasibility issue for SCR for this application is that the COG burned in the coke oven contains an appreciable amount of sulfur. Just as noted above in regard to the technical feasibility of catalytic combustion, although the byproduct plant is designed to maximize the recovery of sulfur from COG produced in the ovens, there will still be an appreciable amount of sulfur level in the clean COG. Just as is thought likely for the catalysts used for catalytic combustion systems, an SCR catalyst will be fouled and degraded by sulfur compounds in the clean COG, but the primary issue for SCR is not catalyst fouling and degradation but rather the generation of higher particulate emissions due to the formation of ammonium sulfate and bisulfate. Since SCR requires ammonia to eliminate NOx, the reaction of ammonia with the sulfur in the clean COG is unavoidable. In addition to the effect of increasing particulate emissions, ammonium bisulfate formation will lead to maintenance issues because it is a particularly corrosive and adherent substance.

- Finally, in contrast to the boilers, internal combustion engines, and combustion turbines for which SCR has reached relatively widespread application, the nature of the coke oven process does not lend itself well to the types of maintenance procedures and schedules that are used for those other types of sources when SCR is used.

SNCR is not technically feasible for this application. There are no known applications, even at a demonstration level, of the application of this technology to a coke oven battery combustion system, and there is no evidence indicating that this is or has ever been studied. SNCR requires both an exhaust temperature of at least 1,500°F and enough residence time at that temperature to allow the injected ammonia to mix with the exhaust gas and allow the NO_x reduction reactions to come to completion. As discussed above relative to the feasibility of SCR, it is theoretically possible to construct a reheat system to bring the exhaust gas temperature back to within the SNCR temperature window, and provide sufficient residence time for the NO_x reduction reactions, but doing so would result in an overall reduction in thermal efficiency and would likely result in the generation of more emissions than would be reduced by the SNCR, and since the application of this technology has not been demonstrated, it is quite possible that there are other technical feasibility issues that render this technology unworkable for this application.

Other post-combustion NO_x emissions control technologies that are reportedly under development for other types of combustion units, such as SCONOx^{TM}, catalytic adsorption, NO_x absorbers, and ozone injection, involve system designs that are very specific to those other types of units and which therefore are not considered to be applicable in this case.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available NO_x emissions control options identified above, the PROven® system, byproduct recovery plant nitrogen compound removal, fuel switching to natural gas, and LNBs are all considered technically feasible for this application. Fuel switching to blast furnace gas, FGR, catalytic combustion, SCR, SNCR, SCONOx^{TM}, and other post-combustion NOx emissions control technologies are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing NO_x emissions from Battery C coking cycle COG combustion is to combine the PROven® system, byproduct recovery plant nitrogen compound removal, and an LNB-staged combustion system. This is the system that is proposed for the Battery C.

Because, for reasons explained above, fuel switching to natural gas will not result in lower NO_x emissions than will be generated by burning the clean COG produced by a byproduct recovery plant with nitrogen compound removal (even if natural gas combustion were used in combination with the PROven® system and LNBs), it was ranked below the proposed control technology and therefore was not assessed further in this analysis.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed combination of the PROven® system, byproduct recovery plant nitrogen compound removal, and LNB-staged combustion system represents both BACT and LAER for NO_x emissions control for Battery C coking cycle COG combustion.

No specific NO_x emissions limit is proposed as BACT for the Battery C coking cycle COG combustion. Since NO_x emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for coking cycle COG combustion set forth in §63.7296 represents the best means to ensure minimization of NO_x emissions.

4.2.4.2 BACT for VOC and CO Emissions

Identification of Available Control Technology Options

VOC and CO emissions from coking cycle COG combustion are both attributable to incomplete combustion of organic compounds in the COG. Oven-to-flue leakage is a particular issue in regard to formation of VOC and CO emissions in coking cycle COG combustion. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants is the same, BACT for both pollutants was addressed concurrently.

The following VOC and CO emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would either contain a lower nitrogen concentration or would burn at a lower temperature
- Oxidation catalysts (OCs)

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower VOC and CO emissions because it will reduce the organic compound concentration in the COG being burned in the heating flues

Fuel switching to natural gas is technically feasible for this application, but would not result in lower VOC or CO emissions than will be generated by burning the clean COG produced by the Clairton Plant byproduct recovery process. Natural gas combustion will actually generate more VOC and CO than the Clairton Plant clean COG combustion because while clean COG typically contains 50% to 65% hydrogen and 25% to 30% methane, natural gas typically contains 80% to 95% methane. The higher carbon content of natural gas translates to higher incomplete combustion of the carbon-containing constituents when it is burned, and thus higher VOC and CO emissions as compared to burning the Clairton clean COG.

Fuel switching to blast furnace gas is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the Battery C.

An **oxidation catalyst** is not technically feasible for this application. OCs are employed with some effectiveness for other types of combustion units such as combustion turbines, but have not have not been attempted, or based on information in open literature, even studied, for a coke oven battery underfiring system. It is in fact unlikely that this technology will be studied for this type of application because, as discussed in MACTEC's "Re-Evaluation of Reasonably Available Control Technology," the concentration of VOCs and CO in the combustion exhaust stream (estimated by MACTEC[8]on the order of 30 parts per billion, by volume, for VOCs) will likely be three orders of magnitude lower than the minimum level for which an oxidation catalyst is feasible. In addition, the same concerns discussed above for the application of catalytic combustion systems and SCR to a coke oven, including catalyst poisoning and resultant maintenance and scheduling issues, and temperature window limitations, would apply as well for an CC.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available VOC and CO emissions control options identified above, the PROven® system and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and an oxidation catalyst are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing VOC and CO emissions from Battery C coking cycle COG combustion is to employ the PROven® system. This is the system that is proposed for the Battery C.

Because, for reasons explained above, fuel switching to natural gas will not result in lower VOC and CO emissions than will be generated by burning the clean COG produced by the byproduct recovery plant (even if natural gas combustion were used in combination with the PROven® system), it was ranked below the proposed control technology and therefore was not assessed further in this analysis.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed combustion system design, featuring the PROven® system, represents both BACT and LAER for VOC and CO emissions control for Battery C coking cycle COG combustion.

No specific VOC or CO emissions limits are proposed as BACT for the Battery C coking cycle COG combustion. Since VOC and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for coking cycle COG combustion set forth in §63.7296 represents the best means to ensure minimization of VOC and CO emissions.

4.2.4.3 BACT for SO_2 Emissions

Identification of Available Control Technology Options

SO_2 emissions from coking cycle COG combustion are attributable to the oxidation of sulfur in the COG, and also to oven-to-flue leakage, where sulfur in untreated COG is oxidized.

The following SO_2 emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant desulfurization
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would have a lower sulfur content
- Flue gas desulfurization (FGD)

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower SO_2 emissions because it will minimize overall fuel sulfur content.

Byproduct recovery plant desulfurization is technically feasible for this application, and will be employed to treat the COG fired in the Battery C. As indicated above, because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton Plant process is designed to achieve the highest feasible levels of sulfur removal from the COG.

Fuel switching to natural gas is technically feasible for this application. This was addressed as an option to byproduct recovery plant desulfurization.

Fuel switching to blast furnace gas is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the Battery C.

FGD is not considered technically feasible for this application. The reason for this is based on the problems with flue gas emissions control technology that was encountered by the coke oven batteries that employed them in the past, including the Clairton Plant's 21 Battery. The following facts were the basis for making the judgment that an FGD system is not technically feasible in this case:

- According to page 3-17 of USEPA's BID[3], "[A]lthough some coke oven batteries had add-on devices (such as baghouses and electrostatic precipitators) on their stacks in the late 1970s to 1980s, they are no longer in use today."

- The Clairton Plant was one of the few mills at which a coke oven battery employing an ESP to control combustion stack emissions was located. The experience with this device, installed on 21 Battery, is likely indicative of the other batteries where this was tried. The 21 Battery combustion stack ESP was removed from service many years ago due to high maintenance and energy requirements and costs - the downtime for that unit was approximately 50%.

- As noted by RTI International[6] "[N]o U.S. coke batteries use an add-on control device to control emissions from a combustion stack" (see page 15).

- In the establishment of the MACT requirements for new batteries, which by definition must represent LAER, USEPA determined that neither an ESP, fabric filter, nor a scrubber should be required. If a flue gas emissions control technology capable of controlling emissions of hazardous air pollutants, including a scrubber, was considered by USEPA to be technically feasible, they would have specified this as LAER and new source MACT. The fact that they did not make this determination is proof that USEPA agrees that such a device is not technically feasible for application to a byproduct coke oven battery coking cycle COG combustion system.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available SO_2 emissions control options identified above, the PROven® system, byproduct recovery plant desulfurization, and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and FGD are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing SO_2 emissions from Battery C coking cycle COG combustion is to employ the PROven® system in combination with fuel switching to natural gas. Pipeline quality natural gas has a typical sulfur content on the order of 0.5 gr/100 dcf while the clean COG produced at the Clairton Plant will meet an H_2S concentration limit of 10 gr/100 dcf.

The next-most effective available option option for minimizing SO_2 emissions from Battery C coking cycle COG combustion is to employ the PROven® system in combination with byproduct recovery plant desulfurization. For reasons explained below, this is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Switching to natural gas firing in combination with the PROven® system represents the top-ranked SO_2 emissions control technology option. As discussed previously, however, natural gas combustion will actually generate more NO_x, VOCs, and CO than the Clairton clean COG combustion because natural gas will contain more nitrogen and methane than the Clairton Plant clean COG. This is considered an unacceptable environmental impact, and on that basis, switching to natural gas was rejected as BACT for this application.

The use of the byproduct recovery desulfurization process in combination with the PROven® system, which is the next-highest ranked technically feasible control technology option for SO_2 emissions from coking cycle COG combustion, was selected for this application.

BACT Determination

The proposed byproduct recovery desulfurization process in combination with the PROven® system represents BACT for SO_2 emissions control for Battery C coking cycle COG combustion.

The applicable H_2S concentration limit of 10 gr/100 dcf is also proposed as a BACT requirement for the Battery C coking cycle COG combustion.

4.2.4.4 BACT for TSP, PM_{10}, and $PM_{2.5}$ Emissions

Identification of Available Control Technology Options

TSP, PM_{10}, and $PM_{2.5}$ emissions from coking cycle COG combustion are also attributable to the oxidation of sulfur in the COG, and also to oven-to-flue leakage, where sulfur in untreated COG is oxidized.

The following TSP, PM_{10}, and $PM_{2.5}$ emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant desulfurization
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would have a lower sulfur content
- Flue gas emissions control technology, including either a baghouse, electrostatic precipitator (ESP), scrubber, or some combination of those types of devices

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower TSP, PM_{10}, and $PM_{2.5}$ emissions because it will minimize overall fuel sulfur content.

Byproduct recovery plant desulfurization is technically feasible for this application, and will be employed to treat the COG fired in Battery C. As indicated above, because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton Plant process is designed to achieve the highest feasible levels of sulfur removal from the COG.

Fuel switching to natural gas is technically feasible for this application. This was addressed as an option to byproduct recovery plant desulfurization.

Fuel switching to blast furnace gas is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in Battery C.

Flue gas emissions control technology is not considered technically feasible for this application, for the same reasons as discussed in Section 4.2.4.3 in reference to SO2 emissions control. It is noted here that in addition to its other problems, the Clairton Plant 21 Battery combustion stack ESP was found to be relatively ineffective in control TSP, PM_{10}, and $PM_{2.5}$ emissions.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available TSP, PM_{10}, and $PM_{2.5}$ emissions control options identified above, the PROven® system, byproduct recovery plant desulfurization, and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and flue gas emissions control technology are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C coking cycle COG combustion is to employ the PROven® system in combination with fuel switching to natural gas. Pipeline quality natural gas has a typical sulfur content on the order of 0.5 gr/100 dcf while the clean COG produced at the Clairton Plant will meet an H_2S concentration limit of 10 gr/100 dcf.

The next-most effective available option for minimizing TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C coking cycle COG combustion is to employ the PROven® system in combination with byproduct recovery plant desulfurization. For reasons explained below, this is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Switching to natural gas firing in combination with the PROven® system represents the top-ranked TSP, PM_{10}, and $PM_{2.5}$ emissions control technology option. As discussed previously, however, natural gas combustion will actually generate more NO_x, VOCs, and CO than the Clairton clean COG combustion because natural gas will contain more nitrogen and methane than the Clairton Plant clean COG. This is considered an unacceptable environmental impact, and on that basis, switching to natural gas was rejected as BACT for this application.

The use of the byproduct recovery desulfurization process in combination with the PROven® system, which is the next-highest ranked technically feasible control technology option for TSP, PM_{10}, and $PM_{2.5}$ emissions from coking cycle COG combustion, was selected for this application.

BACT Determination

The proposed byproduct recovery desulfurization process in combination with the PROven® system represents BACT for TSP, PM_{10}, and $PM_{2.5}$ emissions control for Battery C coking cycle COG combustion.

The applicable H_2S concentration limit of 10 gr/100 dcf is also proposed as a BACT requirement for the Battery C coking cycle COG combustion.

Table 4-1 Top-Down Evaluation of BACT Options for Battery C Coking Cycle COG Combustion

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
NO_x					
PROven® system, byproduct plant removal of nitrogen compounds, and LNB-staged combustion system	Yes	No	Not Evaluated	Selected as LAER and BACT	Page 4-10
PROven® system and fuel switching to natural gas	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-10
Fuel switching to blast furnace gas	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-8
Flue gas recirculation	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-8
Catalytic combustion systems	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-9
SCR	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-9
SNCR	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-10
Other post-combustion NO_x emissions control technologies	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-10
VOC and CO					
PROven® system	Yes	No	Not Evaluated	Selected as LAER and BACT	Page 4-12
PROven® system and fuel switching to natural gas	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-12
Fuel switching to blast furnace gas	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-11
Oxidation catalyst	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-11
SO_2					
PROven® system and fuel switching to natural gas	Yes	Yes	Not Evaluated	Rejected, higher NO_x, VOC, and CO emissions	Page 4-14
PROven® system and byproduct recovery desulfurization	Yes	No	Not Evaluated	Selected as BACT	Page 4-14
Fuel switching to blast furnace gas	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-13
Flue gas desulfurization	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-13

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
TSP, PM_{10}, and $PM_{2.5}$					
PROven® system and fuel switching to natural gas	Yes	Yes	Not Evaluated	Rejected, higher NO_x, VOC, and CO emissions	Page 4-15
PROven® system and byproduct recovery desulfurization	Yes	No	Not Evaluated	Selected as BACT	Page 4-15
Fuel switching to blast furnace gas	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-15
Flue gas emissions control, such as baghouse, ESP, or scrubber	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-15

4.3 BACT for Battery C Pushing

This section addresses BACT for all pushing emissions, including those that are captured and controlled by the PEC BH and fugitive emissions that escape capture by the PEC.

As indicated in **Table 2-1**, pushing emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

4.3.1 Proposed Battery C Pushing Emissions Control Technologies

The proposed approach for the minimization of these emissions includes:

- Emissions of NO_x, VOCs, CO, and SO_2 from pushing are controlled and minimized through proper heating, operating and work practices. The PROven® system will be a key component of the overall approach employed for minimizing these emissions.

- TSP, PM_{10} and $PM_{2.5}$ emissions will be minimized primarily through the PEC capture system and the PEC BH. The PEC capture system will achieve a capture efficiency of 90%, which is the maximum efficiency that technically feasible for this type of system. The control efficiency of the PEC BH will be more than 99%, equivalent to the highest efficiency level required for a coke oven battery pushing emissions control baghouse. As indicated in **Section 2.2.4**, one of the key attributes of the proposed Battery C system will be the Coke Transfer Car, which will be the first of its kind to be installed in the United States, which will reduce fugitive emissions during pushing by combining the functions of the coke-side door machine, coke guide, and pushing emissions capture hood. This makes it feasible to control the coke-side emissions from the time the oven door is removed until the push is complete and the quench car begins the traveling step. In addition the Coke Transfer Car represents an improvement in safety controls for workers versus a coke-side shed.

4.3.2 BACT Baseline - Applicable Emissions Control Standards for Pushing Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for pushing are as follows:

- There are no NSPS applicable to coke oven pushing. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for pushing emissions, effective on April 14, 2006. §63.7290(a)(2) specifies a front-half particulate matter emissions limit of 0.02 pounds per ton of coke (lb/ton coke) from a control device applied to pushing emissions from a new or existing coke oven battery that employs a moveable hood vented to a stationary control device. §63.7290(b)(3) specifies that either the daily average fan motor amperes or the daily average volumetric flow rate at the inlet of the control device be maintained at or above the minimum level established during the initial performance test. Work practice standards are established to minimize visible emissions from pushing under §63.7291 (for byproduct coke oven batteries with vertical flues) and §63.7292 (for byproduct coke oven batteries with horizontal flues). §63.7300(b) and (c) require that written operating and maintenance plans for the coke oven as a whole and the pushing emissions capture and control system, respectively, be developed and followed to ensure the minimization of emissions. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.

- For NO_x, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO_x RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.

- For TSP, PM_{10} and $PM_{2.5}$, ACHD §2105.21(e) requires the installation of a pushing emissions control device. This section does not specify limits for new coke oven batteries. ACHD §2105.21(e)(1) specifies a limit of the higher of either 0.020 gr/dscf or as calculated through a formula presented in that subsection. However, ACHD §2105.21(e)(2) specifies a limit of 0.010 gr/dscf for Batteries 1 - 3, 7 - 9, and 19 at the Clairton Plant. ACHD §2105.21(e)(4) specifies limits on visible emissions for pushing and ACHD §2105.21(e)(6) specifies requirements specific to the Clairton Plant for ensuring that the PEC capture and control system is in place while pushing is done. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken. The limit of 0.010 gr/dscf for particulate matter emissions is the appropriate reference point for the BACT determination. The manufacturer has estimated an outlet grain loading of 0.005 gr/dscf for the Battery C PEC BH.

The proposed controls for the Battery C will comply in full with all of these applicable requirements.

4.3.3 State-of-the-Art for Emissions Control for Pushing Emissions

As presented in **Appendix E-3**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to pushing emissions control are as follows:

- For all of the 45 byproduct recovery coke oven batteries and also for the 12 non-recovery coke oven batteries that are either currently in operation or (for Chicago Coke and the FDS Coke Plant) are expected to operate in the future in the United States, pushing emissions are captured by either (1) a shed enclosure vented to a control device, (2) a mobile capture and control unit, or (3) a traveling capture hood attached to a fixed duct venting to a control device. For all of these batteries, either a baghouse or a wet scrubber is employed to control captured pushing emissions.

- The only emissions control technologies identified for pushing emissions for any coke oven battery are for particulate matter emissions.

- Battery C will employ a moveable hood coupled with a baghouse to achieve an emissions level equivalent to or lower than 0.02 lb/ton coke for front-half particulate matter, and will meet an instantaneous visible emissions opacity limit of 20%. This will mean that for pushing emissions, Battery C will also be the best-controlled coke oven battery in the United States.

- For the 11 tall byproduct recovery coke oven batteries that were identified, the most stringent limits found are 0.02 lb/ton coke for particulate matter and 20% opacity for visible emissions. This is imposed on two of the batteries, and there is one other than is subject to limits of 0.03 lb/ton coke and 20% opacity. All three of those batteries employ the same moveable hood coupled with a baghouse emissions control system as will be employed by Battery C. B Battery at the Clairton Plant, which is the only tall byproduct recovery battery that employs a coke-side shed, is one of six tall byproduct recovery batteries to be required to meet the next-most stringent limit of 0.04 lb/ton coke (this is the limit for total particulate matter emissions; front-half emissions from B Battery are limited to 0.02 lb/ton), and unlike two of the other such tall byproduct recovery batteries, B Battery is also subject to the most stringent instantaneous opacity limit of 20%. It is noted here that the two tall byproduct recovery batteries that employ mobile scrubber cars are also subject to the limits of 0.04 lb/ton coke and 20% opacity; thus the available information indicates that similar control levels are achievable for any of the combinations of capture and control technologies that are employed. The Chicago Coke battery is one of the two that is subject to the 0.02 lb/ton coke limits, but as indicated previously, this unit has not yet been built and thus has not yet demonstrated compliance with its limits.

- For the 34 short byproduct recovery batteries, only one is required to meet limits of 0.03 lb/ton coke and 20% opacity. This battery employs a moveable hood coupled with a baghouse emissions control system. Batteries, 13, 14, 15, and 20 at the Clairton Plant are among 13 short byproduct recovery batteries required to meet the next-most stringent limits of 0.04 (total) lb/ton coke and 20% opacity (these are also total particulate matter emissions limits that are coupled a 0.02 lb/ton limit for front-half emissions). 17 short byproduct recovery batteries are subject to either a less stringent limit or no limit at all for particulate matter; five of those are subject to less stringent opacity limits; no information was found about the particulate matter limits for three of the other short byproduct recovery batteries. For the short byproduct recovery batteries, the information also indicates that similar control levels are achievable for any of the combinations of capture and control technologies that are employed.

- For the 11 non-recovery batteries, two are required to meet limits of 0.03 lb/ton coke and 20% opacity, and another four are required to meet limits of 0.04 lb/ton coke and 20% opacity. The two better-controlled batteries employ a moveable hood coupled with a baghouse emissions control system. Not surprisingly, the six non-recovery batteries that are not subject to a particulate matter emissions limit are also the six that employ coke-side sheds but no control devices.

- No information was found that indicated that limits are imposed on any coke oven batteries for pushing emissions of pollutants other than particulate matter and visible emissions.

4.3.4 Top-Down Assessment of Control Technology Options for Pushing Emissions

4.3.4.1 BACT for NO_x, VOC, and CO Emissions

Identification of Available Control Technology Options

NO_x, VOC, and CO emissions from pushing are attributable to the emission of COG remaining in the oven after the coking cycle has ended and the coke oven doors are removed. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all three pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for pushing emissions control, discussed in **Section 4.3.3**, there are no specific technologies identified as being in use for the control of emissions of NO_x, VOCs, and CO from coke oven battery pushing operations. In general, minimization of these emissions involves employing operating practices that result in minimizing the amount of COG remaining in the oven after the coking cycle has ended. For the Battery C, the PROven® system will be a key component of the overall approach employed to accomplish this.

The following NO_x, VOC, and CO emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. This system was developed specifically to address byproduct coke oven battery fugitive emissions, and as such it will reduce emissions generated during pushing because more of the COG will be removed from the ovens during the coking cycle.

Ranking of Technically Feasible Control Technology Options

As discussed above, the PROven® system is the only available option identified for control of pushing emissions from Battery C, and this option is considered technically feasible for this application. This is the system that is proposed for Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed combustion system design, featuring the PROven® system, represents both BACT and LAER for NO_x, VOC, and CO emissions control for Battery C pushing emissions.

No specific NO_x, VOC, or CO emissions limits are proposed as BACT for the Battery C pushing emissions. Since NO_x, VOC, and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(4) represents the best means to ensure minimization of these emissions.

4.3.4.2 BACT for SO_2 Emissions

Identification of Available Control Technology Options

SO_2 emissions from pushing are attributable to the emission of COG remaining in the oven after the coking cycle has ended and the coke oven doors are opened.

For SO_2 emissions control, the technology options involve two elements. One is how the emissions will be captured, and the other is how the emissions that are captured will be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

Emissions Capture

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

Emissions Control

- SO_2 scrubber

Technical Feasibility Assessment

A coke-side shed is technically feasible for this application. A coke-side shed offers the advantage of capturing not only pushing emissions but all of the coke-side fugitives, notably door leaks, which are not captured by conventional PEC capture hoods. However, a shed requires a significantly larger air handling system and control device (approximately twice that of the proposed system with twice the emissions). A shed is also not capable of as high a level of capture efficiency as are either of the other two pushing emissions capture system options, and therefore a shed is both much more costly and less cost-effective overall than either of the other two options. The achievable capture efficiency for a shed is limited. A major factor that limits the achievable capture efficiency for a shed is that the shed must have at least one open end to allow the quench car to travel to and from the quench tower. In addition to lower emissions capture, the experience with the shed installed on the Clairton Plant B Battery indicates several other significant drawbacks for this option. First, the following information shows that the costs for the coke-side shed are much higher than the costs for a traveling hood attached to a fixed duct and much higher costs.

- Purchased parts
  and services: .... $600,000 for B Battery versus $200,000 for a traveling hood/fixed duct system

- Labor:................ $400,000 for B Battery versus $200,000 for a traveling hood/fixed duct system

- Energy: .... $756,000 for B Battery versus $233,000 for a traveling hood/fixed duct system

It must be noted here that the cost data shown above are averages. The costs for the B Battery in the most recent years has been well above these averages. A second drawback (in addition to the limited achievable capture efficiency) for a coke-side shed that is known based on the experience with B Battery is that the maintenance requirements associated with a shed are more extensive than with either of the other two options Third, the higher maintenance requirements for the shed result in much higher operating costs for B Battery than are experienced for the other batteries at the Clairton Plant that employ a traveling hood/fixed duct system. Fourth, although the B Battery baghouse is significantly larger than the control devices employed on the other batteries, it is the only device that has experienced failures in compliance demonstrations.

A **mobile capture and control unit** is not technically feasible for this application, because it is considered unlikely that a mobile capture and control unit employing a scrubber can meet the applicable ACHD emissions standards. A mobile capture and control unit offers the advantage of being able to capture and control traveling emissions, but this advantage will be outweighed by the superior overall capture and control efficiency and cost-effectiveness of the Coke Transfer Car that is proposed for this project. In fact, since it will capture emissions that escape when the oven doors are opened for pushing, the Coke Transfer Car will greatly reduce the fugitive emissions capture advantage of a coke-side shed. The mobile capture and control unit technology, equipped with scrubbers (referred to commonly as mobile scrubber cars), has been employed at other coke oven batteries owned and operated by U.S. Steel, and (as indicated above) at other batteries as well. According to pages 3-9 of the USEPA's BID, "mobile scrubber cars were popular in the 1970s but have for the most part been replaced by stationary systems." The reasons for this, as explained on pages 3-10 and 3-11 of USEPA's BID, included the high cost of operation and maintenance, the requirement of a heavy track to support the combined weight of the quench car and scrubber car, the creation of scrubber effluents that require treatment (in contrast to alternatives such as a baghouse where such is not created), limitation on accessibility for maintenance due to the need to mount equipment on mobile scrubber cars close together, and maintenance requirements associated with the diesel engine that is required to propel the gas cleaning car. Not included by USEPA in this regard are the emissions from and fuel costs associated with the diesel engine. The experiences at U.S. Steel with this type of technology were that they availability of the mobile scrubbing cars was below expectations, and because as a mobile system the technology required the recycling of scrubbing water, the particulate level of that water was higher than would be used for a fixed-location scrubber, which resulted in lower overall control efficiency.

A **traveling hood attached to a fixed duct** is technically feasible for this application. Fixed duct systems involve either a belt-sealed duct or a dampered port mechanism employed to focus the vacuum to the moveable hood. No information was found that indicated any particular advantage of either option. However, according to page 3-4 of the USEPA's BID, the belt-sealed duct system "has emerged as the most functional and widely accepted method of controlling pushing emissions worldwide." Experience has also shown that the dampered hood systems are more adversely affected by distortion from the heat of the pushes (especially green pushes). That causes more spotting & sealing problems (and/or more maintenance and downtime) than with the belt-sealed systems.

An **SO_2 scrubber** is technically feasible for this application. A number of design options could be considered for this application, e.g., either a packed bed or spray tower could be used, and either sodium or calcium hydroxide could be used for scrubbing. The configuration that would most likely be employed would be to install the SO_2 scrubber following the PEC baghouse. However, this type of arrangement is not known to have been either applied, attempted, or even studied for a coke oven battery pushing emissions control system. The full scope of technical issues that may be associated with this type of arrangement is therefore completely unknown. As seen for other applications of air pollutant emissions control technologies, such as the employment of ESPs for coking cycle COG combustion emissions control, actual experience often reveals issues that are difficult to predict even when appreciable study has been done. Nevertheless, for the purpose of this BACT analysis, an SO_2 scrubber was considered technically feasible for this application.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available SO_2 emissions control options identified above, a coke-side shed and a traveling hood attached to a fixed duct are considered technically feasible for this application for emissions capture, and an SO_2 scrubber is considered technically feasible for this application for control of captured emissions. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing SO_2 emissions from Battery C pushing operations is to capture emissions using a traveling hood attached a fixed duct and vent the emissions to an SO_2 scrubber. As noted above, the most likely configuration for this application would be to install the SO_2 scrubber in series following the PEC baghouse. Of the available types of SO_2 scrubbers that could be considered for this application, the one that was judged to be capable of the highest level of SO_2 emissions reduction for this application is a packed-tower employing a dilute solution of sodium hydroxide; for the purposes of this BACT analysis this type of system was judged capable of achieving 90% reduction of (captured) SO_2 emissions, though as indicated above, there is no actual experience with this type of control application and therefore it is highly probable that this overestimates achievable control efficiency.

The next-most effective available option for minimizing SO_2 emissions from Battery C pushing operations is to capture emissions using a coke-side shed and vent the emissions to a packed-tower type SO_2 scrubber that employs a dilute solution of sodium hydroxide to achieve 90% reduction of captured SO_2 emissions. The same considerations discussed in the paragraph above regarding the type of system and estimated control performance apply to this option as well; since there is no actual experience with this type of control application and therefore it is highly probable that this overestimates achievable control efficiency.

The next-most effective available option for minimizing SO_2 emissions from Battery C pushing operations is to capture emissions using a traveling hood attached a fixed duct but not employ an SO_2 scrubber. For reasons explained below, this is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Although a scrubber would offer the advantage of combined SO_2 and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO_2 emitted during pushing (as compared to TSP, PM_{10}, and $PM_{2.5}$), it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions. More specifically:

- An SO_2 scrubber of the type envisioned for this application (a packed-tower that employs a dilute solution of sodium hydroxide) would generate both a wastewater stream and solid waste that would require treatment and disposal, which constitutes an unacceptable environmental impact).
- Energy impacts with this technology would be even more significant and unacceptable. The packed-tower would add backpressure that would have to be overcome by employing a larger overall fan for the PEC system which by itself will mean that the energy requirements for the system will increase significantly In addition, the larger fan size that will be needed will necessitate a larger-sized baghouse, meaning that the baghouse energy consumption will rise significantly. Finally, in addition to the energy consumed by the fan, additional energy will be required to power pumps to deliver reagent to the scrubber and carry away the scrubber effluent.
- The economic impact associated with an SO_2 scrubber was estimated on a rough order-of-magnitude basis - see **Appendix E-6.** It is noted here that this cost estimate was based on an application for which the energy costs were not nearly as significant as would be expected for this application. Nevertheless, as indicated, the cost of an SO_2 scrubber was estimated at more than $11,000/ton of SO2 reduction. This economic impact is clearly unacceptable for this application.

Because the associated environmental, energy, and economic impacts are considered unacceptable, employing an SO_2 scrubber was rejected as BACT for this application.

The capture of emissions without SO_2 scrubbing, which is the next-highest ranked technically feasible control technology option for SO_2 emissions from pushing operations, was selected for this application.

BACT Determination

The proposed system involving capturing emissions using a traveling hood attached a fixed duct but not employing an SO_2 scrubber represents BACT for SO_2 emissions control for Battery C pushing operations.

No specific SO_2 emissions limit is proposed as BACT for the Battery C pushing emissions. Since SO_2 emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(4) represents the best means to ensure minimization of these emissions.

4.3.4.3 BACT for TSP, PM_{10}, and $PM_{2.5}$ Emissions

Identification of Available Control Technology Options

TSP, PM_{10}, and $PM_{2.5}$ emissions from pushing are attributable to generation of dust by the mechanical operation of pushing the hot coke from the oven into the quench car.

As discussed above in **Section 4.3.4.2** in regard to SO_2 emissions control, for TSP, PM_{10}, and $PM_{2.5}$ emissions control, the technology options also involves how the emissions will be captured and how they will then be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

Emissions Capture

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

Emissions Control

- Electrostatic precipitator
- Baghouse
- Particulate scrubber

Technical Feasibility Assessment

In regard to the technical feasibility of the three emissions capture system options, the findings are as discussed in **Section 4.3.4.2**.

In regard to the technical feasibility of the three emissions control system options, all three are technically feasible for this application. Strictly in terms of the achievable TSP, PM_{10}, and $PM_{2.5}$ emissions control efficiency, a baghouse is considered capable of a higher level of control than either an ESP or a scrubber.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available TSP, PM_{10}, and $PM_{2.5}$ emissions control options identified above, a coke-side shed and a traveling hood attached to a fixed duct are considered technically feasible for this application for emissions capture, and an ESP, baghouse, and particulate scrubber are all considered technically feasible for this application for control of captured emissions. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

For emissions capture, for reasons discussed in **Section 4.3.4.2**, based on the experience with the B Battery at the Clairton Plant, the overall TSP, PM_{10}, and $PM_{2.5}$ emissions control efficiency that could be achieved by a traveling hood attached to a fixed duct is considered superior for this application to the efficiency that could be achieved by a coke-side shed.

For control of captured emissions, a baghouse is considered superior to either an ESP or a scrubber for removal of the type of particulate matter generated in pushing operations. An ESP would also have higher energy usage, maintenance requirements, and overall costs as compared to a baghouse. Although a scrubber could be designed to offer the advantage of combined SO_2 and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO_2 emitted during pushing, it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions.

The most effective available option for minimizing TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C pushing operations, therefore, is to capture emissions using a traveling hood attached to a fixed duct, which will then vent emissions to a baghouse. This is the system that is proposed for the Battery C.

Because, for reasons explained above, a coke-side shed, ESP, and scrubber will not result in lower TSP, PM_{10}, and $PM_{2.5}$ emissions than will be achieved by using a traveling hood attached to a fixed duct coupled with a baghouse, these technologies were ranked below the proposed control technology and therefore were not assessed further in this analysis.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed combination of a traveling hood attached to a fixed duct that will vent emissions to a baghouse represents BACT for TSP, PM_{10}, and $PM_{2.5}$ emissions control for Battery C pushing operations.

The following emissions limits for TSP, PM_{10}, and $PM_{2.5}$ emissions limit is proposed as BACT for the Battery C pushing operations:

- 0.02 lb/ton coke
- 0.005 gr/dscf from the baghouse outlet

Table 4-2 Top-Down Evaluation of BACT Options for Battery C Pushing Emissions

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
NO_x, VOCs, and CO					
PROven® system	Yes	No	Not Evaluated	Selected as LAER and BACT	Page 4-25
SO_2					
Capture emissions with traveling hood attached to fixed duct, venting to an SO_2 scrubber	Yes	Yes	Yes	Rejected, due to significant environmental, energy, and economic impacts	Page 4-23
Capture emissions with coke-side shed, venting to an SO_2 scrubber	Yes	Yes	Yes	Rejected, due to significant environmental, energy, and economic impacts	Page 4-23
Capture emissions with traveling hood attached to fixed duct, with no SO_2 scrubbing	Yes	No	Not Evaluated	Selected as BACT	Page 4-23
Capture emissions with coke-side shed, with no SO_2 scrubbing	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-23
Capture emissions with mobile capture and control system (mobile scrubber car)	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-21

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
TSP, PM_{10}, and $PM_{2.5}$					
Capture emissions with traveling hood attached to fixed duct, venting to a baghouse	Yes	No	Not Evaluated	Selected as BACT	Page 4-25
Capture emissions with traveling hood attached to fixed duct, venting to an ESP	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-25
Capture emissions with traveling hood attached to fixed duct, venting to an scrubber	Yes	Yes	Not Evaluated	Rejected, not as effective as selected control option	Page 4-25
Capture emissions with coke-side shed, venting to a baghouse	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-25
Capture emissions with coke-side shed, venting to an ESP	Yes	No	Not Evaluated	Rejected, not as effective as selected control option	Page 4-25
Capture emissions with coke-side shed, venting to an scrubber	Yes	Yes	Not Evaluated	Rejected, not as effective as selected control option	Page 4-25
Capture emissions with mobile capture and control system (mobile scrubber car)	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-25

4.4 BACT for Battery C Fugitives

This section addresses BACT for fugitive emissions that are generated during charging, decarbonization, soaking, and during the coking cycle due to leaks from coke oven doors, charging port lids, offtakes (at the connections to the ovens and at the standpipe caps), and the coke oven gas collection main. The BACT assessment for the Battery C fugitives that occur during pushing operations is discussed in **Section 4.3.** BACT for fugitive emissions generated during traveling is discussed in **Section 4.5**, and fugitive emissions generated in coke handling are addressed in **Section 4.7.**

As indicated in **Table 2-1**, the cited coke oven fugitive emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

4.4.1 Proposed Battery C Fugitive Emissions Control Technologies

The proposed approach for the minimization of these emissions centers on the employment of the PROven® system, which represents the current state-of-the-art for minimizing coke oven fugitive emissions. Detailed information about the PROven® system is found in **Appendix D**. Beyond that, there are no other specific controls proposed to limit fugitive emissions of NO_x, VOCs, CO, or SO_2.

In addition to the PROven® system, controls that will be employed to minimize fugitive TSP, PM_{10} and $PM_{2.5}$ emissions will include the following:

- Charging emissions will be also minimized by the set of measures described in **Section 2.2.2**, which includes stage charging, which ensures that the oven is not overfed and that the feed rate of the coal permits capture by the exhaust system. The mechanisms that will be used to accomplish this include equipping the larry car with screw feeders and specially designed drop sleeves. Differences are also that steam aspiration will not be required with the PROven® system (suction is provided by the negative pressure in the collector main) and Battery C will utilize a single collector main design.

- Leaks from oven doors, charging port lids, offtakes, and the gas collection main, which with the PROven® system will be lower than at other byproduct recovery coke oven batteries due to suction in the main, will be minimized through diligent operating and maintenance practices, including prompt luting of lids and offtakes, and effective cleaning of door jambs and seals after pushing. Door leaks will also be controlled by employing Flexed design flexible seals, which provide improved gas tightness relative to conventional types of metal door seals. In addition, fugitive emissions minimization will be enhanced by employing Uhde's CONTROLPRESS battery bracing system, which enables the required pre-stressing and gas tightness of the refractory walls of the ovens under varying operating conditions, and the Flexed design flexible seals that provide gas tightness for oven doors.

4.4.2 BACT Baseline - Applicable Emissions Control Standards for Fugitive Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for the cited coke oven fugitive sources, which are as follows:

- There are no NSPS applicable to coke oven fugitive emissions. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.

- The NESHAPs for Coke Ovens Batteries, set forth in 40 CFR Part 63, Subpart L, sets standards for charging, top side, and door leaks, effective on December 31, 1995. §63.302 and §63.304 specify limits on the percentage of coke oven doors, offtakes, and lids that are leaking, and §63.304 specifies limits on the amount of time visible emissions occur during charging. Battery C fits the definition of a brownfield battery, therefore the following limits apply:

§63.302(d) limits	For coke oven batteries qualifying for the exemption under §63.302(c), 4.0% leaking doors 0.4% leaking top side lids 2.5% leaking offtakes 12 seconds of visible emissions per charge
§63.304(b)(3) limits	Effective after January 1, 2010, for a tall byproduct coke oven battery, 4.0% leaking doors 0.4% leaking top side lids 2.5% leaking offtakes 12 seconds of visible emissions per charge

  These requirements apply to visible emissions. The NESHAPs does not, however, specify numerical limits for any regulated air pollutants.

  §63.306 specifies that a written work practice plan be developed and followed to ensure the minimization of emissions. The regulation also specifies requirements for flaring bypass streams, for maintaining collection mains to ensure that leaks from those are minimized, and general, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures).

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for soaking emissions, effective on April 14, 2006. §63.7294 specifies work practice standards which require that a written plan be developed, and personnel trained to follow, a set of procedures to ensure the minimization of emissions, including certain specific procedures spelled out in this section. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.

- For NO_x, VOCs, CO, TSP, PM_{10} and $PM_{2.5}$, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO_x RACT regulations found in §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.

- While no ACHD standards are set for fugitive emissions of TSP, PM_{10} and $PM_{2.5}$, ACHD §2105.21(a) through (d) specifies limits for visible emissions from charging, door leaks, charging ports (top side lids), and offtakes, respectively. The specific requirements that apply to a new byproduct coke oven battery are as follows:

ACHD §2105.21(a) limits	5% leaking doors, excluding the two door areas of the last oven charged and any doors that are obstructed from view; the opacity of the visible emissions from door leaks may not exceed 40% at any time starting 15 minutes after charging has taken place 1% leaking top side lids 4% leaking offtakes 55 seconds of visible emissions per any consecutive 5 charges

ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for the Battery C will comply in full with all of these applicable requirements.

4.4.3 State-of-the-Art for Emissions Control for Fugitive Emissions

As presented in **Appendix E-2**, relatively little information concerning the controls applied to coke oven battery fugitive emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. The most notable findings were as follows:

- For the 45 byproduct recovery coke oven batteries, the only fugitive emissions addressed are visible emissions.

- The only emissions control measures identified for fugitive emissions for any byproduct recovery coke oven battery are work practice requirements.

- To minimize charging fugitive emissions, many of the byproduct recovery coke ovens employ stage charging, a screw feed discharge mechanism, and automatic lid lifting. Several of the batteries are subject to limits on visible emissions for each charge and for consecutive charges.

- For leaks from doors, topside port lids, and offtakes, the most common emissions limit approach is to set a limit on the percentage of overall doors and lids that are generating visible emissions at a given point in time.

4.4.4 Top-Down Assessment of Control Technology Options for Fugitive Emissions

Identification of Available Control Technology Options

Fugitive emissions of NO_x, VOC, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ from coke oven doors, charging port lids, offtakes, and the coke oven gas collection main are attributable to the emission of COG, coal dust, and coke dust from the oven during and after the coking cycle, before the coke oven doors are opened. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for pushing emissions control, discussed in **Section 4.4.3**, there are no other specific technologies identified as being in use for the control of fugitive emissions of NO_x, VOC, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ from these elements of coke oven battery operations. By their nature, these types of emissions, and the techniques that can be applied to minimize them, are very case-specific. For the purposes of this assessment, however, the following technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- The Coke Transfer Car
- Additional capture and control
- Non-recovery coke oven battery design

Technical Feasibility Assessment

The PROven® system is technically feasible for this application. This system was developed specifically to address byproduct coke oven battery fugitive emissions, and represents a significant advancement in this state-of-the-art for byproduct coke oven batteries.

The Coke Transfer Car is technically feasible for this application. This system represents a significant advancement in the state-of-the-art for capturing fugitive emissions by quench cars.

Additional capture and control during pushing is not technically feasible for this application. As discussed by MACTEC Engineering and Consulting, Inc. in the July 2006 “Re-Evaluation of Reasonably Available Control Technology,” this is not considered a feasible approach based on the substantial volume of air that would have to be collected to adequately capture the emissions, which in turn would yield a stream with such low pollutant concentration that control would not be either technically or economically feasible.

Non-recovery coke oven battery design is not technically feasible for this application. Theoretically, much but not all of the fugitive emissions generated during charging, soaking, and during the coking cycle can be eliminated by employing a non-recovery design because those types of ovens operate under negative, rather than positive pressure. Pushing, traveling, and quenching emissions, and fugitive emissions during decarbonization, would be the same for a non-recovery battery as they would be for a byproduct recovery battery. The potential advantage of lower fugitive emissions associated with a non-recovery coke oven battery design are more than outweighed, however, by the disadvantages for this application. In particular, because the Clairton Plant has state of the art byproducts recovery plant that produces clean COG, the overall amount of air emissions associated with a non-recovery design will be higher, perhaps significantly higher, than the emissions from the proposed Battery C. In a non-recovery coke oven battery, the raw COG is burned directly, resulting in higher emissions of NO_x, SO_2, and particulate matter than will be generated by the combustion of clean COG in the proposed Battery C. While the SO_2 can be controlled through flue gas desulfurization, based on the findings made in the permitting of each of the two non-recovery design plants in the United States (Indiana Harbor Coke in Indiana and Jewell Coal and Coke in Virginia) it will not be technically feasible to control the higher NO_x or particulate matter emissions. In addition, since clean COG produced by the byproduct plant is used in place of natural gas throughout the Clairton Plant and at the Irvin and Edgar Thomson facilities, and since (as discussed previously) overall emissions are lower for clean COG combustion than for natural gas, employing a non-recovery design, rather than a byproduct design for the Battery C, will result in higher indirect emissions. Finally, since the byproduct plant produces materials such as tar, light oil, sulfur, and ammonia that are used at the facility and by outside customers, using a non-recovery design rather than a byproduct design will also result in higher indirect emissions attributable to manufacturing such materials rather than recovering them from the COG.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available NO_x, VOC, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions control options identified above, the PROven® system and a Coke Transfer Car are considered technically feasible for this application for emissions capture. Additional emissions capture and a non-recovery coke oven battery design are not considered technically feasible for this application, and were not assessed further in this analysis.

The PROven® system coupled with a Coke Transfer Car is the top-ranked option for control of fugitive emissions for the Battery C. This is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed combustion system design, featuring the PROven® system, coupled with the Coke Transfer Car, represents both BACT and LAER for NO_x, VOC, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions control for Battery C fugitive emissions.

No specific NO_x, VOC, CO, or SO_2 emissions limits are proposed as BACT for the Battery C fugitive emissions. Since emission of these pollutants contributes to visible emissions, it is proposed that compliance with the following applicable visible emissions limits represents BACT for the Battery C fugitive operations, for all pollutants including those and for TSP, PM_{10}, and $PM_{2.5}$:

- 4.0% leaking doors
- 0.4% leaking top side lids
- 2.5% leaking offtakes,
- 12 seconds of visible emissions per charge

Table 4-3 Top-Down Evaluation of BACT Options for Battery C Fugitive Emissions

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
NO_x, VOCs, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$					
PROven® system and Coke Transfer Car	Yes	No	Not Evaluated	Selected as LAER and BACT	Page 4-30
Additional capture and control	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-29
Non-recovery battery design	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-29

4.5 BACT for Battery C Traveling

As indicated in **Table 2-1**, traveling emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

4.5.1 Proposed Battery C Traveling Emissions Control Technologies

There are no specific controls proposed for emissions from traveling. The quench car will be uncovered. However, as indicated in **Section 2.2.5**, the car will be larger than the one that is used for Batteries 7 - 9, and so even though more surface area will be exposed, the new car will emit less then the current car because it will have a lower surface area to volume ratio. Also as discussed, since Battery C will have substantially fewer ovens, and since the quench tower will be closer to those ovens than the current tower, shared by the three batteries, will be to those ovens, there will be far fewer trip-miles associated with the quenching operation for C Batter in comparison to the current operation.

4.5.2 BACT Baseline - Applicable Emissions Control Standards for Traveling Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for traveling are as follows:

- There are no NSPS applicable to coke oven traveling. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, does not set standards for traveling emissions because travel emissions are regulated as part of the push.
- For NO_x, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO_x RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.
- While no ACHD standards are set for TSP, PM_{10} and $PM_{2.5}$ emissions from traveling, ACHD §2105.21(e)(5) specifies a visible emissions limit of 10%, applicable at all times, for traveling. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for the Battery C will comply in full with all of these applicable requirements.

4.5.3 State-of-the-Art for Emissions Control for Traveling Emissions

As presented in **Appendix E-3**, relatively little information concerning the controls applied to coke oven battery traveling emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. The most notable findings were as follows:

- For the 45 byproduct recovery coke oven batteries and also for the 11 non-recovery coke oven batteries, only visible emissions from traveling are addressed.
- No emissions control measures are identified for traveling emissions.
- In most cases, traveling emissions are limited in combination with pushing emissions, not separately. The Clairton Plant batteries are a notable exception to this. These are the most stringent limits that were found, 10% opacity. This same limit will be applied to Battery C.

4.5.4 Top-Down Assessment of Control Technology Options for Traveling Emissions

4.5.4.1 BACT for NO_x, VOC, and CO Emissions

Identification of Available Control Technology Options

For NO_x, VOC, and CO emissions from traveling, because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all three pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for emissions control, discussed in **Section 4.5.3**, there are no specific technologies identified as being in use for the control of emissions of NO_x, VOCs, and CO from coke oven battery traveling operations. In general, minimization of these emissions involves employing operating practices that result in minimizing the amount of time that the hot coke in the quench car is exposed to the air from when it is received in pushing to when it reaches the quench tower. Even more important in reference to minimizing these emissions are practices designed to minimize the amount of volatile material in the coke when it is pushed, i.e., minimizing production of "green coke."

Because no options could be identified for control of NO_x, VOC, and CO emissions, no technology feasibility assessment, ranking of technically feasible control technology options, or top-down assessment of options was performed in this case.

BACT Determination

The proposed system design represents both BACT and LAER for NO_x, VOC, and CO emissions control for Battery C traveling emissions.

No specific NO_x, VOC, or CO emissions limits are proposed as BACT for the Battery C traveling emissions. Since NO_x, VOC, and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

4.5.4.2 BACT for SO_2 Emissions

Identification of Available Control Technology Options

For SO_2 emissions control, the technology options involve two elements. One is how the emissions will be captured, and the other is how the emissions that are captured will be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

Emissions Capture

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")

Emissions Control

- SO_2 scrubber

Technical Feasibility Assessment

A coke-side shed is technically feasible for this application. A coke-side shed offers the advantage of capturing not only pushing emissions but all of the coke-side fugitives, notably door leaks, which are not captured by conventional PEC capture hoods. However, a shed requires a significantly larger air handling system and control device (approximately twice that of the proposed system with twice the emissions). A shed is also not capable of as high a level of capture efficiency as are either of the other two pushing emissions capture system options, and therefore a shed is both much more costly and less cost-effective overall than either of the other two options. The achievable capture efficiency for a shed is limited. A major factor that limits the achievable capture efficiency for a shed is that the shed must have at least one open end to allow the quench car to travel to and from the quench tower. In addition to lower emissions capture and much higher costs, the experience with the shed installed on the Clairton Plant B Battery indicates several other significant drawbacks for this option. The maintenance requirements associated with a shed are more extensive than with either of the other two options Second, the higher maintenance requirements for the shed result in much higher operating costs for B Battery than are experienced for the other batteries at the Clairton Plant that employ a traveling hood/fixed duct system. Third, although the B Battery baghouse is significantly larger than the control devices employed on the other batteries, it is the only device that has experienced failures in compliance demonstrations.

A **mobile capture and control unit** is not technically feasible for this application, because it is considered unlikely that a mobile capture and control unit employing a scrubber can meet the applicable ACHD emissions standards. A mobile capture and control unit offers the advantage of being able to capture and control traveling emissions, but this advantage will be outweighed by the superior overall capture and control efficiency and cost-effectiveness of the Coke Transfer Car that is proposed for this project." In fact, since it will capture emissions that escape when the oven doors are opened for pushing, the Coke Transfer Car will greatly reduce the fugitive emissions capture advantage of a coke-side shed. The mobile capture and control unit technology, equipped with scrubbers (referred to commonly as mobile scrubber cars), has been employed at other coke oven batteries owned and operated by U.S. Steel, and (as indicated above) at other batteries as well. According to pages 3-9 of the USEPA's BID, "mobile scrubber cars were popular in the 1970s but have for the most part been replaced by stationary systems." The reasons for this, as explained on pages 3-10 and 3-11 of USEPA's BID, included the high cost of operation and maintenance, the requirement of a heavy track to support the combined weight of the quench car and scrubber car, the creation of scrubber effluents that require treatment (in contrast to alternatives such as a baghouse where such is not created), limitation on accessibility for maintenance due to the need to mount equipment on mobile scrubber cars close together, and maintenance requirements associated with the diesel engine that is required to propel the gas cleaning car. Not included by USEPA in this regard are the emissions from and fuel costs associated with the diesel engine. The experiences at U.S. Steel with this type of technology were that they availability of the mobile scrubbing cars was below expectations, and because as a mobile system the technology required the recycling of scrubbing water, the particulate level of that water was higher than would be used for a fixed-location scrubber, which resulted in lower overall control efficiency.

An **SO_2 scrubber** is technically feasible for this application. A number of design options could be considered for this application, e.g., either a packed bed or spray tower could be used, and either sodium or calcium hydroxide could be used for scrubbing. The configuration that would most likely be employed would be to install the SO_2 scrubber following the PEC baghouse.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available SO_2 emissions control options identified above, a coke-side shed and an SO_2 scrubber are considered technically feasible for this application. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing SO_2 emissions from Battery C traveling operations is to capture emissions using a coke-side shed and vent the emissions to an SO_2 scrubber.

The next-most effective available option for minimizing SO_2 emissions from Battery C traveling operations is to employ no specific capture or emissions controls, but to ensure compliance with applicable visible emissions opacity standards, which (since SO_2 emissions contribute to visible emissions) represents minimization SO_2 emissions. For reasons explained below, this is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Employing a coke-side shed to capture emissions and then venting the emissions to an SO_2 scrubber represents the top-ranked SO_2 emissions control technology option for traveling emissions. As discussed previously, however, employing this type of system would mean that the proposed pushing emissions control system consisting of a traveling hood attached to a fixed duct vented to a baghouse would not be employed. The net result of that would be significantly higher overall emissions of TSP, PM_{10}, and $PM_{2.5}$ because emissions of particulate matter from pushing far exceed those from traveling. This is considered an unacceptable environmental impact, and on that basis, this option was rejected as BACT for this application.

The next-highest ranked technically feasible control technology option for SO_2 emissions from traveling is to ensure compliance with applicable visible emissions opacity standards. This was selected for this application.

BACT Determination

The proposed system involving no specific capture or emissions controls but ensuring compliance with applicable visible emissions opacity standards represents BACT for SO_2 emissions control for Battery C traveling operations.

No specific SO_2 emissions limit is proposed as BACT for the Battery C traveling operations. Since SO_2 emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

4.5.4.3 BACT for TSP, PM_{10}, and $PM_{2.5}$ Emissions

Identification of Available Control Technology Options

As discussed above in **Section 4.5.4.2** in regard to SO_2 emissions control, for TSP, PM_{10}, and $PM_{2.5}$ emissions control, the technology options also involve how the emissions will be captured and how they will then be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

Emissions Capture

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

Emissions Control

- Electrostatic precipitator

- Baghouse
- Particulate scrubber

Technical Feasibility Assessment

In regard to the technical feasibility of the three emissions capture system options, the findings are as discussed in **Section 4.5.4.2.**

In regard to the technical feasibility of the three emissions control system options, all three are technically feasible for this application. Strictly in terms of the achievable TSP, PM_{10}, and $PM_{2.5}$ emissions control efficiency, a baghouse is considered capable of a higher level of control than either an ESP or a scrubber.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available TSP, PM_{10}, and $PM_{2.5}$ emissions control options identified above, a coke-side shed and an ESP, baghouse, and particulate scrubber are all considered technically feasible for this application. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

For control of captured emissions, a baghouse is considered superior to either an ESP or a scrubber for removal of the type of particulate matter generated in pushing operations. An ESP would also have higher energy usage, maintenance requirements, and overall costs as compared to a baghouse. Although a scrubber could be designed to offer the advantage of combined SO_2 and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO_2 emitted during pushing, it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions.

The most effective available option for minimizing TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C traveling operations is to capture emissions using a coke-side shed and vent the emissions to an ESP, baghouse or particulate scrubber.

The next-most effective available option for minimizing TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C traveling operations is to employ no specific capture or emissions controls, but to ensure compliance with applicable visible emissions opacity standards, which (since TSP, PM_{10}, and $PM_{2.5}$ emissions contribute to visible emissions) represents minimization TSP, PM_{10}, and $PM_{2.5}$ emissions. For reasons explained below, this is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Employing a coke-side shed to capture emissions and then venting the emissions to an ESP, baghouse, or particulate scrubber represents the top-ranked TSP, PM_{10}, and $PM_{2.5}$ emissions control technology option for traveling emissions. As discussed previously, however, employing this type of system would mean that the proposed pushing emissions control system consisting of a traveling hood attached to a fixed duct vented to a baghouse would not be employed. The net result of that would be higher overall emissions of TSP, PM_{10}, and $PM_{2.5}$ because the proposed pushing emissions control system will be more efficient than a coke-side shed even when the traveling emissions capture aspect is included. The higher overall particulate emissions for the coke-side shed option is considered an unacceptable environmental impact, and on that basis, this option was rejected as BACT for this application.

The next-highest ranked technically feasible control technology option for TSP, PM_{10}, and $PM_{2.5}$ emissions from traveling is to ensure compliance with applicable visible emissions opacity standards. This was selected for this application.

BACT Determination

The proposed system involving no specific capture or emissions controls but ensure compliance with applicable visible emissions opacity standards represents BACT for TSP, PM_{10}, and $PM_{2.5}$ emissions control for Battery C traveling operations.

No specific TSP, PM_{10}, and $PM_{2.5}$ emissions limit is proposed as BACT for the Battery C traveling operations. Since TSP, PM_{10}, and $PM_{2.5}$ emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

Table 4-4 Top-Down Evaluation of BACT Options for Battery C Traveling Emissions

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
NO_x, VOCs, and CO					
No specific controls	Yes	No	Not Evaluated	Selected as LAER and BACT	Page 4-32
SO_2					
Capture emissions with coke-side shed, venting to an SO_2 scrubber	Yes	Yes	Not Evaluated	Rejected, higher overall Battery C TSP, PM_{10}, and $PM_{2.5}$ emissions	Page 4-34
No specific controls	Yes	No	Not Evaluated	Selected as BACT	Page 4-34
Capture emissions with mobile capture and control system (mobile scrubber car)	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-33
TSP, PM_{10}, and $PM_{2.5}$					
Capture emissions with coke-side shed, venting to a baghouse	Yes	No	Not Evaluated	Rejected, higher overall Battery C TSP, PM_{10}, and $PM_{2.5}$ emissions	Page 4-35
Capture emissions with coke-side shed, venting to an ESP	Yes	No	Not Evaluated	Rejected, higher overall Battery C TSP, PM_{10}, and $PM_{2.5}$ emissions	Page 4-35
Capture emissions with coke-side shed, venting to an scrubber	Yes	Yes	Not Evaluated	Rejected, higher overall Battery C TSP, PM_{10}, and $PM_{2.5}$ emissions	Page 4-35
No specific controls	Yes	No	Not Evaluated	Selected as BACT	Page 4-36
Capture emissions with mobile capture and control system (mobile scrubber car)	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-35

4.6 BACT for Battery C Quench Tower

As indicated in **Table 2-1**, quenching emissions consist of VOCs, SO_2 and particulate matter; the VOC consists of benzene-soluble organics, which are in particulate form.

4.6.1 Proposed Battery C Quenching Emissions Control Technologies

The Battery C quench tower and settling basin will be designed with a state-of-the-art baffle system which will be the first of its kind to be installed in the United States. The system consists of louver-like baffles arranged in a chevron pattern. The baffles will contain the particulate/VOC emissions by mechanical deflection and electrostatic adsorption. This technology is not new, but it has been substantially improved by adding a second set of baffles. The lower set of baffles will be constructed from stainless steel, while the upper set will be constructed from polypropylene.

A second mist suppression spray, located just below the baffles, will help the dust particles suspended in the stream act as condensation cores around which droplets will form that will either precipitate on the louvers above, or descend downward. The quench tower will also be taller than the existing Battery 7 - 9 quench tower, in order to achieve the required draft for the second set of baffles. One other emissions reduction benefit of the new quench tower will be that it will replace the current auxiliary quench tower for B Battery, and thus to the extent it is used for that battery will represent a substantial improvement for emissions control.

4.6.2 BACT Baseline - Applicable Emissions Control Standards for Quenching Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for quenching are as follows:

- There are no NSPS applicable to coke oven quenching. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for quenching emissions, effective on April 14, 2006. §63.7295(a)(1) specifies that either the concentration of total dissolved solids (TDS) concentration in the water used for quenching must not exceed 1,100 milligrams per liter (mg/L); or the sum of the concentrations of benzene, benzo(a)pyrene, and naphthalene in the water used for quenching must not exceed the applicable site-specific limit approved by the permitting authority. §63.7295(a)(2) specifies that makeup water must be acceptable (this term is not defined further in the regulation; it may be inferred that the makeup water should at least meet the same concentration requirements as specified above). §63.7295(b) specifies that the quench tower must be equipped with baffles, such that no more than 5 percent of the cross sectional area of the tower may be uncovered or open to the sky, and requires that the baffles must be washed daily when the tower is in use, except when ambient temperature remains less than 30°F throughout that day (if the measured ambient temperature rises to 30 °F or more during the day, daily washing must be resumed). This also requires monthly inspection and the initiation of a repair or replacement effort within 30 days of discovery of damaged or missing baffles, to be completed as soon as practicable. §63.7300(b) requires that written operating and maintenance plans for the coke oven as a whole, including quenching, be developed and followed to ensure the minimization of emissions. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.
- ACHD §2105.21(g) specifies the employment of a baffled quench tower using water that "is equivalent to, or better than, the water quality standards established for the nearest stream or river by regulations promulgated by the DEP under Pennsylvania Clean Streams Law, Act of June 22, 1937.

The proposed controls for the Battery C will comply in full with all of these applicable requirements, with the clarification stated in the compliance certification under ACHD §2104.02(h), that "make-up water is equivalent to, or better than, the water quality standards established for the Monongahela River by regulations promulgated by the DEP under the Pennsylvania Clean Streams Law, ... except that water from the Monongahela River may be used" for such make-up."

4.6.3 State-of-the-Art for Emissions Control for Quenching Emissions

As presented in **Appendix E-4**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to quenching emissions control are as follows:

- For the 33 quench towers serving byproduct recovery and non-recovery coke oven batteries that are either currently in operation or (for Chicago Coke and the FDS Coke Plant) are expected to operate in the future in the United States, as required under NESHAPs, all control quenching emissions by equipping the towers with baffles, limiting the total dissolved solids (TDS) level of the quench water, and adhering to a specified schedule for baffle inspections and cleaning.

- The only emissions control technologies identified for pushing emissions for any coke oven battery are for particulate matter emissions. No information was found that indicated that limits are imposed on any coke oven batteries for quenching emissions of pollutants other than particulate matter and visible emissions.

- The proposed Battery C quench tower design and associated operating and maintenance procedures will be equivalent or superior to those employed at the best-controlled quench towers in the United States.

4.6.4 Top-Down Assessment of Control Technology Options for Quenching Emissions

Identification of Available Control Technology Options

VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions from quenching are attributable to generation of dust by the mechanical operation of depositing the large volume of water on the coke.

The nature of the quenching operation, involving periodic bursts of a large volume of water-saturated air containing relative low levels of entrained particulate matter, precludes the consideration of the ESPs, scrubbers, and baghouses that are used for other (even large-scale) sources of particulate emissions. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- Tall tower with chevron baffle design

- Dry quenching

Technical Feasibility Assessment

A **tall tower with a chevron baffle design** is technically feasible for this application. The Low Emission Quench (LEQ) was designed to meet the particulate emissions standard for dry quenching in Germany while avoiding the issues associated with dry quenching (as discussed below).

Dry quenching is not technically feasible for this application. A dry quenching system involves substituting an inert gas such as nitrogen for water for cooling the coke. According Chapter 10 of to STAPPA/ALACO's March 2006 report "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options," "some plants in Europe have switched from water quenching to dry quenching to limit emissions of PM and VOCs," but "[T]his does require major construction activities and associated costs." More specifically, the "European

Commission (EC) estimates that a dry quenching plant may cost between 10 and 15 times more than a wet quenching station." As stated on pages 137 to 139 of the EC's December 2001 report entitled "Integrated Pollution Prevention and Control (IPPC) Best Available Techniques Reference Document on the Production of Iron and Steel," dry quenching processes were generally "intended for application in coke oven plants located in regions which suffer from long periods of severe cold, such as for example: Siberia, Finland, Poland, where wet quenching of coke is difficult or even impossible."

In reference to the CDQ type dry quenching system, USEPA's BID notes that "[T]here are no visible emissions" and that "heat from the hot coke is recovered with minimum operating costs". The USEPA's BID also discusses the Kress Indirect Dry Cooling system that was demonstrated at the Bethlehem Steel Corporation Sparrows Point mill in 1991, which reportedly "looks promising for the reduction of pushing and quenching emissions" (while not stated by USEPA, this would also be a means of controlling traveling emissions), but that the demonstration identified some problems with the technology that were not resolved while it was being tested. A search of the open literature did not identify a single case in which the Kress technology has been applied other than the cited demonstration at Sparrows Point, and therefore it cannot be considered as an available option for this application.

A documented instance of the commercial application of Coke Dry Quenching (CDQ) can be found at the Kaiserstuhl Coke Plant in Dortmund, Germany. Stoppa et al., 1999[10] discuss the relative merits and demerits of dry quenching observed at this facility. According to studies conducted at this plant, the dust emissions (PM emissions) range from 15-50 g/ton coke for a wet quenching system compared to 1-20 g/ton coke for a dry quenching system. While this exhibits a clear advantage of the dry quenching system as opposed to the wet quenching system for abatement of PM emissions, the same study showed that dry quenching process results in significantly higher quantities of gaseous pollutants such as SO_2 and CO. This fact makes it difficult to identify the better of the two technologies.

For those and possibly other reasons, the CDQ process at the Kaiserstuhl plant was shut down: the Kaiserstuhl plant itself was shut down subsequent to the discontinuation of the CDQ process. There are in fact no other dry quenching plant is known to be in operation at this time in Europe. As indicated above, the LEQ tall wet quenching tower design featuring chevron-style baffles was developed for plants such as Kaiserstuhl to meet the same emissions limits as were met by dry quenching but without the other detriments.

Another obvious concern regarding dry quenching is that while this will reduce water consumption for a coke oven battery by a significant amount, this advantage may be outweighed by the associated raw material consumption and other system demands of a CDQ as well as the attendant indirect emissions.

The establishment of a dry quenching process at Clairton would require a large area of real estate which is not available in the current scenario.

Also, coke dry quenching process requires a backup wet quenching process during occurrences of downtime and there is an increased risk of powdering and combustion of the coke during dry quenching thus decreasing the coke yield.

Moreover, the cost benefit ratio comparison conducted at Kaiserstuhl revealed that whereas a CDQ system can be installed at $60-$90 per annual ton coke produced, a wet quenching system accomplishes the same task at less than a quarter of the value ($15 per annual ton coke produced). The cost of labor and material amount to $13 million for CDQ compared to $5 million for a wet quenching system. Furthermore, revisions of CDQ (that occur every 3 years) cost another $2.5 million whereas no such revisions are required for a wet quenching system.

Dry quenching of coke facilitates the recovery of the sensible heat of coke and uses that energy to make steam which can be traded to earn proceeds. As such, a clear determinant of the profitability of the coke plant employing dry quenching lies in the domestic prices of energy. In countries such as Japan, where energy prices are high, it is more cost effective to have a CDQ system. In the U.S.A, where energy prices are much lower, wet quenching systems make for more profitable operations.

Considering the level of emissions that will be associated with the Battery C quenching operation, the significantly higher costs that would be associated with employing a dry quenching system make this unacceptable choice in this case. For these reasons, employing a dry system design as a means to reduce quenching emissions was rejected as BACT for this application.

Ranking of Technically Feasible Control Technology Options

As discussed above, of the available VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions control options identified above, a wet quenching system featuring a tall tower design with chevron style baffles is considered technically feasible for this application. A dry quenching system is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions from Battery C quenching operations, therefore, is to employ a wet quenching system featuring a tall tower design with chevron style baffles. This is the system that is proposed for the Battery C.

Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

BACT Determination

The proposed wet quenching system featuring a tall tower design with chevron style baffles represents LAER and BACT for VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions control for Battery C quenching operations.

The following emissions limits for TSP, PM_{10}, and $PM_{2.5}$ emissions limit is proposed as BACT for the Battery C quenching operations:

- 5% maximum of tower cross-sectional area left uncovered or open to the sky,
- 1,100 mg/L TDS in quenching makeup water

Table 4-5 Top-Down Evaluation of BACT Options for Battery C Quenching Emissions

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
VOCs, SO_2, TSP, PM_{10}, and $PM_{2.5}$					
Wet quenching, with a tall tower design and chevron-style baffles	Yes	No	Not Evaluated	Selected as BACT and LAER	Page 4-40
Dry quenching	No	Not Evaluated	Not Evaluated	Rejected, not technically feasible	Page 4-38

4.7 BACT for Battery C Coke Handling

As indicated in **Table 2-1**, coke handling emissions consist of particulate matter only.

4.7.1 Proposed Battery C Coke Handling Emissions Control Technologies

As indicated in **Section 2.2.7**, emissions from coke handling will be minimized by applying a surfactant to suppress dust formation, and the employment of a new baghouse to be installed on No. 3 Screening Station. A separate BACT analysis for the No. 3 Screening Station was prepared by MACTEC Engineering and Consulting, Inc., and was submitted in May 2007.

4.7.2 BACT Baseline - Applicable Emissions Control Standards for Coke Handling Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for traveling are as follows:

- There are no NSPS applicable to coke handling. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, does not set standards for coke handling.

- For VOCs, there is no specific emissions control requirement or emissions limit specified under ACHD Article XXI.

- For TSP, PM_{10} and $PM_{2.5}$ emissions, ACHD §2104.02(b) specifies limits on general process source particulate emissions of "seven (7) pounds in any 60 minute period or 100 pounds in any 24-hour period, except that no person subject to the requirements of this Subsection b shall be required to reduce emissions to a greater degree than 99 percent." ACHD §2104.02(f) specifies a source-specific PM_{10} emissions limit of 2.8 gr/ton coke for No. 3 Screening Station. This limit has recently been found to be in error and a revision has been proposed by ACHD, gone through the required public comment period and is currently in front of Allegheny County Council for approval. ACHD §2104.05 specifies that emissions from materials handling operations must not be visible beyond the property line. ACHD §2105.21 does not specify emissions control requirements or emissions limits for coke handling. ACHD §2105.40 specifies that visible emissions from material transportation within permitted source facilities cannot be visible at or beyond the property line of such source, have an opacity of 20% or more for a period or periods aggregating more than three (3) minutes in any 60 minute period, or have an opacity of 60% or more at any time. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for Battery C will comply in full with all of these applicable requirements.

4.7.3 State-of-the-Art for Emissions Control for Coke Handling Emissions

Little information concerning the controls applied to coke handling emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. From the information that was obtained, it is clear that baghouses are the exclusive technology employed to control emissions from coke screening operations, and that other potential sources of fugitive emissions from coke handling are minimized through diligent work practices.

4.7.4 Top-Down Assessment of Control Technology Options for Coke Handling Emissions

Identification of Available Control Technology Options

There are no technologies beyond those that are proposed for coke handling emissions that can be considered for this application.

Because no options could be identified, no technology feasibility assessment, ranking of technically feasible control technology options, or top-down assessment of options was performed in this case.

BACT Determination

The proposed system design represents BACT for TSP, PM_{10} and $PM_{2.5}$ emissions control for Battery C coke handling emissions.

The following emissions limits for TSP, PM_{10}, and $PM_{2.5}$ emissions limit is proposed as BACT for the Battery C coke handling operations:

- 7 lbs/60 minute period, or
- 100 lbs/24-hour period,
- not to exceed 99% control

Table 4-6 Top-Down Evaluation of BACT Options for Battery C Coke Handling Emissions

Technology Option	Technically Feasible?	Significant Environmental or Energy Impact?	Significant Economic Impact?	Finding	Reference
TSP, PM_{10}, and $PM_{2.5}$					
Effective work practices and baghouse control of screening operations	Yes	No	Not Evaluated	Selected as BACT	Page 4-42

4.8 BACT Determination Summary

The review of the RBLC and California's BACT Clearinghouse identified no listings for BACT or LAER determinations for coke oven battery emissions controls, including control of coke handling emissions. A summary of the most relevant information found regarding limits on coke handling emissions is presented in **Table 4-7**.

Table 4-7 Summary of Best Available Control Technology for Battery C

Pollutant	Emissions Control Technology	BACT Emissions Levels
Coking Cycle COG Combustion		
NO_x	PROven® system, staged combustion, byproduct recovery plant removal of nitrogen-containing organic compounds	No specific limit
VOCs	PROven® system, effective combustion	No specific limit
CO	PROven® system, effective combustion	No specific limit
SO_2	PROven® system, byproduct recovery plant desulfurization	10 gr/dcf H_2S content in treated COG
TSP, PM_{10}, $PM_{2.5}$	PROven® system, byproduct recovery plant desulfurization	0.015 gr/dscf, 10 gr/dcf H_2S content in treated COG
Pushing		
NO_x	PROven® system, effective work practices	No specific limit
VOCs	PROven® system, effective work practices	No specific limit
CO	PROven® system, effective work practices	No specific limit
SO_2	PROven® system, effective work practices	No specific limit
TSP, PM_{10}, $PM_{2.5}$	PROven® system, Coke Transfer Car, moveable hood with belt-sealed fixed duct, baghouse, achieving 90% capture efficiency and 99% control efficiency	0.02 lb/ton coke. 0.010 gr/dscf
Fugitives		
NO_x	PROven® system, effective work practices	No specific limit
VOCs	PROven® system, effective work practices	No specific limit
CO	PROven® system, effective work practices	No specific limit
SO_2	PROven® system, effective work practices	500 ppmvd
TSP, PM_{10}, $PM_{2.5}$	PROven® system, Coke Transfer Car	4.0% leaking doors 0.4% leaking top side lids 2.5% leaking offtakes, 12 seconds of visible emissions per charge 20% instantaneous opacity from push via VEO

Pollutant	Emissions Control Technology	BACT Emissions Levels
Traveling		
NO_x	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO_2	Effective work practices	No specific limit
TSP, PM_{10}, $PM_{2.5}$	Coke Transfer Car	10% Opacity via VEO
Quenching		
NO_x	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO_2	Effective work practices	No specific limit
TSP, PM_{10}, $PM_{2.5}$	State-of-the-art tower and baffle design, employ clean quenching water, daily cleaning of baffles, monthly inspection of baffles	5% maximum of tower cross-sectional area left uncovered or open to the sky, 1,100 mg/L TDS in quenching makeup water
Coke Handling		
NO_x	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO_2	Effective work practices	500 ppmvd
TSP, PM_{10}, $PM_{2.5}$	Effective work practices and baghouse control of screening operations	7 lbs/60 minute period, or 100 lbs/24-hour period, not to exceed 99% control except as specified in a unit-specific BACT determination

4.9 References

1. USEPA. RACT/BACT/LAER Clearinghouse. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Available at http://cfpub1.epa.gov/rblc/htm/bl02.cfm

2. CARB. Statewide Best Available Control Technology (BACT) Clearinghouse. California Environmental Protection Agency, Air Resources Board, Sacramento, CA. Available at http://www.arb.ca.gov/bact/bact.htm

3. USEPA. National Emission Standards for Hazardous Air Pollutants (NESHAP) for Coke Ovens: Pushing, Quenching, and Battery Stacks - Background Information for Proposed Standards, Final Report. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-453/R-01-006. February 2001.

4. GCA Corporation. An Air Pollution Control Equipment Inventory of the American Steel Industry, Final Report. Prepared for United States Environmental Protection Agency, Stationary Source Compliance Division, by GCA Corporation, Bedford, MA. December 1983.

5. MIDEQ. Renewable Operating Permit No. 199600132d issued to United States Steel Corporation, Great Lakes Works, Coke, Iron and Steel Manufacturing Operations, Located at 1 Quality Drive, Ecorse, Michigan, Effective Date: March 1, 2005. Available at http://www.deq.state.mi.us/aps/downloads/ROP/pub_ntce/A7809/A7809%20Final%203-6-07.pdf

6. RTI International. Evaluation of PM2.5 Emissions and Controls at Two Michigan Steel Mills and a Coke Oven Battery. Prepared for United States Environmental Protection Agency, Office of Air Quality Planning and Standards, by RTI International, Research Triangle Park, NC. February 7, 2006.

7. U.S. Steel. NO_x Emissions Test Results for Clairton Plant Boilers.

8. MACTEC. Re-Evaluation of Reasonably Available Control Technology, Clairton Works, Clairton, Pennsylvania. Prepared for U.S. Steel Clairton Works, by MACTEC Engineering and Consulting, Inc., Pittsburgh, PA. July 17, 2006.

9. European Commission. Integrated Pollution Prevention and Control (IPPC), Best Available Techniques Reference Document on the Production of Iron and Steel. December 2001

10. Stoppa, et. al. Costs and Environmental Impact of Dry and Wet Quenching, Cokemaking International 1/99, 65-70. Stoppa, H.; Strunk, J.; Wuch, G.; Hein, M.. 1999.

APPENDICES

Appendix A

Allegheny County Health Department Installation Permit Application Forms

ALLEGHENY COUNTY HEALTH DEPARTMENT

AIR QUALITY PERMIT APPLICATION FORM

SECTION 1. PERMIT DESCRIPTION

Check Type of Permit:

	Installation	Operating
Initial		
New Construction		
Major Modification		
Minor Modification		
Reactivation		
Temp.Source/Multi.Loc		
New Permit		
Renewal		
Adm. Permit Amend.		
Other (Explain Below)	X	

This permit application is for a:
Coke Oven Battery

Major Source	X
Minor Source	
Synthetic Minor Source (See Section 10)	

Amount enclosed:

$__1,700_____

FOR ACHD USE ONLY

Permit Number: 0052-I011

Completeness: __________

Administration: __________

Engineering: __________

Assigned to: __________

Brief Description of Permit Application/Source:

New Coke Oven Battery (C Battery). Project will produce a net emissions decrease, thus not a modification.

SECTION 2. APPLICANT INFORMATION

RECEIVED
FEB 28 2008
ALLEGHENY COUNTY HEALTH DEPT.
AIR QUALITY PROGRAM

FOR ACHD USE ONLY

Applicant Type Code: 01

Applicant Name or Registered Fictitious Name: United States Steel Corporation, Mon Valley Works

First Name	M. I.	Last Name
Anton		Lukac

Title: General Manager

Mailing Address (Street # and Name or P. O. Box #, Box #, RR #, RD #)
P.O. Box 878

City	State	Zip Code + Extension
Dravosburg	PA	15034

Relationship of Applicant to Permitted Activity. See instructions for appropriate code.
03

Telephone (412) 675-2600

FAX (412) 675-5407

E-mail

SECTION 3. SITE INFORMATION

Facility Site Name: U.S. Steel Clairton Plant

Federal Tax Identification Number: 25-0996816

Address (Street #, Street Prefix, Street Name, Street Type, Street Suffix) *P. O. BOX # IS NOT ACCEPTABLE*
400 State Street

Municipality	State	Zip Code + Extension
Clairton	PA	15025-1855

Telephone (Day) (412) 233-1003

Telephone (Eve.) (412) 233-1035

FAX (412) 233-1004

SECTION 3. (cont.)

MAP LOCATION: Please provide the Universal Transverse Mercator (UTM) coordinates or the exact latitude and longitude of the plant. UTM coordinates are preferable to latitude and longitude and can be determined from US Geological Survey 7 Minute 1:24,000 scale maps.

Attach a drawing of your source showing all emission points. Number each stack S001, S002, S003, etc., and number each fugitive emission location F001, F002, etc. Identify roads as paved or unpaved, marking all parking lots (see Form E). Identify the plant boundary on the map. Include local roads and other necessary identifiers that will allow the Department to locate your source on County-wide maps.

UTM North	4461.9	Or Latitude	NA	Degrees	NA	Minutes	NA	Seconds NORTH
UTM East	595.5	Or Longitude	NA	Degrees	NA	Minutes	NA	Seconds WEST

PLANT PROPERTY	400	Acres or	NA	Square feet
BUILDING AREA	Unknown	Acres or	NA	Square feet

GIVE TRAVEL DIRECTIONS FROM DOWNTOWN PITTSBURGH:
Travel Route 837 South to Clairton, Pennsylvania. The General Office Building is located at 400 State Street in Clairton on the left.

DESCRIPTION OF BUSINESS

GIVE A BRIEF DESCRIPTION OF BUSINESS OR ACTIVITY CARRIED OUT AT THIS LOCATION:

This facility manufactures metallurgical coke for use in the steelmaking process at various other steel mills.

PRINCIPAL PRODUCT(S):

Metallurgical Coke and Coke By-Products

APPROXIMATE NUMBER OF EMPLOYEES: 1100
If employment is seasonal, give the typical peak employment and indicate what season.
Not seasonal.

STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE FOR THIS LOCATION:
If there is more than one activity at this location, provide the Standard Industrial Code (SIC) for the principal activity, and other SIC codes in descending order of importance.

Primary SIC Code:	3312	Primary activity:	By-product coke manufacturing
Secondary SIC Code:	NA	Secondary activity:	NA
Tertiary SIC Code:	NA	Tertiary activity:	NA

SECTION 4. ENVIRONMENTAL CONTACT

First Name Coleen	M. I. M.	Last Name Davis

Title Sr. Environmental Control Engineer

Telephone (412) 233-1015	FAX (412) 233-1011

Mailing Address (Street # and Name or P. O. Box #, Box #, RR #, RD #)
400 State Street

City Clairton	State PA	Zip Code + Extension 15025-1855

E-mail cdavis@uss.com

SECTION 5: APPLICABLE REQUIREMENTS

In this section, briefly describe all applicable federal, state, or local air rules or requirements pertaining to the facility or any part of the facility.

"Applicable requirements" can come from any of the following:

(i.) Regulations that have been promulgated or approved by the EPA under the Clean Air Act or the regulations adopted under the Clean Air Act through rulemaking at the time of issuance but have future-effective compliance dates.
(ii.) A regulation under Allegheny County Article XXI (Air Pollution Control), including those incorporated by reference.
(iii.) A term or condition of any installation or operating permits issued pursuant to the County air quality regulations.
(iv.) A standard or other requirement under Section 111 of the Clean Air Act, including subsection (d).
(v.) A standard or other requirement under Section 112 of the Clean Air Act (42 U.S.C.A.. 7412), including any requirement concerning accident prevention under subsection (r) (7).
(vi.) A standard or other requirement of the acid rain program under Title IV of the Clean Air Act (42 U.S.C.A. 7641 - 7651o) or the regulations promulgated under the Clean Air Act.
(vii.) Requirements established under Section 504(b) or Section 114(a)(3) of the Clean Air Act (42 U.S.C.A. 7414(a)(3).
(viii.) A standard or other requirement governing solid waste incineration, under Section 129 of the Clean Air Act (42 U.S.C.A. 7429).
(ix.) A standard or other requirement for consumer and commercial products, under Section 183(e) of the Clean Air Act (42 U.S.C.A. 7511b(e)).
(x.) A standard or other requirement for tank vessels, under Section 183(f) of the Clean Air Act (42 U.S.C.A. 7511b).
(xi.) A standard or other requirement of the program to control air pollution from outer continental shelf sources, under Section 328 of the Clean Air Act (42 U.S.C.A. 7627).
(xii.) A standard or other requirement of the regulations promulgated to protect stratospheric ozone under Title VI of the Clean Air Act (42 U.S.C.A. 7671-7671q), unless the Administrator of the EPA has determined that such requirements need not be contained in a Title V permit.
(xiii.) A national ambient air quality standard or increment or visibility requirement under Title I, Part C of the Clean Air Act (42 U.S.C.A. 7470-77491), but only as it would apply to temporary sources permitted pursuant to Section 504(e) of the CAA (42 U.S.C.A. 7661d).

Include any regulations that are final, but may require controls to be put on, or lower emission rates to come into effect in th future. Be as specific as necessary. For example, if you have boilers rated at 10, 70, and 100 MMBtu, then for sulfur dioxid emissions list Article XXI 2104.03 a.1, 2, and 3. When you complete the Forms for specific operations, you will be requested to repeat those requirements unique to that unit. Include general emission requirements, such as 2104.04, odor emissions, if they apply.

If there are any limitations on source operation affecting emissions or any work practice standards, provide details in this section. Include supporting documents, if necessary. If the facility is claiming any exemptions to a part of an applicable requirements stated above or any other requirements, clearly identify what section. Copy this page as needed, and attach these additional pages to this section.

An example of how Section 5.A might be completed:

Emission Regulation	Description
Art. XXI 2104.02.a.2	PM 0.40 #/10^6 BTU
Art. XXI 2104.03.a.1	SO_2 1.0 #/10^6 BTU
Art. XXI 2104.01.a	Opacity 20% for ≤3 min./hr. or 60% at no time
Art. XXI 2105.06.d.1	Low NOx Burners w/overfire air

List and summarize all applicable federal, state, or local air rules or requirements pertaining to the facility or any part of the facility. Also describe any regulated work practice standards that affect air emissions. Include any regulations that are in place, but have delayed deadlines for compliance. (COPY THIS PAGE AS NEEDED)

REGULATION DESCRIPTION

ACHD Article XXI Regulations

PART A - GENERAL

2101.11	*Prohibition of air pollution*
2101.12.a	*Interstate air pollution: General*
2101.12.b	*Interstate air pollution: Findings by EPA*

2101.17	Circumvention

PART B - PERMITS GENERALLY

2102.01	Certification
2102.04.a	Installation permits: General Requirements
2102.05	Installation permits for new and modified major sources
2102.10	Installation permit application and administration fees

PART C - OPERATING PERMITS

2103	Operating permits

PART D - POLLUTANT EMISSION STANDARDS

2104.01.a	Visible emissions: General Limits
2104.01.b	Visible emissions: Exclusions
2104.01.c	Visible emissions: Measurements
2104.02.b	Particulate mass emissions: Processes - General
2104.02 c	Crushing, grinding, or screening
2104.02 e	Specific controlled process sources *(1)
2104.02 f	#3 Coke Screening
2104.03.a	Sulfur oxide emissions: Fuel Burning or Combustion Equipment
2104.03.c	Sulfur oxide emissions: Processes
2104.03.e	Sulfur oxide emissions: Measurements
2104.04.a	Odor emissions: General (LOCAL ONLY)
2104.04.c	Odor emissions: Measurements (LOCAL ONLY)
2104.05	Materials handling emissions
2104.06	Violations
2104.07	Stack heights
2104.08	National emission standards for Hazardous Air Pollutants

PART E - SOURCE EMISSION AND OPERATING STANDARDS

2105.03	Operation and maintenance (of air pollution control equipment)
2105.05	New source performance standards
2105.06	Major sources of nitrogen oxides and volatile organic compounds (RACT)
2105.12	Volatile organic compound storage tanks
2105.15	Degreasing Operations
2105.21	Coke ovens and coke oven gas *(3)
2105.40	Permit source premises
2105.41	Non-permit premises
2105.42	Parking lots and roadways
2105.43	Permit source transport
2105.44	Non-permit source transport
2105.45	Construction and land clearing
2105.47	Demolition
2105.48	Areas subject to sections 2105.40 through 2105.47
2105.49	Fugitive emissions
2105.50	Open Burning
2105.51	Abrasive blasting
2105.60	Asbestos Abatement Contractor Licenses

Asbestos Abatement Accreditation Requirements

* (1), (2), (3) - see clarification on page 1-28.

PART F - AIR POLLUTANT EPISODES

2105.61	Asbestos Abatement Applicability, Federal Requirements, Notices and Permits
2105.62	Asbestos Abatement Procedures
2106.01.a	Air Pollution Episode System: General
2106.02	Air Pollution Source Curtailment Plans
2106.04	Episode Actions
2106.05	USX Clairton Works PM-10 Self Audit Emergency Action Plan

PART G - METHODS

2107.01	*General methods of measurement*
2107.02	*Particulate matter measurements*
2107.03	*Sulfur oxide measurements*
2107.05	*Nitrogen oxide measurements*
2107.07	*Coke oven emissions*
2107.08	*Coke oven gas*
2107.09	*Hydrogen sulfide*
2107.10	*Sulfur content of coke*
2107.11	*Visible emissions measurement*
2107.13	*Odor emissions measurements*
2107.20	*Ambient measurements*

PART H - REPORTING, TESTING, & MONITORING

2108.01	*Reports required*
2108.02.a	*New and modifies sources*
2108.02.b	*Emissions testing: Existing sources*
2108.02.c	*Emissions testing: Existing sources orders*
2108.02.e	*Emissions testing: Existing sources testing requirements*
2108.03	*Continuous emissions monitoring*
2108.04	*Ambient monitoring*

PART I - ENFORCEMENT

2109.01.a	*Inspections: General*
2109.03	*Enforcement Orders*
2109.04	*Orders Establishing an Additional or More Restrictive Standards*

Pennsylvania State Requirements

25 PA. Code 145	*Interstate Pollution Transport Reduction*

Federal Requirements

40 CFR Part 63 Subpart L	*National Emission Standards for Coke Oven Batteries*
40 CFR Part 63 Subpart CCCCC	*National Emission Standards for Pushing, Quenching, and Battery Stacks*

SECTION 6: METHOD OF DEMONSTRATING COMPLIANCE

List the method of demonstrating compliance with each of the emission standards (these may become conditions of the Operating Permit):

A. Compliance Method/ Monitoring Devices:

EMISSION UNIT #	POLLUTANT	REFERENCE TEST METHOD OR COMPLIANCE METHOD OR MONITORING DEVICE	FREQUENCY / DURATION OF SAMPLING
Battery C Combustion Stack	Opacity	COM	Continuous
Battery C	SO2	Stack Testing	Biennial
Battery C	NOx	CEM	Continuous
Battery C	PM10	Stack Testing	Biennial
Battery C	PM2.5	Stack Testing after approved EPA Method is promulgated	Once per permit cycle
Battery C	VOC	Stack Testing	Biennial
Baghouse	PM	Baghouse leak detection system	Continuous
Battery C - Doors	Visual Emissions Observations (VEO)	Method 303 per 40 CFR 63.304	Daily
Battery C - Lids	Visual Emissions Observations (VEO)	Method 303 per 40 CFR 63.304	Daily
Battery C - Offtakes	Visual Emissions Observations (VEO)	Method 303 per 40 CFR 63.304	Daily
Battery C - Charging	Visual Emissions Observations (VEO)	Method 303 per 40 CFR 63.304	Daily
Battery C – Collector Main	Visual Emissions Observations (VEO)	Method 303 per 40 CFR 63.304	Daily
Battery C - Pushing	Visual Emissions Observations (VEO)	Method 9	4 per day
Battery C - Travel	Visual Emissions Observations (VEO)	Method 9	4 per day
PEC Baghouse	VEO, PM	Method 9, Stack Testing	Biennial
Coal Charged (in tons)		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Coke Produced (in tons)		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
COG produced (in tons)		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Sulfur content in Coal (%)		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Sulfur Content in coke (%)		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly

Total Number of Pushes		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Number of Controlled Pushes		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Pushing Outages		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Flaring Incidents		Production Records per 3/28/90 Enforcement Order and ACHD 2109.03	Monthly
Attach any details that would further explain the method of compliance.			

B. Record keeping and Reporting:

1. List what parameter will be recorded and the frequency of recording:

PARAMETER	FREQUENCY
NOx Continuous NO_X monitoring measurements will record: - daily fuel consumption and average fuel Btu content; - average monthly fuel input; - average monthly NO_X emission rate; and calculate 30 day rolling average NO_X emissions in lb/MMBtu.	Continuous
Opacity Continuous opacity monitoring measurements will record: - monthly percentage of availability; - daily percentage availability; - number of days less than 100 percent availability; - hours of opacity exceedance by day and month as recorded by COM; and number and nature of all tests and calibrations of the COM.	Continuous
Monitoring parameters will be recorded in accordance with Article XXI.	
Biennial source test of underfire stack for PM will be conducted and recorded per method, biennially.	Biennially
Biennial source test of underfire stack for PM will be conducted and recorded per method, biennially.	Biennially
Visual emissions observations by Method 303 will be conducted and recorded.	Daily
Pushing Observations	Daily
Travel Observations	Daily

2. Describe what is to be reported and the frequency of reporting? (Reports must be submitted at least every six (6) months)

DESCRIPTION	FREQUENCY
Production reports	Semi-Annual
Visual emission observations by Method 303	Monthly by ACHD Contractor
Opacity monitoring reports on the underfire stack	Monthly
NOx continuous monitoring reports will be submitted	Quarterly

Biennial source testing results	Biennially
Pushing Observations	Semi-annually

3. Beginning reporting date: __ /__ /__

COPY THIS PAGE AS NEEDED

SECTION 7: COMPLIANCE PLAN

A source may apply for and receive an Operating Permit if one or more emission units are out of compliance with a regulation provided that an adequate plan is in place to bring the unit(s) into compliance.

A.__ 1. At the time of this permit application is your source in compliance with all applicable requirements, and do you expect your source to remain in compliance with these requirements during the permit duration (with the exception noted in item C)?

__ Yes _X_ No

2. Will your source be in compliance with all applicable requirements scheduled to take effect during the term of the permit, and will they be met by the applicable deadline?

_X_ Yes __ No

B.__ If you checked "No" for any question in Part A, please attach information identifying the requirement(s) and emission units for which compliance is not achieved, briefly describe how compliance will be achieved with the applicable requirement(s), and provide a detailed Schedule of Compliance (i.e., a schedule of remedial measures, including an enforceable sequence of actions with milestones and projected compliance dates). Title this portion of the document "**Schedule M: Compliance Information**". Indicate the frequency for submittal of progress reports (at least every six (6) months) and the starting date for submittal of progress reports. See Appendix H1-H4, Compliance history information.

C.__ Do you have scheduled shutdown of control equipment for maintenance while the emission units are still operating?

_X_ Yes __ No

If yes, attach a description of the equipment that will be taken out of service, what pollutants and emission sources ar affected, the schedule and duration of the shutdown, and what actions will be taken to minimize emissions.

In the event of a Coke Transfer Car outage a back-up traveling hood will be utilized. Outages or breakdowns of the PEC system will be reported as required.

SECTION 8: OTHER PERMITS

Do you own or are you related to any other permitted company in Pennsylvania?

X Yes __ No

If so, please list the company names:

U.S. Steel Mon Valley Works (i.e., USS Edgar Thomson Plant, the USS Irvin Plant, and USS Fairless)

SECTION 9: COMPLIANCE CERTIFICATION

You are required to submit a certificate of compliance with all applicable requirements and a method of determining compliance with those requirements (CEMS, monitoring, tests, record keeping and other reporting). Compliance certifications are to be submitted at least on an annual basis. Please answer the following:

Schedule for Submission of Compliance Certification during the term of the permit:

_X_ We will submit a Compliance Certification annually at the same time as the submittal of the annual administrative fee. **OR**

___ Beginning on: __ /__ /___ as defined in the Title V permit when issued

---

CERTIFICATION OF COMPLIANCE WITH ALL APPLICABLE REQUIREMENTS

A "responsible official" must sign this certification. Applications without original signed certifications or necessary corporate authorizations will be returned as incomplete.

Except for the requirements identified in Section 7 for which compliance is not yet achieved, except for exceedances of emission standards resulting from breakdowns reported per Article XXI, Section 2108.01(c), and except for the following clarifications for quench water, cooling tower water, big plug doors, and coal pulverizer enclosures,* I hereby certify that, based on information and belief formed after reasonable inquiry, the source identified in this application is in compliance with all applicable air requirements.**

Signature of Responsible Official

Mr. Anton Lukac, General Manager
Name and Title of Signer (Print or Type)

400 State Street
Mailing Address (Street # and Name or P. O. Box #, RR #, RD #, Box #)

Clairton, PA 15025-1855
City, State, and Zip Code + Extension

Date: **02 / 02 / 2008**

***** This certification applies only to the revised General Plant Information section for C Battery and revised Schedule of Compliance, Schedule M. These section replace those submitted on October 23, 2003.***

**** (1) ACHD XXI, δ2104.02.e Specific Controlled Process Sources***

The compliance certification contained in this application is based on the understanding that δ2104.02.e "...enclose all coal feed chutes...", requires the enclosure of all feed chutes to the pulverizers per Paragraph 14, page 7 of the GASP Agreement, "...enclose all feed chutes to the pulverizers..."

(2) ACHD XXI, δ2104.02.h Cooling Tower Water

The compliance certification contained in this application is based on the understanding that make-up water used in the Clairton Works Cooling Tower "will be equivalent to, or better than, the water quality standards established for the Monongahela River by regulations promulgated by the DEP under the Pennsylvania Clean Streams Law, ... except that water from the Monongahela River may be used" for such make-up."

(3a) ACHD XXI, δ2105.21.b.5 Coke Ovens and Coke Oven Gas, Door Areas

The compliance certification contained in this application is based on the understanding that big plug doors, required by ξ2105.21.b.5, meet the specified dimensions contained in the regulation when initially installed except that portion of the plug located in the tunnel head above the design coal line. The plugs may experience inconsequential dimensional changes over time in the course of normal operations.

(3b) ACHD XXI, δ2105.21.g Quenching

The compliance certification contained in this application is based on the understanding that make-up water used for the quenching of coke "will be equivalent to, or better than, the water quality standards established for the Monongahela River by regulations promulgated by the DEP under the Pennsylvania Clean Streams Law, ... except that water from the Monongahela River may be used" for such quenching make-up.

SECTION 10: SYNTHETIC MINOR

A Major source may, at its option, choose to place limits on its operation or emissions in order to become a "Synthetic Minor" source, and not be subject to the additional requirements of a Major source. These limits will become permit restrictions and will be federally enforceable.

Does this application include any requested restrictions?
__ Yes _X_ No

If so, have these restrictions caused this site to go below Major source thresholds and become a Synthetic Minor?
__ Yes __ No

Is this facility requesting to become a Synthetic Minor source?
__ Yes _X_ No
(Please check the box on the top of page 1 as well.)

Be sure to include on each source information sheets, Forms A, B, and C, a complete description of the limitations that make this source a Synthetic Minor. Attach extra pages, if needed.

SECTION 11: INFORMATION FOR INSTALLATION PERMITS

Is this a new Major source or Major Modification for any criteria pollutant which is in or impacting a non-attainment area?
__ Yes _X_ No

If yes, list below for which pollutant(s).
NA

Attach all required documents required under Article XXI, sections 2102.05 and 2102.06.

Is this a new Major source or Major Modification for any criteria pollutant which is in or impacting an attainment area or unclassified area?
__ Yes _X_ No

If yes, list below for which pollutant(s).
NA

Attach all required documents required under Article XXI, sections 2102.05 and 2102.07.

A source applying for a Minor Installation Permit may request public review at this time.

Are you requesting public review for a Minor Installation Permit?

__ Yes _X_ No

SECTION 12: ALTERNATIVE OPERATING SCENARIOS

This permit allows for certain flexibility in operations. Please note the explanation of this section in the instructions. While filling out your permit application, consider all the different operating scenarios you might want to operate under during the 5-yea term of your permit. This may include a change in inks or solvents, operating schedules, or other expected departures fr operations that cannot be adequately described in the main body of the permit application.

Do you seek approval of any alternative operating scenario?

__ Yes _X_ No

If "Yes": Complete Form N to provide complete information for each alternative operating scenario to be employed at this location. Duplicate pages as needed.

Please note that there may be additional reporting requirements for alternative scenarios.

SECTION 13: ADDITIONAL SUBMITTALS

A form must be submitted for each process, boiler, incinerator, etc., as indicated below. Provide the numbers of each type of unit below, and submit the designated form for each unit. Also, identify each criteria pollutant and other regulated pollutant emitted by this source (facility). See Article XXI, definition of hazardous air pollutant and section 2101.10. Include also other pollutants not regulated, but with known emission rates. Provide the total below, and submit an emissions summary for each pollutant. List below all attachments made for this application. All applicable forms must be attached to each copy of the application.

_2_ Number of Processes - Submit one Form A for each process. Number each P001, P002, etc.
_0_ Number of Boilers - Submit one Form B for each boiler. Number each B001, B002, etc.
_0_ Number of Incinerators - Submit Form C for each incinerator. Number each I001, I002, etc.
_0_ Number of storage tanks - Submit one Form D for each tank or group of tanks. Number each D001, D002, et
_0_ Dry bulk materials storage and handling - Submit Form E.
_0_ Roads and vehicles - Submit Form F.
_0_ Miscellaneous fugitive emissions - Submit Form G.
_0_ Number of Form F: Roads and Vehicles.
_0_ Number of Form G: Miscellaneous Fugitive Emissions.
_0_ Number of Form K: One Emissions Summary Form for Each Pollutant.
_0_ Number of Form M: One Form M for each.
_0_ Number of Form N: One Form N for each scenario.

Are map(s)/drawing(s) attached? _X_ Yes __ No

Are required documents attached pertaining to an Installation Permit? _X_ Yes __ No

Are other comments/notes attached? _X_ Yes __ No

Is a Best Available Control Technology (BACT) analysis attached for installations? _X_ Yes __ No

Is a Compliance Assurance Monitoring (CAM) Plan (40 CFR Part 64) attached? (applicable to Title V Operating Permit Renewals.) _X_ Yes __ No

SECTION 14: ANNUAL APPLICATION / ADMINISTRATION FEE CALCULATION

INSTALLATION PERMIT APPLICATION - Check all that pertain to this application:

If this source is applicable to more than one category listed below, it is subject to the highest of the applicable fees, not to the total.

A		Prevention of Significant Deterioration ($22,700)	
B		Involving ACHD Development of a MACT Standard ($8,000)	
C		Major new source or Major Modification ($8,000)	
D	×	Any source subject to an existing NSPS, NESHAP, or MACT ($1,700)	$1,700
E		Any other Installation Permit ($1,000)	
F		Modification to an existing Installation Permit ($300)	

Installation Permit Fee $ 1,700

Note: An administrative fee of $750.00 will be billed to the source, beginning 30 days after the Installation Permit is approved, and annually on the anniversary of the approval thereafter, until a complete Operating Permit Application has been submitted to the Department.

OPERATING PERMIT APPLICATION - Check all that pertain to this application:

A. Base fee (Minor or Synthetic Minor Source - $375.00 / Major Source - $750.00): $ ______

B. Hazardous Air Pollutant Source fee - (Major Source only - if any "hazardous air pollutants" (see 40CFR2101.10) are listed on Form K, add $375.00) +$ ______

C. Acid Rain Source fee (Major Source only - if any "acid rain" regulations are listed in Section 5, - add $375.00) +$ ______

D. Adjusted Base fee - Add A., B., and C.: =$ ______

E. Noncomplying Source fee (if "No" is checked in Section 7 Part A) Add 50% of the "Adjusted Base fee" from line D. above: +$ ______

F. Total Fee Due - Add D. and E.: =$ ______

Checks are to be made payable to the "ACHD Air Pollution Control Fund."

All sources that apply for Operating Permits will be required to pay an annual administrative fee equal to the Operating Permit Application Fee. Major sources are also required to pay annual emissions fees. These are to be paid at the scheduled submittal of the annual emissions inventory.

SECTION 14. BILLING CONTACT

First Name Michael	M. I.	Last Name Hohman
Title Manager, Mon Valley Works Environmental		
Telephone 412-233-1467		FAX 412-233-1011
Mailing Address (Street # and Name or P. O. Box #, Box #, RR #, RD #): 400 Stare Street		
City Clairton	State PA	Zip Code + Extension 15025
E-mail mhohman@USS.com		

SECTION 15: SIGNATURES AND CERTIFICATION

CERTIFICATION OF COMPLETED APPLICATION

CERTIFICATION {for corporate applicants: Attach Certificate of Corporate Authority}

Subject to the penalties of Title 18 Pa. C.S. Section 4904 relating to unsworn falsification to authorities, I certify that I have the authority to submit this Permit Application on behalf of the applicant named herein and that the information provided in this Application is true and correct to the best of my knowledge and information.	Signature of Preparer of Form (if different than applicant).
Signature Date	Signature
Name – Print or Type	Name, Mailing Address, and Phone# - Print or Type Coleen M Davis
Title – Print or Type	U. S. Steel Clairton plant
Mailing Address – Print or Type	400 State Street
City, State, and Zip Code + Extension – Print or Type	Clairton, PA 15025
( ) Day Phone Number ( ) Fax Phone Number	412-233-1015

{For corporations:
Certificate of Corporate Authority must be completed, by the Corporate Secretary, and attached}

CERTIFICATE OF CORPORATE AUTHORITY

I, ______________________, certify that I am the Secretary of the corporation named above; that ______________________, who has signed this document on behalf of the corporation was then ______________________ of the said corporation; and that I know his/her signature and his/her signature is genuine; and that said Agreement was fully signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

ATTESTED TO BY: ______________________ DATE: __/__/____

{Signature}

NAME:

{Print or type}

TITLE: SECRETARY

[AFFIX CORPORATE SEAL]

PERMIT FORM A
PROCESS OPERATIONS

PLANT NAME AND LOCATION: *USS Clairton Works - 400 State Street, Clairton,PA*

ART 1. DESCRIPTION OF PROCESS (MAKE A COPY OF SCHEDULE A FOR EACH PROCESS.)
Company Identification or Description: *C Battery (P046)*

ACHD Permit Number (if any) NA

Design (*X*) Charging or ( ) Production rate (specify units) *1,253,690 tons of coal/year Total*

Annual Production (specify units normally used) *1,005,528 tons of coke/year and raw coke oven gas*

Raw materials *Coal, supplemented with recycled coke plant materials such as tar decanter sludge, bio sludge, and coke oven gas pipeline material; synfuel; metallurgical coke; petroleum coke; coke breeze; Synfuel additive; recycled tire chips; and bulk density control additives such as diesel fuel.*

Materials Produced *Metallurgical Coke*

Process Operation Units:	(1) *Charging*
(Name and Previous County	(2) *Door*
Permit Number, if any)	(3) *Lid*
	(4) *Offtake*
	(5) *Soaking*
	(6) *Flare Stacks*
	(7) *Underfire Stack*
	(8) *Baghouse Stack*
	(9) *Fugitive Pushing*
	(10) *Traveling Hot Car*
	(11) *Uncontrolled Pushing*
	(12) *Baghouse Dust Handling*

Diagram of Process Flow: Attach a separate sheet with a drawing of a flow diagram of this process, labeling each segment listed under Process Operation Segments. Label product intake points and product discharge points for each segment. Label emissions discharge points and the location of emissions control devices.

PART 2. PROCESS OPERATION SCHEDULE
A. Normal schedule: (Provide information for last year. If a new unit, please estimate)
Hrs/day *24* Days/week *7* Weeks/year *52* Hrs/Year *8760*
Start time *00:00* End time *24:00*

Seasonal: Periods correspond to seasons instead of calendar quarters. The first season is split to include December, January, and February.

Percent of Annual Production

Dec., Jan., and Feb.:	*25*	June to August:	*25*
March to May:	*25*	Sept. to Nov.:	*25*

B. Requested limits: (limitations on operating hours are optional.) Choose one:
(*X*) 8760 hours (no limitations) or
( ) I/We request the following limitation -- **This may become a federally enforceable ermit condition:** Describe how this can be enforced: either list an operating schedule or downtime (e.g. only operate 8:00 to 4:00) or an operating hour reporting requirement.
_____ total days x _____ hours/day = _______ hours/year

PART 3. FUELS

A. Normal Operation (Provide information for last year. If a new unit, please estimate)

()YEAR _ or (**X**)Estimate	Primary	Secondary	Other	Other
Type:	*COG*	*Natural Gas*		
Max amount/hour	*699,000 CF*	*0 CF*		
Sulfur content (%wt):	*0.1248%* as H2S	-----		
Ash content (%wt):	-----	-----		
BTU Rating (specify units)	*448 BTU/CF*	*1000 BTU/CF*		
Annual Fuel Consumption	*6,123.24 MMcf*	*None*		
Seasonal Fuel Consumption (%):				
Dec-Feb	25			
Mar-May	25			
Jun-Aug	*25*			
Sep-Nov	25			

Fuel Mixing: If more than one fuel is used, explain usage, stating whether it is burned separately, mixed in a fixed ratio of ___:___ (give units such as BTU, MMcf, gallons per ton, etc.), mixed in a variable ratio of ____to ___, determined by _(give reason). **Natural gas may be substituted in part or whole in the event of an interruption of coke oven gas supply**

B. Requested limits (limitations on operations are optional, but may allow a major source to be exempted from some requirements) **These may become permit conditions.** Please check one:

(*X*) full use of any fuel or combination at any time (no limitations)

( ) the following limitations on types of fuels or the combination of fuels (describe how compliance with this method will be demonstrated)

PART 4. OTHER LIMITATIONS

Identify any other requested limitations, such as on production rates or materials use. Describe how compliance with these restrictions will be demonstrated. **These limitations may become permit conditions.**

NA

PART 5. APPLICABLE REQUIREMENTS (Describe all applicable requirements affecting air emissions for this unit)

Regulation # Requirements

ederal and ACHD Article XXI Regulations

Regulatory Citation	Regulated Pollutant	Operation	Applicable Standard/Requirement
40 CFR Part 63 - Subpart L 63.304(b)(2)(iv)	*Visible Emissions*	*Charging*	*12 seconds / charge for 5 charges/30 day log average*
40 CFR Part 63 - Subpart L 63.304(b)(3)(i)	*Visible Emissions*	*Door Leaks*	*4.0% leaking doors per battery 30 day rolling average*
40 CFR Part 63 - Subpart L 63.304(b)(2)(ii)	*Visible Emissions*	*Lid Leaks (charging ports)*	*0.4% leaking lids 30 day rolling average*
40 CFR Part 63 - Subpart L 63.304(b)(2)(iii)	*Visible Emissions*	*Offtake Leaks*	*2.5% leaking offtakes 30 day rolling average*
40 CFR Part 63 - Subpart L 63.308(a) through (d)	*Visible Emissions*	*Collector Mains*	*Monitor Daily, Record the time & date leak is observed, time and date leak was temporarily sealed, Temporary seal within 4 hours, Initiate permanent repair within 5 days, Complete repair within 15 days*
40 CFR Part 63 - Subpart L 63.306	*Visible Emissions*	*Work Practices*	*Implement after 2 exceedances in 6 mos. & then for 90 days*
40 CFR Part 63 - Subpart L 63.307	*Visible Emissions*	*ByPass / Bleeder Stacks (Flare)*	*Install Flares/ Prohibition of venting, flare requirements*
40 CFR Part 63 - Subpart L 63.310	*NA*	*Startup, Shutdown, Malfunction*	*Startup, Shutdown, Malfunction: operate and maintain battery and equipment consistent with good air pollution control practices to minimize emissions, develop and implement SSM Plan.*
40 CFR Part 63 - Subpart L 63.311	*NA*	*Reporting & Recordkeeping*	*Perform specified reporting and recordkeeping requirements*
40 CFR Part 63 – Subpart CCCCC 63.7290	*Particulate Matter*	*PEC BH*	*0.02 lb / ton of coke if moveable hood used (EPA Method 5 front half)*
40 CFR Part 63 – Subpart CCCCC 63.7291	*Opacity*	*Ovens*	*Perform specified observations, recording of fugitive pushing emission; corrective action if necessary*
40 CFR Part 63 – Subpart CCCCC 63.7294	*NA*	*Soaking Work Practice*	*Operate according written work practice plan*
40 CFR Part 63 – Subpart CCCCC 63.7295	*Water Quality*	*Quenching*	*TDS <=1,100 mg/L;*
40 CFR Part 63 – Subpart CCCCC 63.7295	*NA*	*Quench Tower Design and Work Practice*	*<=5% of area open to sky; baffle washing & inspection & repair frequency*
40 CFR Part 63 – Subpart CCCCC 63.7296	*Opacity*	*Battery Stacks*	*Daily <=15% normal coking cycle; daily <=20% extended coking cycle*
40 CFR Part 63 – Subpart CCCCC 63.7300	*NA*	*Work Practice*	*Written operation & Maintenance plan; corrective action if bag leak detection system alarm triggered*
40 CFR Part 63 – Subpart CCCCC 63.7320 – 63.7343	*NA*	*Compliance*	*Procedures for initial performance testing and ongoing compliance, recordkeeping, reporting*
2108.02(b)	*SO2 & PM*	*Underfire Stacks*	*Conduct biennial testing*
2105.21(a)(1)	*Visible Emissions*	*Charging*	*55 seconds/total for 5 charges*
2105.21(b)(4)	*Visible Emissions*	*Door Leaks*	*40% Visible Emissions, at any time for 15 minutes after charge*
2105.21(b)(1)	*Visible Emissions*	*Door Leaks*	*5% leaking, excluding the two door areas of last oven charged and any oven door obstructed from view.*
2105.21(c)(1)	*Visible Emissions*	*Lid Leaks (charging ports)*	*1% leaking lids*
2105.21(d)(2)	*Visible Emissions*	*Offtake Leaks*	*4% leaking offtakes*
NOx RACT	*NOx/VOC*	*All Operations*	*Properly maintained & operated according to good engineering and air pollution control practices*
NOx RACT	*NOx/VOC*	*Pushing*	*Pushing emission control system properly maintained & operated according to good engineering & air pollution practices*
2105.21(e)	*PM*	*Pushing*	*Install PEC to reduce emissions (use BACT)*
2105.21(e)(4)	*Visible Emissions*	*Pushing*	*Pushing or PEC outlet - not to equal or exceed 20% at any time*
2105.21(e)(5)	*Visible Emissions*	*Pushing*	*Coke transport - not to exceed 10% at any time*
2105.21(e)(6)	*Visible Emissions*	*Pushing*	*Contingency Plan*
2105.21(e)(3)(E)	*PM*	*Pushing - BH Stack*	*0.040 lbs/ton of coke*
2104.05	*Visible Emissions*	*Baghouse Dust Handling*	*No emissions visible at or beyond the property line.*

2105.21(f)(4)	*Visible Emissions*	*Underfire stack*	*60% Visible Emissions at anytime*
2105.21(f)(3)	*Visible Emissions*	*Underfire stack*	*20% Visible Emissions 3 mins/hr*
2105.21(f)(1)	*Particulate*	*Underfire stack*	*0.015 grains/ DSCF*
2105.21(g)	*NA*	*Quenching*	*Coke must be quenched through a baffled tower and water must be of the same quality as the nearest stream or from the nearest stream*
2104.03(c)	*SO2*	*Underfire stack*	*500 ppm (vol dry) in effluent gas*
2108.03(b)	*NOx*	*Underfire stack*	*Install & operate continuous NOx emission monitor*
2109.03	*Visible Emissions*	*Underfire stack*	*Install & operate Continuous Opacity Monitor*
2105.21(h)(2)	*H_2S*	*COG Combustion*	*H_2S must be less than 10 gr/100 dcf*

PART 6: EMISSION CONTROLS: Complete the following applicable sections for each pollution control device. Attach additional sheets to provide sufficient information and engineering calculations to support the control device performance.

n the space to the left of each device, number the device(s) by the order in which they process the waste ream(s). Fill out the requested information, then complete the table for efficiencies by pollutant for each evice.

Capture efficiency of all units 90 % air flow *187,000 ACFM @ 250°F*

6 **BAGHOUSE (fabric collector)** Mfr.'s name, model ________

(6 modules: 5 operating and 1 on stand-by)

Type of bag material *Polyester Felt*

Total filter cloth area *46,800* sq.ft., air to cloth ratio *3.99:1* (gross)

Bag cleaning method: *Pulse Jet* , cycle ______ min

Pressure drop: clean *2* "H2O, dirty *10* "H2O

Pollutant	Efficiency (%)	Basis for Efficiency	Outlet grain loading
PM-10	*99%*	*Stack Test*	*0.005 grains/DSCF*

NA **ELECTROSTATIC PRECIPITATOR:** Mfr.'s name, model

Type: ___single stage, ___two stage, ___plate, ___tube

Total collecting area: ____________ sq.ft., cleaning cycle ________ min.

as Velocity __________ ft./sec., corona power ________ kw

Bulk resistivity of dust: ______ ohm-cm Moisture content of gases: ______ vol.%

Pollutant	Efficiency (%)	Basis for Eff.	Outlet grain loading

NA **CYCLONE (dry gas only):** Mfr.'s name and model

Gas inlet: width ______ ft., height ______ ft.

Diameter: gas outlet ______ ft., cyclone cylinder(s) __________ ft.

Length of cyclone: ______ ft., no. of cylinders: ______ Pressure Drop ______ "H2O

Pollutant	Efficiency (%)	Basis for Eff.	Outlet grain loading

NA **CONDENSER:** Mfr.'s name and model

Type: surface ________, contact

Heat transfer area: ______ sq.ft., max process pressure ________ psia

Heat duty: ________ BTU/hr. Coolant temp: inlet ______ °F, outlet ______ °F

ollutant	Efficiency (%)	Basis for Eff.	Outlet concentration (ppm)

NA **WET COLLECTOR**:Mfr.'s name and model

Type: _____venturi, _____cyclone, _____spray chamber, _____packed bed

Entrainment/separator: type________________, bed depth

Type & construction of chemicals added to the scrubbing liquid:

____Pressure drop__________"H2O

Scrubbing liquid: flow rate_______gpm, inlet temp._____°F, outlet_____°F

Pollutant	Efficiency (%)	Basis for Eff.	Outlet concentration (ppm)

NA AFTERBURNER:Mfr.'s name and model

Type: _____direct flame, _____catalytic

If catalytic: inlet temp.______°F, outlet temp.______°F, catalyst life

If direct flame: internal volume_______cu.ft., average temp._______°F

Residence time at average temp________________sec

Auxiliary fuel: max. rating_______BTU/hr, set point_______°F, ______BTU/hr

Size of Chamber___________________cu.ft., flow rate

Pollutant	Efficiency (%)	Basis for Eff.	Outlet grain loading (gn/cu.ft)

NA ADSORPTION EQUIPMENT:Mfr.'s name and model

Type: _____continuous, _____, fixed bed

Adsorbing material:_____________________, bed depth_____in., flow area_____sq.ft.

Breakthrough (breakpoint) time:_______________, Pressure drop___________"H2O

Pollutant	Efficiency (%)	Basis for Eff.	Outlet concentration (ppm)

YES OTHER TYPES: Name and describe. Attach complete details.

Bleeder Flare: If the gas suction from the gas treatment plant fails to work entirely or partly, the crude gas continually produced must be bled-off at the coke oven batteries. For this purpose, each half of a collecting main section is equipped with a crude gas flare, which is opened automatically as soon as the pressure in the relevant collecting main section exceeds the pre-set limit value. By means of an electric ignition and/or constant pilot, the crude gas streaming out is lit to burn, adding injector steam to achieve smokeless bleeding with a stable flame. Opening of the crude gas flares is effected via a safety-oriented control means, which the signal from the collecting main pressure control is directly fed forward to. Thus it is ensured that the function of the crude gas flares is maintained and ensured even in case of a PLC failure.

FUGITIVE DUST CONTROLS: Describe below or attach a complete explanation of all controls of fugitive emissions not discussed in Form E, Roads, or Form F, storage piles.

Charging operations utilize stage charging optimization to control normal stage charging particulate emissions. Door leak fugitive particulate emissions are controlled by the battery leak prevention program. Topside and Lid leak emissions are also minimized by the battery leak prevention program. Moreover, the PROven system prevents the emissions from doors, lids and offtakes leaks as well as charging emissions.

PART 7. STACK DATA: Stack data must be provided for each flue, duct, pipe, stack, chimney or conduit (stacks) at which collected emissions are vented to open air through a restricted opening.

Stack Identification: *C Battery Combustion Stack (S046)*

UTM East __________ UTM North __________ or

Longitude *79°52'23.62"* Latitude *40°18'15.16"*

Most important stacks have been located on topographic or air navigation charts. If you know the UTM coordinates or latitude and longitude, provide this information. If there is a number of stacks close together, a common location may be used.

Stack Height: *322.0* ft Ground level elevation: *760* ft Diameter *12* ft. inner at top

Material Outer: concrete Lining:

Exit Temperature (F): *446* Exit Velocity: *19.06* (f/s)

Exhaust Rate: *124,202* (ACFM) % Moisture *19.93*

Nearest building to stack: (C battery)distance *365* ft height *50'8" at larry car rails* _ft top of coal bunker is 201' above grade

length *490* ft width *57* ft

Processes Sharing Stack: If more than one process shares a stack, list them and estimate relative contribution of each.

Description *NA*

Contribution to emissions from stack: ______%

Description *NA*

Contribution to emissions from stack: ______%

Description *NA*

Contribution to emissions from stack: ______%

PART 7. STACK DATA: Stack data must be provided for each flue, duct, pipe, stack, chimney or conduit (stacks) at which collected emissions are vented to open air through a restricted opening.

Stack Identification: ***Battery C PEC System Baghouse Stacks (S047)***
(6 modules; 5 running; 1 standby)

UTM East ________ UTM North ________ or

Longitude *79°52'26.12"* Latitude *40°18'11.91"*

Most important stacks have been located on topographic or air navigation charts. If you know the UTM coordinates or latitude and longitude, provide this information. If there is a number of stacks close together, a common location may be used.

Stack Height: Unknown ft Ground level elevation: *760* ft Diameter Unknown ft. (each)

Material Outer: Unknown Lining: Unknown

Exit Temperature (F): 250 Exit Velocity: ________ (f/s)

Exhaust Rate: *187,000* (ACFM) % Moisture ________

Nearest building to stack: distance *495* ft height ____ ft

length ***Unknown*** ft width ***Unknown*** ft

Processes Sharing Stack: If more than one process shares a stack, list them and estimate relative contribution of each.

Description ***NA***

Contribution to emissions from stack: ________ %

Description ***NA***

Contribution to emissions from stack: ________ %

Description ***NA***

Contribution to emissions from stack: ________ %

PART 8. Remarks
Attach calculations and reference all emission factors for Allowable, Potential to Emit, and Actual emissions to this sheet. Reference all emission factors and efficiencies of control equipment.

SEE ANNUAL AIR EMISSION INVENTORY REPORT

Note: ***It is possible that there are additional Title V regulated air pollutants in the emission relating to this source; however, an applicable requirement for such pollutant(s) does not exist.***

PART 9a: (1) CHARGING EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.12*	*NA*	*NA*	*0.076*	*NA*	*0.15*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.12*	*NA*	*NA*	*0.076*	*NA*	*0.15*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (1) CHARGING EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.4*	*NA*	*NA*	*0.25*	*NA*	*0.5*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.4*	*NA*	*NA*	*0.25*	*NA*	*0.5*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (2) DOOR LEAKS EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.493*	*NA*	*NA*	*0.301*	*NA*	*0.60*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.493*	*NA*	*NA*	*0.301*	*NA*	*0.60*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (2) DOOR LEAKS EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*2.16*	*NA*	*NA*	*1.32*	*NA*	*2.64*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*2.16*	*NA*	*NA*	*1.32*	*NA*	*2.64*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (3) LID LEAKS EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.016*	*NA*	*NA*	*0.012*	*NA*	*0.027*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.016*	*NA*	*NA*	*0.012*	*NA*	*0.027*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (3) LID LEAKS EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.07*	*NA*	*NA*	*0.04*	*NA*	*0.09*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.07*	*NA*	*NA*	*0.04*	*NA*	*0.09*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (4) OFFTAKE LEAKS EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.03*	*NA*	*NA*	*0.013*	*NA*	*0.04*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.03*	*NA*	*NA*	*0.013*	*NA*	*0.04*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphth-alene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (4) OFFTAKE LEAKS EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*0.1*	*NA*	*NA*	*0.06*	*NA*	*0.13*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*0.1*	*NA*	*NA*	*0.06*	*NA*	*0.13*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (5) SOAKING EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*H_2S*		
Allowable										
Maximum Potential	*1.43*	*NA*	*9.44*	*NA*	*0.09*	*0.55*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*1.43*	*NA*	*9.44*	*NA*	*0.09*	*0.55*	*NA*	*NA*	*NA*	*NA*

Pollutant									
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (5) SOAKING EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*H2S*		
Allowable										
Maximum Potential	*4.7*	*NA*	*31.029*	*NA*	*0.313*	*1.8*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*4.7*	*NA*	*31.029*	*NA*	*0.313*	*1.8*	*NA*	*NA*	*NA*	*NA*

Pollutant									
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

List all known pollutants, including, but not limited to those found under Article XXI section 2103.10 and the definition of Hazardous Air Pollutants.

Transfer this information to the summary emissions sheets.

PART 9a: (6) FLARE STACK EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphth-alene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

PART 9b: (6) FLARE STACK EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphth-alene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

Transfer this information to the summary emissions sheets.

PART 9a: (7) UNDERFIRE STACK EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*3.5*	*3.35*	*21.08*	*97.32*	*105.29*	*8.76*	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	*3.5*	*3.35*	*21.08*	*97.32*	*105.29*	*8.76*	***NA***	***NA***	***NA***	***NA***

Pollutant	*H_2S.*	*POM*	*Benzene*	*Cyanide Comps.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

PART 9b: (7) UNDERFIRE STACK EMISSIONS -- ANNUAL TPY

Pollutant	***Particulate***	*PM10*	*SO_2*	*CO*	*NOX*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*15.34*	*14.7*	*92.35*	*319.7*	*461.18*	*28.8*	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	*15.34*	*14.7*	*92.35*	*319.7*	*461.18*	*28.8*	***NA***	***NA***	***NA***	***NA***

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
Actual or Estimated	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***

Transfer this information to the summary emissions sheets.

PART 9a: (8) BAGHOUSE STACK EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NOX*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*7.64*	*3.38*	*12.3*	*7.91*	*3.3*	*0.315*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*7.64*	*3.38*	*12.3*	*7.91*	*3.3*	*0.315*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphth-alene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (8) BAGHOUSE STACK EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NOX*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*33.47*	*14.8*	*54.005*	*34.64*	*14.47*	*1.38*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*33.47*	*14.8*	*54.005*	*34.64*	*14.47*	*1.38*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphth-alene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

Note: Actual emissions listed are 1999 Emissions Inventory values

PART 9a: (9) FUGITIVE PUSHING EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*24.1*	*13.6*	*0.674*	*3.34*	*0.18*	*4.23*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*24.1*	*13.6*	*0.674*	*3.34*	*0.18*	*4.23*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (9) FUGITIVE PUSHING EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*107.95*	*59.65*	*2.95*	*14.65*	*0.79*	*18.54*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*107.95*	*59.65*	*2.95*	*14.65*	*0.79*	*18.54*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (10) TRAVELING HOT CAR EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*3.13*	*1.19*	*5.5*	*1.18*	*1.47*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*3.13*	*1.19*	*5.5*	*1.18*	*1.47*	*NA*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (10) TRAVELING HOT CAR EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*13.79*	*5.194*	*24.08*	*5.16*	*6.45*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*13.79*	*5.194*	*24.08*	*5.16*	*6.45*	*NA*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (11) UNCONTROLLED PUSHING EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*1.25*	*0.68*	*0.27*	*0.174*	*0.05*	*0.21*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*1.25*	*0.68*	*0.27*	*0.174*	*0.05*	*0.21*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

PART 9b: (11) UNCONTROLLED PUSHING EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_X*	*VOC*	*LEAD*	*NH3*	*CS_2*	*Styrene*
Allowable										
Maximum Potential	*5.49*	*3.0*	*1.186*	*0.76*	*0.23*	*0.93*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*5.49*	*3.0*	*1.186*	*0.76*	*0.23*	*0.93*	*NA*	*NA*	*NA*	*NA*

Pollutant	*H_2S*	*POM*	*Benzene*	*Cyanide Comp.*	*Ethyl-Benzene*	*Naphthalene*	*Phenol*	*Toluene*	*Xylene*
Allowable									
Maximum Potential	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Transfer this information to the summary emissions sheets.

PART 9a: (12) BAGHOUSE DUST HANDLING EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*				
Allowable										
Maximum Potential	*0.004*	*0.004*	*NA*	*NA*	*NA*	*NA*				
Actual or Estimated	*0.004*	*0.004*	*NA*	*NA*	*NA*	*NA*				

Pollutant									
Allowable									
Maximum Potential									
Actual or Estimated									

PART 9b: (12) BAGHOUSE DUST HANDLING EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*SO_2*	*CO*	*NO_x*	*VOC*				
Allowable										
Maximum Potential	*0.016*	*0.016*	*NA*	*NA*	*NA*	*NA*				
Actual or Estimated	*0.016*	*0.016*	*NA*	*NA*	*NA*	*NA*				

Pollutant									
Allowable									
Maximum Potential									
Actual or Estimated									

Transfer this information to the summary emissions sheets.

PART 9a: (13) DECARBONIZATION EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	Particulate	PM10	SO_2	CO	NO_x	VOC				
Allowable										
Maximum Potential	NA	NA	NA	191.45	NA	NA				
Actual or Estimated	NA	NA	NA	191.45	NA	NA				

Pollutant									
Allowable									
Maximum Potential									
Actual or Estimated									

PART 9b: (13) DECARBONIZATION EMISSIONS -- ANNUAL TPY

Pollutant	Particulate	PM10	SO_2	CO	NO_x	VOC				
Allowable										
Maximum Potential	NA	NA	NA	628.9	NA	NA				
Actual or Estimated	NA	NA	NA	628.9	NA	NA				

Pollutant									
Allowable									
Maximum Potential									
Actual or Estimated									

Transfer this information to the summary emissions sheets.

PERMIT FORM A
PROCESS OPERATIONS

PLANT NAME AND LOCATION: *USS Clairton Works - 400 State Street, Clairton,PA*

ART 1. DESCRIPTION OF PROCESS (MAKE A COPY OF SCHEDULE A FOR EACH PROCESS.)

Company Identification or Description: *C Quench Tower (Battery C) (P047)*

ACHD Permit Number (if any)

Design (*X*)Charging or ( )Production rate(specify units) *1,253,690 tons of coal/year*

Total Annual Production (specify units normally used) *1,253,690 tons of coal/year*

Raw materials *Incandescent Coke*

Materials Produced *Quenched Coke*

Process Operation Units: (1) *Quench Tower*

(Name and Previous County (2) ____

Permit Number, if any) (3) ____

(4) ____

(5) ____

(6) ____

Diagram of Process Flow: Attach a separate sheet with a drawing of a flow diagram of this process, labeling each segment listed under Process Operation Segments. Label product intake points and product discharge points for each segment. Label emissions discharge points and the location of emissions control devices.

ART 2. PROCESS OPERATION SCHEDULE

A. Normal schedule: (Provide information for last year. If a new unit, please estimate)

Hrs/day *24* Days/week *7* Weeks/year *52* Hrs/Year *8760*

Start time *00:00* End time *24:00*

Seasonal: Periods correspond to seasons instead of calendar quarters. The first season is split to include December, January, and February.

Percent of Annual Production

Dec., Jan., and Feb.:	*25*	June to August:	*25*
March to May:	*25*	Sept. to Nov.:	*25*

B. Requested limits: (limitations on operating hours are optional.) Choose one:
(*X*) 8760 hours (no limitations) or

( ) I/We request the following limitation -- **This may become a federally enforceable permit condition:** Describe how this can be enforced: either list an operating schedule or downtime (e.g. only operate 8:00 to 4:00) or an operating hour reporting requirement.

_____ total days x _____ hours/day = _______ hours/year

PART 3. FUELS

A. Normal Operation (Provide information for last year. If a new unit, please estimate)
NA

( )YEAR ________ or ( )Estimate	Primary	Secondary	Other	Other
Type:				
Max amount/hour				
Sulfur content (%wt):				
Ash content (%wt):				
BTU Rating (specify units)				
Annual Fuel Consumption				
Seasonal Fuel Consumption (%):				
Dec-Feb				
Mar-May				
Jun-Aug				
Sep-Nov				

Fuel Mixing: If more than one fuel is used, explain usage, stating whether it is burned separately, mixed in a fixed ratio of _____:______ (give units such as BTU, mmcf, gallons per ton, etc.), mixed in a variable ratio of ________ to __________, determined by ______________(give reason).

B. Requested limits (limitations on operations are optional, but may allow a major source to be exempted from some requirements) **These may become permit conditions.** Please check one:

( ) full use of any fuel or combination at any time (no limitations)

( ) the following limitations on types of fuels or the combination of fuels (describe how compliance with this method will be demonstrated)

PART 4. OTHER LIMITATIONS

Identify any other requested limitations, such as on production rates or materials use. Describe how compliance with these restrictions will be demonstrated. **These limitations may become permit conditions.**

NA

PART 5. APPLICABLE REQUIREMENTS (Describe all applicable requirements affecting air emissions for this unit)

Regulation # Requirements

CHD Article XXI Regulations

2105.21(g) Coke Ovens and Coke Oven Gas (quenching emissions are vented through a baffled quench tower; the water used for quenching is equivalent or better than the water quality standards established for the nearest stream or river…except that the river from the nearest stream or river may be used for quenching of coke. The nearest stream or river to the USX Corporation facility in Clairton, PA, shall be the Monongahela River.)

The compliance certification contained in this application is based on the understanding that make-up water used for the quenching of coke "will be equivalent to, or better than, the water quality standards established for the Monongahela River by regulations promulgated by the DEP under the Pennsylvania Clean Streams Law, … except that water from the Monongahela River may be used" for such quenching make-up.

2109.03 Enforcement Orders (facility is required to comply with Enforcement Orders)

NESHAPS 40CFR63.7295

63.7295(a)(1)(i) The concentration of total dissolved solids (TDS) in the water used for quenching must not exceed 1,100 milligrams per liter (mg/L); or

63.7295(a)(1)(ii) The sum of the concentrations of benzene, benzo(a)pyrene, and naphthalene in the water used for quenching must not exceed the applicable site-specific limit approved by the permitting authority.

63.7295(a)(2) You must use acceptable makeup water, as defined in §63.7352, as makeup water for quenching.

63.7295 (b) For each quench tower at a new or existing coke oven battery and each backup quench station at a new coke oven battery, you must meet each of the requirements in paragraphs (b)(1) through (4) of this section.

3.7295 (b) (1) You must equip each quench tower with baffles such that no more than 5 percent of the cross sectional area of the tower may be uncovered or open to the sky.

63.7295 (b) (2) You must wash the baffles in each quench tower once each day that the tower is used to quench coke, except as specified in paragraphs (b)(2)(i) and (ii) of this section.

63.7295 (b) (2) (i) You are not required to wash the baffles in a quench tower if the highest measured ambient temperature remains less than 30 degrees Fahrenheit throughout that day (24-hour period). If the measured ambient temperature rises to 30 degrees Fahrenheit or more during the day, you must resume daily washing according to the schedule in your operation and maintenance plan.

63.7295 (b) (2) (ii) You must continuously record the ambient temperature on days that the baffles were not washed.

63.7295 (b) (3) You must inspect each quench tower monthly for damaged or missing baffles and blockage.

63.7295 (b) (4) You must initiate repair or replacement of damaged or missing baffles within 30 days and complete as soon as practicable.

63.7295 (c) As provided in §63.6(g), you may request to use an alternative to the work practice standards in paragraph (b) of this section.

ACHD Permits

Permit 78-I-0083-P (not yet issued)

Enforcement Orders

Enforcement Order dated 3/28/90, Item 1.d. Reporting requirements for quenching with contaminated water.

Second Consent Decree: Compliance requirement as referenced on page 15 in paragraph V.G.(vent quenching emissions through a baffled quench tower). Reporting requirements as referenced on page 38 in paragraph XIII.A.5.(reporting of quenching in violation of paragraph V.G.).

PART 6: EMISSION CONTROLS: Complete the following applicable sections for each pollution control device. Attach additional sheets to provide sufficient information and engineering calculations to support the control device performance.

On the space to the left of each device, number the device(s) by the order in which they process the waste stream(s). Fill out the requested information, and then complete th table for efficiencies by pollutant for each device.

Capture efficiency of all units ___> 95___ **% air flow** ___*NA*___ **@** ___*NA*___ **°F**

___**NA**___ **BAGHOUSE (fabric collector)** Mfr.'s name, model

Type of bag material

Total filter cloth area__________sq.ft., air to cloth ratio

Bag cleaning method:________, cycle__________________________min

Pressure drop: clean__________"H2O, dirty____________"H2O

Pollutant Efficiency (%) Basis for Eff. Outlet grain loading

___**NA**___ **ELECTROSTATIC PRECIPITATOR:** Mfr.'s name, model

Type: ___single stage, ___two stage, ___plate, ___tube

Total collecting area:________________sq.ft., cleaning cycle________min.

Gas Velocity__________ft./sec., corona power_________kw

Bulk resistivity of dust:______ohm-cm Moisture content of gases:______vol.%

Pollutant Efficiency (%) Basis for Eff. Outlet grain loading

___**NA**___ **CYCLONE (dry gas only):** Mfr.'s name and model

Gas inlet: width_____ft., height_____ft.

Diameter: gas outlet______ft., cyclone cylinder(s)___________ft.

Length of cyclone:_____ft., no. of cylinders:_____Pressure Drop _____"H2O

Pollutant Efficiency (%) Basis for Eff. Outlet grain loading

___***NA***___ **CONDENSER:** Mfr.'s name and model

Type: surface_______, contact

Heat transfer area:______sq.ft., max process pressure_________psia

Heat duty:________BTU/hr. Coolant temp: inlet_______ F, outlet_______ F

Pollutant Efficiency (%) Basis for Eff. Outlet concentration (ppm)

NA **WET COLLECTOR**:Mfr.'s name and model

Type: _____venturi, _____cyclone, _____spray chamber, _____packed bed

Entrainment/separator: type_______________, bed depth

Type & construction of chemicals added to the scrubbing liquid:

____Pressure drop__________"H2O

Scrubbing liquid: flow rate_______gpm, inlet temp._____ F, outlet_____ F

Pollutant   Efficiency (%)   Basis for Eff.   Outlet concentration (ppm)

NA **AFTERBURNER**:Mfr.'s name and model

Type: _____direct flame, _____catalytic

If catalytic: inlet temp.______ F, outlet temp.______ F, catalyst life

If direct flame: internal volume_______cu.ft., average temp._______ F

Residence time at average temp________________sec

Auxiliary fuel: max. rating_______BTU/hr, set point_______ F, ______BTU/hr

Size of Chamber___________________cu.ft., flow rate

Pollutant   Efficiency (%)   Basis for Eff.   Outlet grain loading (gn/cu.ft)

NA **ADSORPTION EQUIPMENT**:Mfr.'s name and model

Type: _____continuous, _____, fixed bed

Adsorbing material:_____________________, bed depth_____in., flow area_____sq.ft.

Breakthrough (breakpoint) time:_______________, Pressure drop___________"H2O

Pollutant   Efficiency (%)   Basis for Eff.   Outlet concentration (ppm)

1 OTHER TYPES: Name and describe. Attach complete details.

Quenching of incandescent coke occurs underneath a double baffled quench tower. The baffles capture particulate matter that is entrained in the water vapor emissions as they rise from the quenched coke. Baffles are estimated to control over 75 percent of the particulate emissions from quenching operations.

FUGITIVE DUST CONTROLS: Describe below or attach a complete explanation of all controls of fugitive emissions not discussed in Form E, Roads, or Form F, storage piles.

NA

PART 7. STACK DATA: Stack data must be provided for each flue, duct, pipe, stack, chimney or conduit (stacks) at which collected emissions are vented to open air through a restricted opening.

Stack Identification *C Battery Quench Tower (S047)*

UTM East NA UTM North NA or

Longitude *40°18'13.75"* Latitude *79°52'25.7"*

Most important stacks have been located on topographic or air navigation charts. If you know the UTM coordinates or latitude and longitude provide this information. If there is a number of stacks close together, a common location may be used.

Stack Height: *164* ft Ground level elevation: 760 ft Diameter 46 ft by 29.5 ft.

Material Outer: *Wood* baffles: *Polypropylene (upper) and stainless steel (lower)*

Exit Temperature (F): *221* Exit Velocity: *11.5 - 13* (f/s)

Exhaust Rate: *Unknown* (ACFM) % Moisture *Unknown*

Nearest building to stack: (C Battery) distance *337* ft height *50'8" (top of larry car)* ft

length *490* ft width *57* ft

Processes Sharing Stack: If more than one process shares a stack, list them and estimate relative contribution of each.

Description *NA*

Contribution to emissions from stack: ______%

Description *NA*

Contribution to emissions from stack: ______%

Description *NA*

Contribution to emissions from stack: ______%

PART 8. Remarks

Attach calculations and reference all emission factors for Allowable, Potential to Emit, and Actual emissions to this sheet. Reference all emission factors and efficiencies of control equipment.

SEE ANNUAL AIR EMISSION INVENTORY REPORT

Note: **It is possible that there are additional Title V regulated air pollutants in the emission relating to this source; however, an applicable requirement for such pollutant(s) does not exist.**

PART 9a: EMISSIONS -- SHORT TERM LB/HR or other

Pollutant	*Particulate*	*PM10*	*PM2.5*	*SO2*	*CO*	*NOx*	*VOC*	*LEAD*
Allowable								
Maximum Potential	*22.5*	*21.9*	*21.3*	*2.65*	*NA*	*NA*	*9.09*	*NA*
Actual or Estimated	*22.5*	*21.9*	*21.3*	*2.65*	*NA*	*NA*	*9.09*	*NA*

Pollutant	*Cyanide Compounds*	*Naphthalene*	*Phenol*	*Polycylic Organic Matter*
Allowable	*NA*	*NA*	*NA*	*NA*
Maximum Potential	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*

PART 9b: EMISSIONS -- ANNUAL TPY

Pollutant	*Particulate*	*PM10*	*PM2.5*	*SO2*	*CO*	*NOX*	*VOC*	*LEAD*
Allowable								
Maximum Potential	*98.44*	*95.93*	*93.41*	*11.62*	*NA*	*NA*	*39.82*	*NA*
Actual or Estimated	*98.44*	*95.93*	*93.41*	*11.62*	*NA*	*NA*	*39.82*	*NA*

Pollutant	*Cyanide Compounds*	*Naphthalene*	*Phenol*	*Polycylic Organic Matter*
Allowable	*NA*	*NA*	*NA*	*NA*
Maximum Potential	*NA*	*NA*	*NA*	*NA*
Actual or Estimated	*NA*	*NA*	*NA*	*NA*

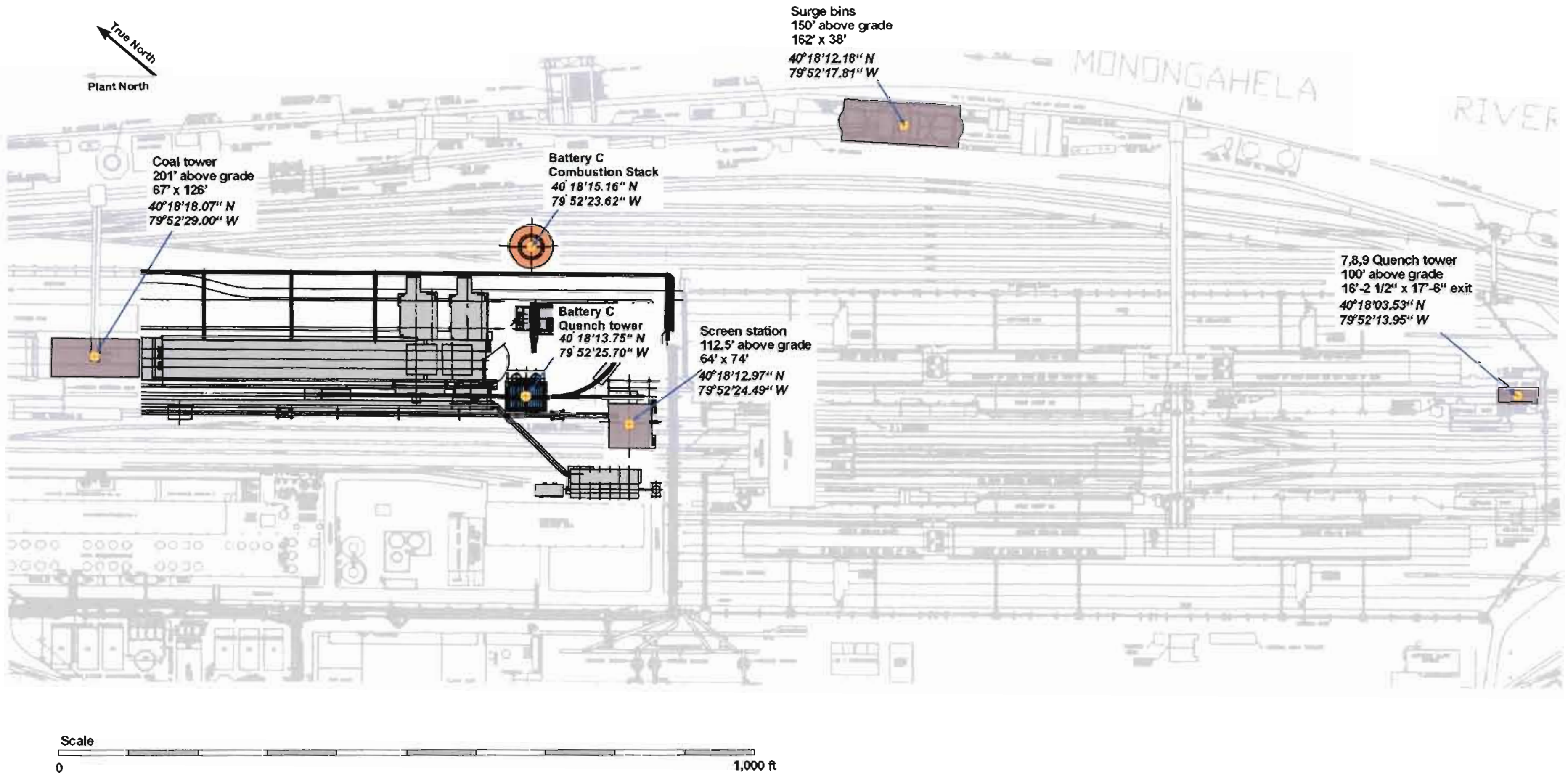
Transfer this information to the summary emissions sheets.

Appendix B

Process Flow Diagrams, Site Layouts and Project Specification Sheets

H-327540
USS Clairton C Battery FEL 2 Project
Building Reference Diagram

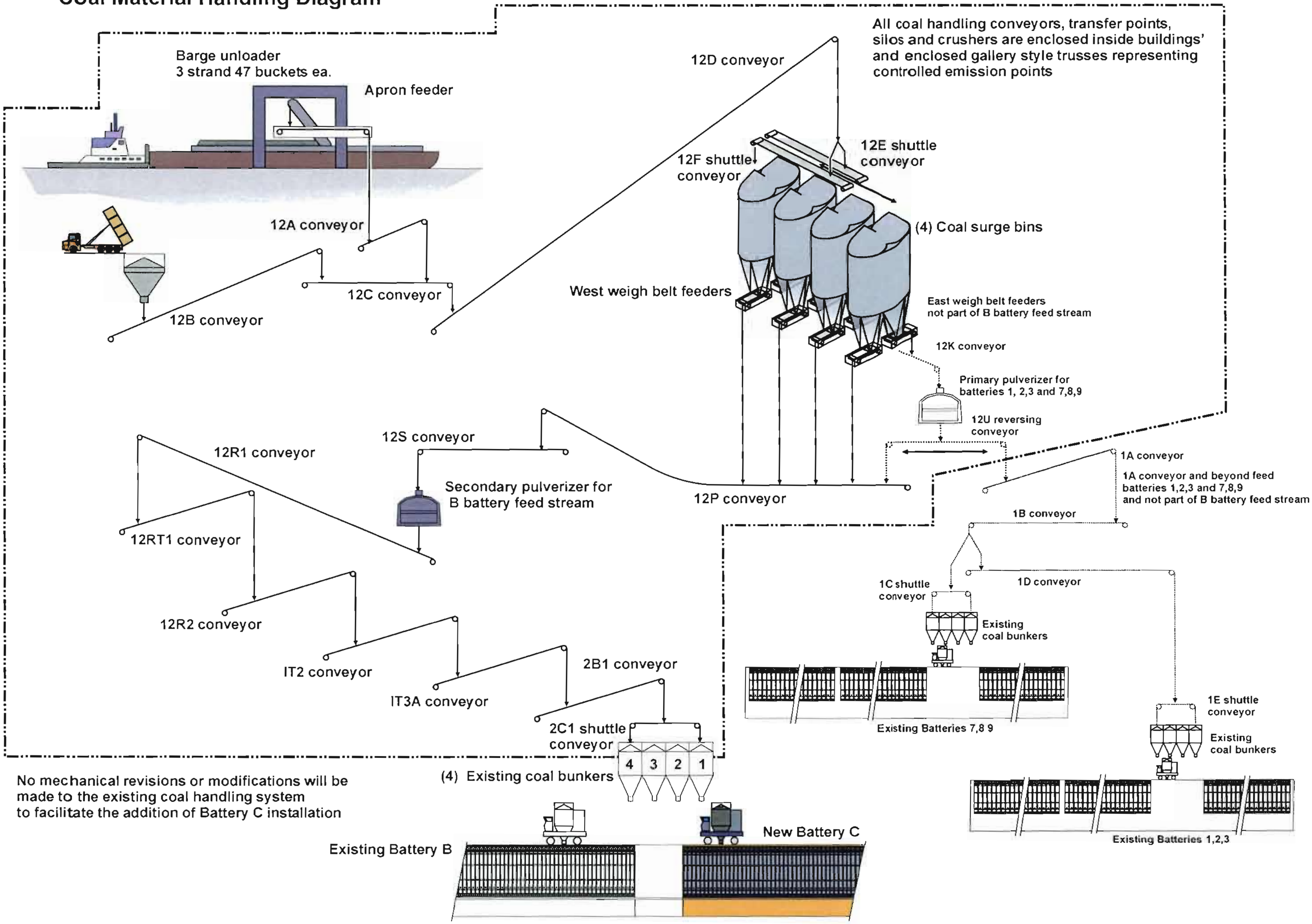
2/22/08
PRELIMINARY



H-327540
USS Clairton C Battery FEL 2 Project
Coal Material Handling Diagram

12/04/07

PRELIMINARY



All coal handling conveyors, transfer points, silos and crushers are enclosed inside buildings' and enclosed gallery style trusses representing controlled emission points

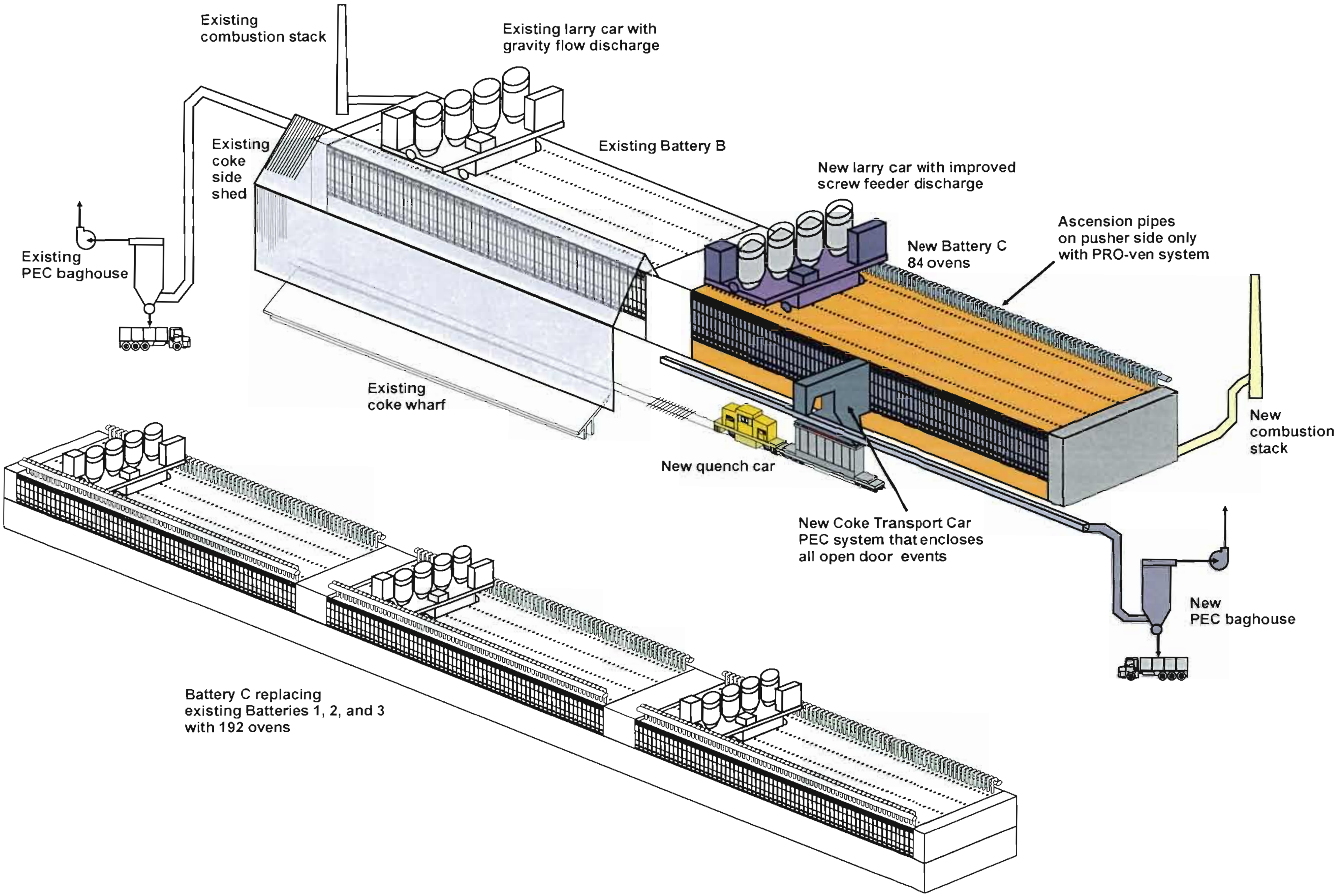
No mechanical revisions or modifications will be made to the existing coal handling system to facilitate the addition of Battery C installation

H-327540

USS Clairton C Battery FEL 2 Project Coke Oven Process Reference Diagram

12/07/07

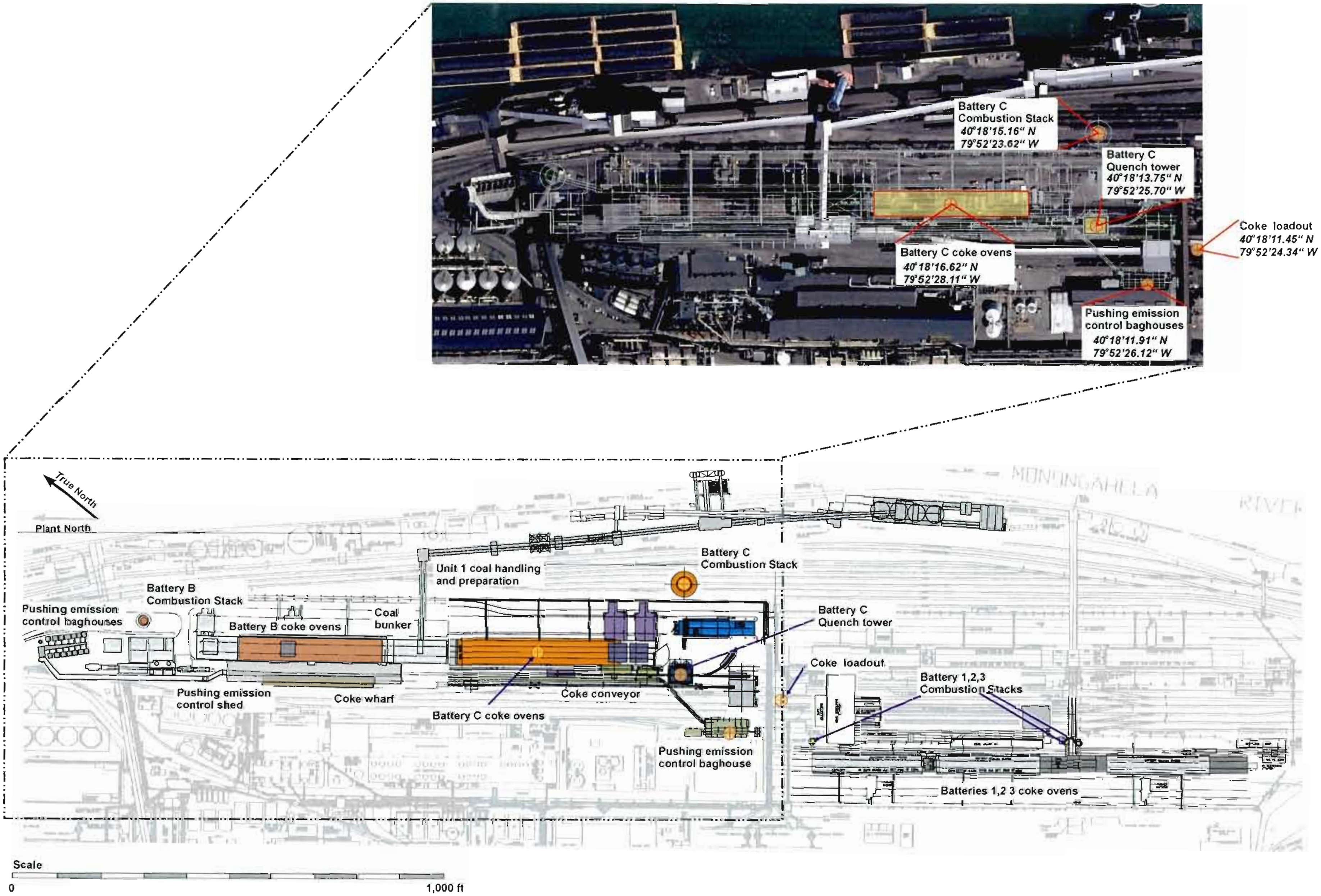
PRELIMINARY



H-327540
USS Clairton C Battery FEL 2 Project
Site Reference Diagram

12/04/07

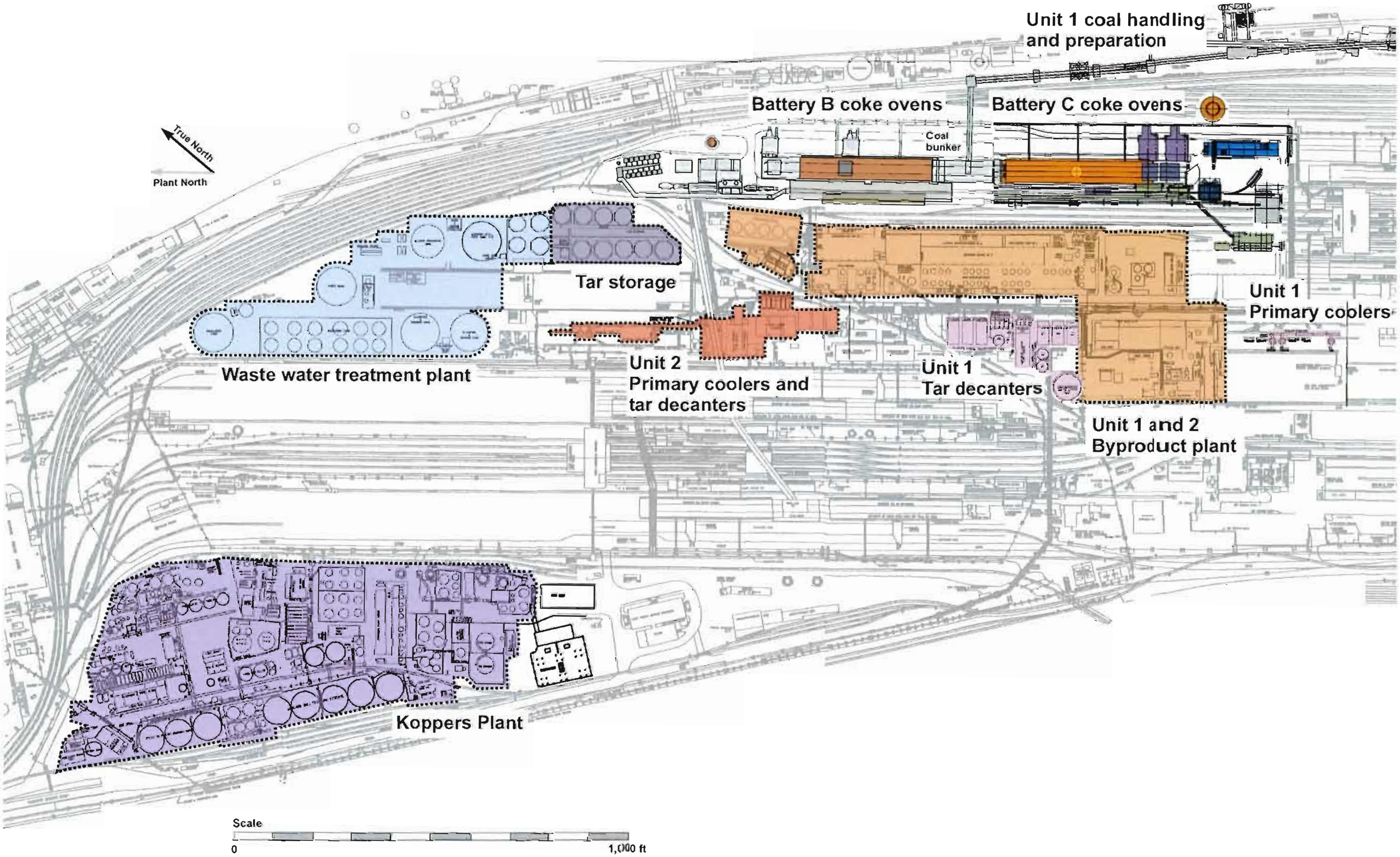
PRELIMINARY



12/04/07

PRELIMINARY

H-327540
USS Clairton C Battery FEL 2 Project
Byproduct Area Diagram



Appendix C
Emission Calculations

Table C1 - 1

PSD and NONATTAINMENT NEW SOURCE REVIEW APPLICABILITY ANALYSIS

	Emission Increases due to C Battery			Emission Decreases due to Retirement of 7-9 Batteries			APPLICABILITY ANALYSIS				
Pollutant	**Installation of Battery C**	**Coal Handling Battery C**	**Coke Handling Battery C**	**Retirement of Batteries 7-9**	**Coal handling Battery 7-9**	**Coke handling Battery 7-9**	**Net Emission Change (TPY)**	**PSD Significant Threshold**	**PSD Applicability?**	**NA NSR Significant Threshold**	**NA NSR Applicability?**
NO_x	483.4			1061.1			**-577.7**	25	NO	40	NO
SO_2	230.1			269.2			**-39.1**	40	NO	N/A	N/A
VOC	73.1			87.3			**-14.2**	N/A	N/A	40	NO
TSP	283.2	34.0	14.7	690.4	31.4	13.1	**-403.0**	N/A	N/A	25	NO
PM_{10}	194.5	14.4	6.9	517.3	13.7	6.2	**-321.4**	15	NO	N/A	N/A
$PM_{2.5}$	155.8	13.4	6.4	398.7	13.1	5.7	**-241.9**	N/A	N/A	10	NO
CO	1005.5			1203.0			**-197.5**	100	NO	N/A	N/A
Lead	0.011			0.012			**-0.001**	0.6	NO	N/A	N/A
H_2S	134.814			277.289			**-142.5**	10	NO	N/A	N/A
TRS	138.130			300.767			**-162.6**	10	NO	N/A	N/A

N/A = Not Applicable
NOx, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

Table C1 - 2 Summary of Emission Calculations

	Actual Annual Emissions for BATTERIES 7-9							Future Allowable Emissions for BATTERY C						
PROCESS	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140	0.006	0.021	0.004	0.484	0.250	0.234	0.005
WITHOUT HOOD														
Pushing Fugitives	0.2	1.3	1.0	5.9	3.2	2.0	0.8	0.2	1.2	0.9	5.5	3.0	1.9	0.8
WITH HOOD														
PEC BH	13.5	50.5	3.1	15.2	7.2	3.5	33.9	14.5	54.0	1.4	33.5	14.8	6.1	34.6
Traveling	10.9	40.6		23.2	8.7	3.2	8.7	6.4	24.1		13.8	5.2	1.9	5.2
PEC fugitives	0.7	2.6	29.8	169.8	94.5	58.8	22.1	0.8	3.0	18.5	108.0	59.7	36.9	14.7
Quenching		10.4	35.5	367.1	297.0	226.9			11.6	39.8	98.4	95.9	93.4	
STACK TOTAL (from Stacks_2006)	1035.0	102.4	6.7	82.0	100.4	98.5	418.0	461.2	105.2	7.2	16.1	15.6	15.3	319.7
Ball Mill				0.015	0.015	0.015					0.016	0.016	0.016	
Soaking	0.6	60.9	3.7	9.2				0.3	31.0	1.9	4.7			
Decarbonization							715.6							628.9
Fugitives														
Doors			6.8	5.5			3.4			2.6	2.2			1.3
Lids			0.0	0.01			0.01			0.1	0.1			0.04
Charging			0.4	0.4			0.2			0.5	0.4			0.2
Offtakes			0.2	0.2			0.1			0.1	0.1			0.1
TOTAL	1061.1	269.2	87.3	690.4	517.3	398.7	1203.0	483.4	230.1	73.1	283.2	194.5	155.8	1005.5

Table C1 - 3 Pre Push Emissions

PRE-PUSH							
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO$_x$	2.86E-04	0.176	all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	9.34E-06	0.006	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.170
SO$_2$	1.01E-03	0.623		3.31E-05	0.021		0.602
PM total							
PM filter'bl		11.949	PM filterable = PM10 filterable+ PM2.5 filterable		0.484	PM filterable = PM10 filterable+ PM2.5 filterable	11.465
PM condens'bl							
PM$_{2.5}$ filter'bl	9.39E-03	5.775	HRM PRE_PUSH 121907; sheet SUMMARY	3.74E-04	0.234	HRM PRE_PUSH 121907; sheet SUMMARY	5.541
PM$_{10}$ filter'bl	1.00E-02	6.174	HRM PRE_PUSH 121907; sheet SUMMARY	3.99E-04	0.250	HRM PRE_PUSH 121907; sheet SUMMARY	5.923
CO	2.29E-04	0.140	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	7.47E-06	0.005	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.136
VOC	1.83E-04	0.113		6.13E-06	0.004		0.109

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 4 Pushing Fugitives (without Hood)

UNCONTROLLED PUSHING

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	7.34E-02	0.245	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/(1-74.1% capture efficiency)	0.073	0.230	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/74.1% capture efficiency	0.015
SO_2	0.3784	1.265	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/(1-74.1% capture efficiency)	0.378	1.186	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/74.1% capture efficiency	0.080
PM total		5.86	TPM = PM filterable + PM condensible	-	5.494	TPM = PM filterable + PM condensible	
PM filter'bl	1.39E+00	4.649	AP-42, 2007; Table 12.2-6	1.390	4.357	AP-42, 2007; Table 12.2-6	0.292
PM condens'bl	3.63E-01	1.214	AP-42, 2007; Table 12.2-7	0.363	1.138	AP-42, 2007; Table 12.2-7	0.076
$PM_{2.5}$ filter'bl	2.32E-01	0.776	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.232	0.728	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.049
PM_{10} filter'bl	6.02E-01	2.013	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.602	1.886	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.126
CO	2.43E-01	0.813	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/(1-capture efficiency) (74.1%)	0.243	0.762	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.051
VOC	2.97E-01	0.994	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077/(1-capture efficiency) (74.1%)	0.297	0.932	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.062

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 5 Pushing Emission Control (PEC) Baghouse Emissions

	7-9 Batteries		C battery	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6123.24	MMcf/year
BH Exhaust flow rate	122,000	dscfm	175200	dscfm
COKE PRODUCED	1,792,841	Tons	1,005,528	Tons
BH collection efficiency	0.98		0.99	

PEC BH							
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	2.21E-02	13.536	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-02	14.471	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
SO_2	8.27E-02	50.535	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-02	54.005	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
PM total		15.196	TPM = PM filterable + PM condensible		33.474	TPM = PM filterable + PM condensible	[redacted]
	gr/dscf	Tons per Year		gr/dscf	Tons per year		
PM filter'bl	3.07E-03	14.046	Stack test July 24-26, 2007 conducted on Batteries 7-9 at Clairton Plant.	5.00E-03	32.888	Manufacturer's guarantee of outlet conc. = 0.005 gpdscf	[redacted]
PM condens'bl	9.40E-02	1.149	AP-42, 2007; Table 12.2-7	9.40E-02	0.586	AP-42, 2007; Table 12.2-7	0.563
$PM_{2.5}$ filter'bl	5.12E-04	2.346	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	8.35E-04	5.492	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	[redacted]
PM_{10} filter'bl	1.33E-03	6.082	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	2.17E-03	14.240	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	[redacted]
CO	5.54E-02	33.873	AP-42, 2007; Table 12.2-9	5.54E-02	34.642	AP-42, 2007; Table 12.2-9	[redacted]
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	6.83E-03	3.063	Stack test Sep. 27-29, 2005 conducted on Batteries 7-9 at Clairton Plant.	2.60E-03	1.380	Stack test July 17-19, 2007 conducted on Batteries 1-3 at Clairton Plant. The fraction of pre-push emissions emitted at the BH have also been added to the these values.	1.683
PM condensible = PM10 condensible = PM2.5 condensible							

Table C1 - 6 Travel Emissions

TRAVEL							
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coke/sec	Tons per Year		lb/ton coke/sec	Tons per Year		Tons per Year
NO$_x$	3.943E-04	10.863	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.943E-04	6.450	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	4.413
SO$_2$	1.472E-03	40.555	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.472E-03	24.080	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	16.475
PM total	8.432E-04	23.232	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.432E-04	13.794	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.438
PM filter'bl	8.411E-04	23.174	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.411E-04	13.760	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.414
PM condens'bl	2.103E-06	0.058	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	2.103E-06	0.034	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	0.024
PM$_{2.5}$ filter'bl	1.157E-04	3.186	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.157E-04	1.892	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.294
PM$_{10}$ filter'bl	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530
CO	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 7 PEC Fugitives (with hood)

	7-9 Battery	C battery
HOOD Capture efficiency	0.836	0.9

For 7-9 batteries, the tons per year Pushing emissions (with the hood in place and working) were calculated as (uncontrolled emissions - travelling emissions) * 0.741

PUSHING FUGITIVES

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	0.006	0.692	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-03	0.791	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
SO_2	0.021	2.585	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-03	2.953	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
PM total		169.758	TPM = PM filterable + PM condensible		107.953	AP-42, 2007 EF / 0.741 X 0.1	61.805
PM filter'bl	0.228	133.380	AP-42, 2007; Table 12.2-6	1.39E-01	85.320	AP-42, 2007 EF / 0.741 X 0.1	48.060
PM condens'bl	0.060	36.378	AP-42, 2007; Table 12.2-7	3.63E-02	22.633	AP-42, 2007 EF / 0.741 X 0.1	13.745
$PM_{2.5}$ filter'bl	0.038	22.451	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	2.32E-02	14.289	AP-42, 2007 EF / 0.741 X 0.1	8.162
PM_{10} filter'bl	0.099	58.102	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	6.02E-02	37.023	AP-42, 2007 EF / 0.741 X 0.1	21.078
CO	0.040	22.140	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063 (capture efficiency = 74.1%)	2.43E-02	14.655	AP-42, 2007 EF / 0.741 X 0.1	7.485
VOC	0.049	29.811	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077 (capture efficiency = 74.1%)	2.97E-02	18.543	AP-42, 2007 EF / 0.741 X 0.1	11.269

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 8 Quenching Emissions

	7-9 Battery		C battery	
COKE PRODUCED per year	896,421	Tons	1,005,528	Tons
Coke per quench	25	Tons	25	Tons

QUENCH TOWER

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		Tons per Year
PM total	6.26E-01	280.400	Table 12.2-19. The TPM has been scaled up from PM2.5 by dividing the PM2.5 EF by 0.5.	2.00E-02	10.055	Manufacturer's (UHDE) guarantee	270.345
$PM_{2.5}$	3.13E-01	140.200	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	1.00E-02	5.028	Scaled down from total PM by multiplying the TPM EF by 0.5	135.173
PM_{10}	4.69E-01	210.300	PM10 EF has been scaled down by multiplying the TPM EF by 0.75.	1.50E-02	7.541	Scaled down from total PM by multiplying the TPM EF by 0.75	202.759
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		
PM (condensible)	1.41E-01	86.683	non-PM constituents from the B test have the EF = 0.141lb/ton coal	1.41E-01	88.385	non-PM constituents from the B test have the EF = 0.141lb/ton coal	
$PM_{2.5}$ (filt.+condensible)		226.884			93.413		133.471
PM_{10} (filt.+condensible)		296.984			95.927		201.057
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	7.92E-02	35.498	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	7.92E-02	39.819	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	
SO_2	2.31E-02	10.363	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	2.31E-02	11.624	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	

Emission factors of lb/quench have been converted to lb/ton coke. FOR 7-9: PM10 = 0.75 * TSP and PM2.5 = 0.5 * TSP; FOR C: PM10 = 0.098 * TSP and PM2.5 = 0.06 * TSP

B Battery quench test results have been used for SO2 and VOC emissions factors for 7-9 as well as C.

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 9 Combustion (Underfire) Stack Emissions

	7-9 Battery		C battery	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6123.24	MMcf/year
MMscf/stack	4,460	MMcf per period	NA	
NUMBER OF PUSHES	174,192	Pushes	NA	Pushes
COKE PRODUCED	1,792,841	Tons	1,005,528	Tons
Heat value of COG	448	Btu/scf	448	Btu/scf
Total BTUs/stack	1,998,080.00	MMBtu	2,743,211.52	Btu
Volumetric flow rate (stack 1)	43,600.00	dscfm	103,562.00	dcfm
Volumetric flow rate (stack 2)	32,200.00	dscfm	49,040.28	dscfm
Volumetric flow rate (stack 3)	42,700.00	dscfm		
Volumetric flow rate (TOTAL)	118,500.00	dscfm		

From 2006-07 Stack Test data of Battery 7-9		
ACFM	DSCFM	DSCFM/ACFM
89700	43600	0.486
72200	32200	0.446
87400	42700	0.489
AVEARAGE		0.474

COMBUSTION STACKS

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/MMBtu	Tons per Year		lb/MMBtu	Tons per Year		Tons per Year
STACK 7							
NO_x	8.07E-01	403.113	Emission factors derived from the stack tests conducted at Clairton works on Stack 7 on Feb 21 and 22, 2006. Results are averaged over 3 runs. The average volumetric flow rate during the test was 43,600 dscfm.			C Battery will have only one stack	
SO_2	6.90E-02	34.467					
VOC$^{(1)}$	2.80E-02	3.497					
	gpdscf	Tons per Year					
PM total	2.10E-02	34.374					
PM filter'bl	1.60E-02	26.190					
PM condens'bl	5.00E-03	8.184					
$PM_{2.5}$ filter'bl	1.96E-02	32.140					
PM_{10} filter'bl	2.01E-02	32.965					
STACK 8	lb/MMBtu	Tons per Year					
NO_x	5.15E-01	257.253	Emission factors derived from the stack tests conducted at Clairton works on Stack 8 on May 16 and 17, 2007. Results are averaged over 3 runs. The average volumetric flow rate during the test was 32,200 dscfm.			C Battery will have only one stack	
SO_2	6.70E-02	33.468					
VOC$^{(1)}$	1.10E-02	1.374					
	gpdscf	Tons per Year					
PM total	1.82E-02	22.002					
PM filter'bl	1.36E-02	16.441					
PM condens'bl	4.60E-03	5.561					
$PM_{2.5}$ filter'bl	1.70E-02	20.572					
PM_{10} filter'bl	1.75E-02	21.100					
STACK 9	lb/MMBtu	Tons per Year					
NO_x	7.50E-01	374.640	Emission factors derived from the stack tests conducted at Clairton works on Stack 9 on Feb. 23 and 24, 2006. Results are averaged over 3 runs. The average volumetric flow rate during the test was 42,700 dscfm.			C Battery will have only one stack	
SO_2	6.90E-02	34.467					
VOC$^{(1)}$	1.50E-02	1.873					
	gpdscf	Tons per Year					
PM total	1.60E-02	25.649					
PM filter'bl	1.00E-02	16.031					
PM condens'bl	5.00E-03	8.015					
$PM_{2.5}$ filter'bl	1.50E-02	23.982					
PM_{10} filter'bl	1.53E-02	24.598					
TOTAL STACK 7-9	lb/ton	Tons per Year		lb/year	Tons per Year		Tons per Year
NO_x		1035.005	These are the additions of the tonnage per year of each of the pollutants emitted from all the stacks combined.	9.22E+05	461.182	Uhde (manufacturer) guarantee	573.823
				lb/MMBtu	Tons per Year		
SO_2		102.402		7.67E-02	105.156	C battery has only one stack. The Efs for the pollutants for this stack were derived as the average of the emission factors of stacks 1-3.	[redacted]
VOC$^{(1)}$		6.744		2.10E-02	7.201		[redacted]
		Tons per Year		gpdscf	Tons per Year		
PM total		82.025		8.77E-03	16.140		65.885
PM filter'bl		58.661		6.30E-03	11.599		47.062
PM condens'bl		21.761		2.43E-03	4.480		17.281
$PM_{2.5}$ filter'bl		76.694		5.89E-03	10.845		65.848
PM_{10} filter'bl		78.662		6.04E-03	11.123		67.539
CO	6.80E-01	418.047	Clairton Plant "2006 Emissions Inventory"	5.10E-01	319.691	25% reduction from baseline in CO due to better combustion practices.	98.356
PM condensible = PM10 condensible = PM2.5 condensible							
(1) VOC emissions have been multiplied by a factor of 0.25 to exclude methane and ethane.							

Table C1 - 10 Ball Mill Emissions

	7-9 Battery		C battery	
DUST COMING OUT OF THE BH is approximately 0.063% of the coal charged	774.62	Tons	789.82	Tons

BALL MILL							
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton BH dust	Tons per Year		lb/ton BH dust	Tons per Year		Tons per Year
PM filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.016	1994 Title V Application, Appendix A	
$PM_{2.5}$ filter'bl	4.00E-02	0.0155	Assumed equal to PM-10 (filterable)	4.00E-02	0.016	Assumed equal to PM-10 (filterable)	
PM_{10} filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.016	1994 Title V Application, Appendix A	
PM condensible = PM10 condensible = PM2.5 condensible							

Table C1 - 11 Soaking Emissions

POLLUTANT	SOAKING						
	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	1.00E-03	0.615	AP-42, 2007; Table 12.2-18	5.00E-04	0.313	Emission factors provided in AP-42, 2007; Table 12.2-18 were halved because soaking emissions are expected to be reduced by 50% by the PROven system	0.301
SO_2	9.90E-02	60.863		4.95E-02	31.029		29.834
VOC	6.00E-03	3.689		3.00E-03	1.881		1.808
PM total	1.50E-02	9.222		7.50E-03	4.701		4.520
PM filter'bl							
PM condens'bl							
$PM_{2.5}$ filter'bl							
PM_{10} filter'bl							

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 12 Decarbonization Emissions

	DECARBONIZATION						
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
CO	1.16E+00	715.556	DECARB 121907.xls;	1.00E+00	628.891	DECARB 121907.xls;	86.665

Table C1 - 13 Fugitive Emissions (charging, doors, lids, offtakes)

WITH HRM's RESULTS IN BOTH 7-9 AS WELL AS C BATTERY

HRM's CALCULATIONS DONE USING CURRENT ACTUAL EMISSIONS AND NESHAP LIMITS (FOR CHARGING, OFFTAKES, LIDS AND DOORS) FOR 7-9 BATTERIES AND C BATTERY RESPECTIVELY.

CHARGING/DOORS/LIDS/OFFTAKES

RATIO TO BSO	PROCESS	POLLUTANT	7-9 Batteries			C Battery			Reduction (TPY)
			Emission Factor lb/hr * Ratio to BSO	Emissions Tons per Year	Reference for Emission Factor	Emission Factor lb/hr	Emissions Tons per Year	Reference for Emission Factor	
NA	CHARGING	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total		0.386			0.409		[redacted]
0.9		PM filter'bl	0.044	0.193		0.047	0.204		[redacted]
0.9		PM condens'bl	0.044	0.193		0.047	0.204		[redacted]
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.108	0.471		0.114	0.500		[redacted]
1.1		CO	0.054	0.236		0.057	0.250		[redacted]
NA	DOORS	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	1.267	5.547		0.492	2.157		3.391
0.9		PM filter'bl	0.633	2.774		0.246	1.078		1.695
0.9		PM condens'bl	0.633	2.774		0.246	1.078		1.695
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	1.548	6.780		0.602	2.636		4.144
1.1		CO	0.774	3.390		0.301	1.318		2.072
NA	LIDS	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	0.003	0.013		0.016	0.069		[redacted]
0.9		PM filter'bl	0.002	0.007		0.008	0.035		[redacted]
0.9		PM condens'bl	0.002	0.007		0.008	0.035		[redacted]
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.004	0.016		0.019	0.085		[redacted]
1.1		CO	0.002	0.008		0.010	0.042		[redacted]
NA	OFFTAKES	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	0.036	0.156		0.025	0.108		0.048
0.9		PM filter'bl	0.018	0.078		0.012	0.054		0.024
0.9		PM condens'bl	0.018	0.078		0.012	0.054		0.024
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.044	0.191		0.030	0.133		0.059
1.1		CO	0.022	0.096		0.015	0.066		0.029

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 14 Coal Handling Emissions

MATERIAL HANDLING *(for 7-9 Batteries during the baseline period May 2002-April 2004 and potentials for C battery)*

COAL HANDLING	Pulverizer				Unloader								
	#1 Pri	#1 Sec	#2 Pri	#2 Sec	#1	#2	Clamshell	Pedestal Crane	Coal Transfer	Boom Conveyor	Bins and Bunkers	Storage Piles acre*day	TPY
Batteries 7-9 (tons per period)	2,459,102	-	-	-	2,336,147	-	368,865	122,955	2,459,102	221,319	2,459,102	24,591	
Emission Factors (lb/ton coal)													
$PM_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM_{10}	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
$PM_{2.5}$	0.18	-	-	-	0.14	-	0.02	0.01	0.20	0.01	0.00	25.57	13.1
PM_{10}	0.71	-	-	-	0.42	-	0.07	0.02	0.64	0.04	0.00	25.57	13.7
TSP	3.55	-	-	-	0.91	-	0.14	0.05	1.35	0.09	0.01	56.81	31.4
Battery C (tons per year)	940,268	940,268			1,191,006		250,738	125,369	1,253,690	150,443	1,253,690	12,537	
Emission Factors (lb/ton coal)													
$PM_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM_{10}	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
$PM_{2.5}$	0.07	0.12	-	-	0.07	-	0.01	0.01	0.10	0.01	0.00	13.04	13.4
PM_{10}	0.27	0.47	-	-	0.22	-	0.05	0.02	0.33	0.03	0.00	13.04	14.4
TSP	1.36	2.37	-	-	0.46	-	0.10	0.05	0.69	0.06	0.00	28.96	34.0

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
$PM_{2.5}$	13.069	13.431	0.362
PM_{10}	13.741	14.424	0.683
TSP	31.448	34.048	2.600

Table C1 - 15 Coke Handling Emissions

MATERIAL HANDLING (for the baseline period May 2002-April 2004 and future for C battery)

COKE HANDLING	Coke Pile (Load & unload)	Coke Transfer	Screen Stn.	Screening Stn. Loadout	Coke Pile Erosion	TOTAL
					Acre*day	TPY
Batteries 7-9 (tons per period)	**4,124**	**1,792,841**	**1,792,841**	**1,792,841**	**17,570**	
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	6.36	0.24	0.18	4.57	5.7
PM_{10}	0.01	6.36	0.75	0.63	4.57	6.2
TSP	0.03	13.45	1.58	0.90	10.19	13.1
Battery C (tons)	**2,313**	**1,005,528**	**1,005,528**	**1,005,528**	**9,854**	TPY
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	3.57	0.13	0.10	2.56	6.4
PM_{10}	0.01	3.57	0.42	0.35	2.56	6.9
TSP	0.02	7.54	0.89	0.50	5.72	14.7

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
$PM_{2.5}$	5.68	6.37	0.69
PM_{10}	6.16	6.91	0.75
TSP	13.07	14.66	1.59

Table C1 - 1

PSD and NONATTAINMENT NEW SOURCE REVIEW APPLICABILITY ANALYSIS

	Emission Increases due to C Battery			Emission Decreases due to Retirement of 7-9 Batteries			APPLICABILITY ANALYSIS				
Pollutant	Installation of Battery C	Coal Handling Battery C	Coke Handling Battery C	Retirement of Batteries 7-9	Coal handling Battery 7-9	Coke handling Battery 7-9	Net Emission Change (TPY)	PSD Significant Threshold	PSD Applicability?	NA NSR Significant Threshold	NA NSR Applicability?
NO_x	483.4			1061.1			**-577.7**	25	NO	40	NO
SO_2	230.1			269.2			**-39.1**	40	NO	N/A	N/A
VOC	73.1			87.3			**-14.2**	N/A	N/A	40	NO
TSP	283.2	34.0	14.7	690.4	31.4	13.1	**-403.0**	N/A	N/A	25	NO
PM_{10}	194.5	14.4	6.9	517.3	13.7	6.2	**-321.4**	15	NO	N/A	N/A
$PM_{2.5}$	155.8	13.4	6.4	398.7	13.1	5.7	**-241.9**	N/A	N/A	10	NO
CO	1005.5			1203.0			**-197.5**	100	NO	N/A	N/A
Lead	0.011			0.012			**-0.001**	0.6	NO	N/A	N/A
H_2S	134.814			277.289			**-142.5**	10	NO	N/A	N/A
TRS	138.130			300.767			**-162.6**	10	NO	N/A	N/A

N/A = Not Applicable
NOx, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

Table C1 - 2 Summary of Emission Calculations

PROCESS	Actual Annual Emissions for BATTERIES 7-9							Future Allowable Emissions for BATTERY C						
	NO$_x$	SO$_2$	VOC	PM TOTAL (filt+cond)	PM$_{10}$ TOTAL (filt+cond)	PM$_{2.5}$ TOTAL (filt+cond)	CO	NO$_x$	SO$_2$	VOC	PM TOTAL (filt+cond)	PM$_{10}$ TOTAL (filt+cond)	PM$_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140	0.006	0.021	0.004	0.484	0.250	0.234	0.005
WITHOUT HOOD														
Pushing Fugitives	0.2	1.3	1.0	5.9	3.2	2.0	0.8	0.2	1.2	0.9	5.5	3.0	1.9	0.8
WITH HOOD														
PEC BH	13.5	50.5	3.1	15.2	7.2	3.5	33.9	14.5	54.0	1.4	33.5	14.8	6.1	34.6
Traveling	10.9	40.6		23.2	8.7	3.2	8.7	6.4	24.1		13.8	5.2	1.9	5.2
PEC fugitives	0.7	2.6	29.8	169.8	94.5	58.8	22.1	0.8	3.0	18.5	108.0	59.7	36.9	14.7
Quenching		10.4	35.5	367.1	297.0	226.9			11.6	39.8	98.4	95.9	93.4	
STACK TOTAL (from Stacks_2006)	1035.0	102.4	6.7	82.0	100.4	98.5	418.0	461.2	105.2	7.2	16.1	15.6	15.3	319.7
Ball Mill				0.015	0.015	0.015					0.016	0.016	0.016	
Soaking	0.6	60.9	3.7	9.2				0.3	31.0	1.9	4.7			
Decarbonization							715.6							628.9
Fugitives														
Doors			6.8	5.5			3.4			2.6	2.2			1.3
Lids			0.0	0.01			0.01			0.1	0.1			0.04
Charging			0.4	0.4			0.2			0.5	0.4			0.2
Offtakes			0.2	0.2			0.1			0.1	0.1			0.1
TOTAL	1061.1	269.2	87.3	690.4	517.3	398.7	1203.0	483.4	230.1	73.1	283.2	194.5	155.8	1005.5

Table C1 - 3 Pre Push Emissions

PRE-PUSH							
POLLUTANT	**7-9 Batteries**			**C Battery**			**REDUCTION**
	Emission Factor	**Emissions**	**Reference for Emission Factor**	**Emission Factor**	**Emissions**	**Reference for Emission Factor**	
	lb/ton coal	**Tons per Year**		**lb/ton coal**	**Tons per Year**		**Tons per Year**
NO_x	2.86E-04	0.176	all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	9.34E-06	0.006	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.170
SO_2	1.01E-03	0.623		3.31E-05	0.021		0.602
PM total							
PM filter'bl		11.949	PM filterable = PM10 filterable+ PM2.5 filterable		0.484	PM filterable = PM10 filterable+ PM2.5 filterable	11.465
PM condens'bl							
$PM_{2.5}$ filter'bl	9.39E-03	5.775	HRM PRE_PUSH 121907; sheet SUMMARY	3.74E-04	0.234	HRM PRE_PUSH 121907; sheet SUMMARY	5.541
PM_{10} filter'bl	1.00E-02	6.174	HRM PRE_PUSH 121907; sheet SUMMARY	3.99E-04	0.250	HRM PRE_PUSH 121907; sheet SUMMARY	5.923
CO	2.29E-04	0.140	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	7.47E-06	0.005	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.136
VOC	1.83E-04	0.113		6.13E-06	0.004		0.109

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 4 Pushing Fugitives (without Hood)

UNCONTROLLED PUSHING							
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	7.34E-02	0.245	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/(1-74.1% capture efficiency)	0.073	0.230	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/74.1% capture efficiency	0.015
SO_2	0.3784	1.265	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/(1-74.1% capture efficiency)	0.378	1.186	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/74.1% capture efficiency	0.080
PM total		5.86	TPM = PM filterable + PM condensible	-	5.494	TPM = PM filterable + PM condensible	
PM filter'bl	1.39E+00	4.649	AP-42, 2007; Table 12.2-6	1.390	4.357	AP-42, 2007; Table 12.2-6	0.292
PM condens'bl	3.63E-01	1.214	AP-42, 2007; Table 12.2-7	0.363	1.138	AP-42, 2007; Table 12.2-7	0.076
$PM_{2.5}$ filter'bl	2.32E-01	0.776	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.232	0.728	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.049
PM_{10} filter'bl	6.02E-01	2.013	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.602	1.886	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.126
CO	2.43E-01	0.813	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/(1-capture efficiency) (74.1%)	0.243	0.762	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.051
VOC	2.97E-01	0.994	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077/(1-capture efficiency) (74.1%)	0.297	0.932	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.062

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 5 Pushing Emission Control (PEC) Baghouse Emissions

	7-9 Batteries		C battery	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6123.24	MMcf/year
BH Exhaust flow rate	122,000	dscfm	175200	dscfm
COKE PRODUCED	1,792,841	Tons	1,005,528	Tons
BH collection efficiency	0.98		0.99	

PEC BH							
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	2.21E-02	13.536	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-02	14.471	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
SO_2	8.27E-02	50.535	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-02	54.005	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
PM total		15.196	TPM = PM filterable + PM condensible		33.474	TPM = PM filterable + PM condensible	[redacted]
	gr/dscf	Tons per Year		gr/dscf	Tons per year		
PM filter'bl	3.07E-03	14.046	Stack test July 24-26, 2007 conducted on Batteries 7-9 at Clairton Plant.	5.00E-03	32.888	Manufacturer's guarantee of outlet conc. = 0.005 gpdscf	[redacted]
PM condens'bl	9.40E-02	1.149	AP-42, 2007; Table 12.2-7	9.40E-02	0.586	AP-42, 2007; Table 12.2-7	0.563
$PM_{2.5}$ filter'bl	5.12E-04	2.346	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	8.35E-04	5.492	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	[redacted]
PM_{10} filter'bl	1.33E-03	6.082	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	2.17E-03	14.240	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	[redacted]
CO	5.54E-02	33.873	AP-42, 2007; Table 12.2-9	5.54E-02	34.642	AP-42, 2007; Table 12.2-9	[redacted]
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	6.83E-03	3.063	Stack test Sep. 27-29, 2005 conducted on Batteries 7-9 at Clairton Plant.	2.60E-03	1.380	Stack test July 17-19, 2007 conducted on Batteries 1-3 at Clairton Plant. The fraction of pre-push emissions emitted at the BH have also been added to the these values.	1.683

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 6 Travel Emissions

TRAVEL							
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coke/sec	Tons per Year		lb/ton coke/sec	Tons per Year		Tons per Year
NO$_x$	3.943E-04	10.863	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.943E-04	6.450	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	4.413
SO$_2$	1.472E-03	40.555	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.472E-03	24.080	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	16.475
PM total	8.432E-04	23.232	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.432E-04	13.794	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.438
PM filter'bl	8.411E-04	23.174	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.411E-04	13.760	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.414
PM condens'bl	2.103E-06	0.058	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	2.103E-06	0.034	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	0.024
PM$_{2.5}$ filter'bl	1.157E-04	3.186	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.157E-04	1.892	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.294
PM$_{10}$ filter'bl	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530
CO	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 7 PEC Fugitives (with hood)

	7-9 Battery	C battery
HOOD Capture efficiency	0.836	0.9

For 7-9 batteries, the tons per year Pushing emissions (with the hood in place and working) were calculated as (uncontrolled emissions - travelling emissions) * 0.741

PUSHING FUGITIVES							
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	0.006	0.692	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-03	0.791	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
SO_2	0.021	2.585	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-03	2.953	From "HRM PUSH Nox & SO2 122607.xls"	[redacted]
PM total		169.758	TPM = PM filterable + PM condensible		107.953	AP-42, 2007 EF / 0.741 X 0.1	61.805
PM filter'bl	0.228	133.380	AP-42, 2007; Table 12.2-6	1.39E-01	85.320	AP-42, 2007 EF / 0.741 X 0.1	48.060
PM condens'bl	0.060	36.378	AP-42, 2007; Table 12.2-7	3.63E-02	22.633	AP-42, 2007 EF / 0.741 X 0.1	13.745
$PM_{2.5}$ filter'bl	0.038	22.451	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	2.32E-02	14.289	AP-42, 2007 EF / 0.741 X 0.1	8.162
PM_{10} filter'bl	0.099	58.102	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	6.02E-02	37.023	AP-42, 2007 EF / 0.741 X 0.1	21.078
CO	0.040	22.140	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063 (capture efficiency = 74.1%)	2.43E-02	14.655	AP-42, 2007 EF / 0.741 X 0.1	7.485
VOC	0.049	29.811	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077 (capture efficiency = 74.1%)	2.97E-02	18.543	AP-42, 2007 EF / 0.741 X 0.1	11.269

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 8 Quenching Emissions

	7-9 Battery		C battery	
COKE PRODUCED per year	896,421	Tons	1,005,528	Tons
Coke per quench	25	Tons	25	Tons

QUENCH TOWER							
	7-9 Batteries			C Battery			
POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	REDUCTION
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		Tons per Year
PM total	6.26E-01	280.400	Table 12.2-19. The TPM has been scaled up from PM2.5 by dividing the PM2.5 EF by 0.5.	2.00E-02	10.055	Manufacturer's (UHDE) guarantee	270.345
$PM_{2.5}$	3.13E-01	140.200	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	1.00E-02	5.028	Scaled down from total PM by multiplying the TPM EF by 0.5	135.173
PM_{10}	4.69E-01	210.300	PM10 EF has been scaled down by multiplying the TPM EF by 0.75.	1.50E-02	7.541	Scaled down from total PM by multiplying the TPM EF by 0.75	202.759
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		
PM (condensible)	1.41E-01	86.683	non-PM constituents from the B test have the EF = 0.141lb/ton coal	1.41E-01	88.385	non-PM constituents from the B test have the EF = 0.141lb/ton coal	
$PM_{2.5}$ (filt.+condensible)		226.884			93.413		133.471
PM_{10} (filt.+condensible)		296.984			95.927		201.057
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	7.92E-02	35.498	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	7.92E-02	39.819	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	
SO_2	2.31E-02	10.363	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	2.31E-02	11.624	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	

Emission factors of lb/quench have been converted to lb/ton coke. FOR 7-9: PM10 = 0.75 * TSP and PM2.5 = 0.5 * TSP; FOR C: PM10 = 0.098 * TSP and PM2.5 = 0.06 * TSP

B Battery quench test results have been used for SO2 and VOC emissions factors for 7-9 as well as C.

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 9 Combustion (Underfire) Stack Emissions

	7-9 Battery		C battery	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6123.24	MMcf/year
MMscf/stack	4,460	MMcf per period	NA	
NUMBER OF PUSHES	174,192	Pushes	NA	Pushes
COKE PRODUCED	1,792,841	Tons	1,005,528	Tons
Heat value of COG	448	Btu/scf	448	Btu/scf
Total BTUs/stack	1,998,080.00	MMBtu	2,743,211.52	Btu
Volumetric flow rate (stack 1)	43,600.00	dscfm	103,562.00	dcfm
Volumetric flow rate (stack 2)	32,200.00	dscfm	49,040.28	dscfm
Volumetric flow rate (stack 3)	42,700.00	dscfm		
Volumetric flow rate (TOTAL)	118,500.00	dscfm		

From 2006-07 Stack Test data of Battery 7-9

ACFM	DSCFM	DSCFM/ACFM
89700	43600	0.486
72200	32200	0.446
87400	42700	0.489
AVEARAGE		0.474

COMBUSTION STACKS

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/MMBtu	Tons per Year		lb/MMBtu	Tons per Year		Tons per Year
STACK 7							
NO_x	8.07E-01	403.113	Emission factors derived from the stack tests conducted at Clairton works on Stack 7 on Feb 21 and 22, 2006. Results are averaged over 3 runs. The average volumetric flow rate during the test was 43,600 dscfm.			C Battery will have only one stack	
SO_2	6.90E-02	34.467					
VOC[(1)]	2.80E-02	3.497					
	gpdscf	Tons per Year					
PM total	2.10E-02	34.374					
PM filter'bl	1.60E-02	26.190					
PM condens'bl	5.00E-03	8.184					
$PM_{2.5}$ filter'bl	1.96E-02	32.140					
PM_{10} filter'bl	2.01E-02	32.965					
STACK 8	lb/MMBtu	Tons per Year					
NO_x	5.15E-01	257.253	Emission factors derived from the stack tests conducted at Clairton works on Stack 8 on May 16 and 17, 2007. Results are averaged over 3 runs. The average volumetric flow rate during the test was 32,200 dscfm.			C Battery will have only one stack	
SO_2	6.70E-02	33.468					
VOC[(1)]	1.10E-02	1.374					
	gpdscf	Tons per Year					
PM total	1.82E-02	22.002					
PM filter'bl	1.36E-02	16.441					
PM condens'bl	4.60E-03	5.561					
$PM_{2.5}$ filter'bl	1.70E-02	20.572					
PM_{10} filter'bl	1.75E-02	21.100					
STACK 9	lb/MMBtu	Tons per Year					
NO_x	7.50E-01	374.640	Emission factors derived from the stack tests conducted at Clairton works on Stack 9 on Feb. 23 and 24, 2006. Results are averaged over 3 runs. The average volumetric flow rate during the test was 42,700 dscfm.			C Battery will have only one stack	
SO_2	6.90E-02	34.467					
VOC[(1)]	1.50E-02	1.873					
	gpdscf	Tons per Year					
PM total	1.60E-02	25.649					
PM filter'bl	1.00E-02	16.031					
PM condens'bl	5.00E-03	8.015					
$PM_{2.5}$ filter'bl	1.50E-02	23.982					
PM_{10} filter'bl	1.53E-02	24.598					
TOTAL STACK 7-9	lb/ton	Tons per Year		lb/year	Tons per Year		Tons per Year
NO_x		1035.005	These are the additions of the tonnage per year of each of the pollutants emitted from all the stacks combined.	9.22E+05	461.182	Uhde (manufacturer) guarantee	573.823
				lb/MMBtu	Tons per Year		
SO_2		102.402		7.67E-02	105.156	C battery has only one stack. The Efs for the pollutants for this stack were derived as the average of the emission factors of stacks 1-3.	[redacted]
VOC[(1)]		6.744		2.10E-02	7.201		[redacted]
		Tons per Year		gpdscf	Tons per Year		
PM total		82.025		8.77E-03	16.140		65.885
PM filter'bl		58.661		6.30E-03	11.599		47.062
PM condens'bl		21.761		2.43E-03	4.480		17.281
$PM_{2.5}$ filter'bl		76.694		5.89E-03	10.845		65.848
PM_{10} filter'bl		78.662		6.04E-03	11.123		67.539
CO	6.80E-01	418.047	Clairton Plant "2006 Emissions Inventory".	5.10E-01	319.691	25% reduction from baseline in CO due to better combustion practices.	98.356
PM condensible = PM10 condensible = PM2.5 condensible							
(1) VOC emissions have been multiplied by a factor of 0.25 to exclude methane and ethane.							

Table C1 - 10 Ball Mill Emissions

	7-9 Battery		C battery	
DUST COMING OUT OF THE BH is approximately 0.063% of the coal charged	774.62	Tons	789.82	Tons

BALL MILL							
	7-9 Batteries			C Battery			REDUCTION
POLLUTANT	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton BH dust	Tons per Year		lb/ton BH dust	Tons per Year		Tons per Year
PM filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.016	1994 Title V Application, Appendix A	[redacted]
$PM_{2.5}$ filter'bl	4.00E-02	0.0155	Assumed equal to PM-10 (filterable)	4.00E-02	0.016	Assumed equal to PM-10 (filterable)	[redacted]
PM_{10} filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.016	1994 Title V Application, Appendix A	[redacted]
PM condensible = PM10 condensible = PM2.5 condensible							

Table C1 - 11 Soaking Emissions

POLLUTANT	SOAKING						
	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	1.00E-03	0.615	AP-42, 2007; Table 12.2-18	5.00E-04	0.313	Emission factors provided in AP-42, 2007; Table 12.2-18 were halved because soaking emissions are expected to be reduced by 50% by the PROven system	0.301
SO_2	9.90E-02	60.863		4.95E-02	31.029		29.834
VOC	6.00E-03	3.689		3.00E-03	1.881		1.808
PM total	1.50E-02	9.222		7.50E-03	4.701		4.520
PM filter'bl							
PM condens'bl							
$PM_{2.5}$ filter'bl							
PM_{10} filter'bl							

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 12 Decarbonization Emissions

		DECARBONIZATION					
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
CO	1.16E+00	715.556	DECARB 121907.xls;	1.00E+00	628.891	DECARB 121907.xls;	86.665

Table C1 - 13 Fugitive Emissions (charging, doors, lids, offtakes)

WITH HRM's RESULTS IN BOTH 7-9 AS WELL AS C BATTERY

HRM's CALCULATIONS DONE USING CURRENT ACTUAL EMISSIONS AND NESHAP LIMITS (FOR CHARGING, OFFTAKES, LIDS AND DOORS) FOR 7-9 BATTERIES AND C BATTERY RESPECTIVELY.

CHARGING/DOORS/LIDS/OFFTAKES

RATIO TO BSO	PROCESS	POLLUTANT	7-9 Batteries			C Battery			
			Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	Reduction (TPY)
			lb/hr * Ratio to BSO	Tons per Year		lb/hr	Tons per Year		
NA	CHARGING	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total		0.386			0.409		[redacted]
0.9		PM filter'bl	0.044	0.193		0.047	0.204		[redacted]
0.9		PM condens'bl	0.044	0.193		0.047	0.204		[redacted]
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.108	0.471		0.114	0.500		[redacted]
1.1		CO	0.054	0.236		0.057	0.250		[redacted]
NA	DOORS	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	1.267	5.547		0.492	2.157		3.391
0.9		PM filter'bl	0.633	2.774		0.246	1.078		1.695
0.9		PM condens'bl	0.633	2.774		0.246	1.078		1.695
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	1.548	6.780		0.602	2.636		4.144
1.1		CO	0.774	3.390		0.301	1.318		2.072
NA	LIDS	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	0.003	0.013		0.016	0.069		[redacted]
0.9		PM filter'bl	0.002	0.007		0.008	0.035		[redacted]
0.9		PM condens'bl	0.002	0.007		0.008	0.035		[redacted]
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.004	0.016		0.019	0.085		[redacted]
1.1		CO	0.002	0.008		0.010	0.042		[redacted]
NA	OFFTAKES	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8		PM total	0.036	0.156		0.025	0.108		0.048
0.9		PM filter'bl	0.018	0.078		0.012	0.054		0.024
0.9		PM condens'bl	0.018	0.078		0.012	0.054		0.024
NA		PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.044	0.191		0.030	0.133		0.059
1.1		CO	0.022	0.096		0.015	0.066		0.029

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 14 Coal Handling Emissions

MATERIAL HANDLING (for 7-9 Batteries during the baseline period May 2002-April 2004 and potentials for C battery)

COAL HANDLING	Pulverizer				Unloader								
	#1 Pri	#1 Sec	#2 Pri	#2 Sec	#1	#2	Clamshell	Pedestal Crane	Coal Transfer	Boom Conveyor	Bins and Bunkers	Storage Piles acre*day	TPY
Batteries 7-9 (tons per period)	2,459,102	-	-	-	2,336,147	-	368,865	122,955	2,459,102	221,319	2,459,102	24,591	
Emission Factors (lb/ton coal)													
$PM_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM_{10}	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
$PM_{2.5}$	0.18	-	-	-	0.14	-	0.02	0.01	0.20	0.01	0.00	25.57	13.1
PM_{10}	0.71	-	-	-	0.42	-	0.07	0.02	0.64	0.04	0.00	25.57	13.7
TSP	3.55	-	-	-	0.91	-	0.14	0.05	1.35	0.09	0.01	56.81	31.4
Battery C (tons per year)	940,268	940,268			1,191,006		250,738	125,369	1,253,690	150,443	1,253,690	12,537	
Emission Factors (lb/ton coal)													
$PM_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM_{10}	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
$PM_{2.5}$	0.07	0.12	-	-	0.07	-	0.01	0.01	0.10	0.01	0.00	13.04	13.4
PM_{10}	0.27	0.47	-	-	0.22	-	0.05	0.02	0.33	0.03	0.00	13.04	14.4
TSP	1.36	2.37	-	-	0.46	-	0.10	0.05	0.69	0.06	0.00	28.96	34.0

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
$PM_{2.5}$	13.069	13.431	0.362
PM_{10}	13.741	14.424	0.683
TSP	31.448	34.048	2.600

Table C1 - 15 Coke Handling Emissions

MATERIAL HANDLING *(for the baseline period May 2002-April 2004 and future for C battery)*

COKE HANDLING	Coke Pile (Load & unload)	Coke Transfer	Screen Stn.	Screening Stn. Loadout	Coke Pile Erosion	TOTAL
					Acre*day	TPY
Batteries 7-9 (tons per period)	**4,124**	**1,792,841**	**1,792,841**	**1,792,841**	**17,570**	
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	6.36	0.24	0.18	4.57	5.7
PM_{10}	0.01	6.36	0.75	0.63	4.57	6.2
TSP	0.03	13.45	1.58	0.90	10.19	13.1
Battery C (tons)	**2,313**	**1,005,528**	**1,005,528**	**1,005,528**	**9,854**	TPY
Emission Factors (lb/ton coke)						
$PM_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM_{10}	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
$PM_{2.5}$	0.01	3.57	0.13	0.10	2.56	6.4
PM_{10}	0.01	3.57	0.42	0.35	2.56	6.9
TSP	0.02	7.54	0.89	0.50	5.72	14.7
Note: Emission factors for storage piles are in lb/(acre*day)						

	Batteries 7-9 (TPY)	Battery C (TPY)	Increase (TPY)
$PM_{2.5}$	5.68	6.37	0.69
PM_{10}	6.16	6.91	0.75
TSP	13.07	14.66	1.59

Table C1 - 16 (i) HAP Emissions

	7-9 Battery		C battery	
BSO charging EF	0.0029	lb/(secVE/chg)/hr	0.0035	lb/(secVE/chg)/hr

	TPY Values							
	Lead		Hydrogen Sulfide		Carbon Disulfide		Total Reduced Sulfur	
7-9 Batteries	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.355E-03			4.200E-05	2.568E-02		2.57E-02
Traveling	1.530E-06	9.355E-04			4.220E-06	2.580E-03		2.58E-03
PEC fugitives	2.509E-06	1.534E-03			5.750E-06	3.516E-03		3.52E-03
Uncontrolled pushing	5.480E-05	1.833E-04			4.800E-05	1.605E-04		1.61E-04
Quenching					5.490E-03	3.357E+00		3.36E+00
7-9 STACK TOTAL					3.150E-03	5.27E-03		5.27E-03
Ball Mill								
Soaking			4.300E-01	2.629E+02				2.63E+02
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.138	0.138	0.001	0.001		1.72E+01
Lids			4.800E-03	4.800E-03	3.200E-05	3.200E-05		4.83E-03
Offtakes			4.770E-03	4.770E-03	3.200E-05	3.200E-05		4.80E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.423E+01	1.180E-01	2.998E+00		1.72E+01
TOTAL		**1.201E-02**		**2.773E+02**		**6.393E+00**		**3.008E+02**
C Battery	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.543E-03			4.200E-05	2.620E-02		2.62E-02
Traveling	9.088E-07	5.668E-04			2.507E-06	1.563E-03		1.56E-03
PEC fugitives	1.530E-06	9.543E-04			5.750E-06	3.586E-03		3.59E-03
Uncontrolled pushing	5.480E-05	1.718E-04			4.570E-05	1.432E-04		1.43E-04
Quenching					5.254E-03	3.277E+00		3.28E+00
C STACK					2.363E-03	7.23E-03		7.23E-03
Ball Mill								
Soaking			2.150E-01	1.348E+02				1.35E+02
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.069	0.035	0.000	0.000		3.47E-02
Lids			4.320E-03	3.888E-03	2.880E-05	2.592E-05		3.91E-03
Offtakes			4.293E-03	3.864E-03	2.880E-05	2.592E-05		3.89E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.717E+01	1.180E-01	2.998E+00		2.02E+01
TOTAL		**1.124E-02**		**1.348E+02**		**3.316E+00**		**1.381E+02**
NET CHANGE (C minus 7-9)		**-7.722E-04**		**-1.425E+02**		**-3.077E+00**		**-1.626E+02**

LB/HR Values			
Lead	Hydrogen Sulfide	Carbon Disulfide	TRS
lb/hr	lb/hr	lb/hr	lb/hr
0.0021		0.006	0.006
0.0002		0.001	0.001
0.0004		0.001	0.001
0.0000		0.000	0.000
		0.766	0.766
		0.001	0.001
	60.026		60.026
	0.032	0.000205	3.932
	0.001	0.000007	0.001
	0.001	0.000007	0.001
	3.248	0.684400	3.932

lb/hr	lb/hr	lb/hr	lb/hr
0.0022		0.006	0.006
0.0001		0.000	0.000
0.0002		0.001	0.001
0.0000		0.000	0.000
		0.748	0.748
		0.002	0.002
	30.770		30.770
	0.008	0.00005	0.008
	0.001	0.00001	0.001
	0.001	0.00001	0.001
	3.920	0.684	4.604

Table C1 - 16 (ii) HAP Emissions

	Batteries 7-9	Battery C	Units
TOTAL COAL CHARGED (per year @ 3.5% moisture)	1229551.0000	1,253,690.00	Tons
COKE OVEN GAS CHARGED	6690.0000	6,123.24	MMcf/year
BSO charging EF	0.0030	0.0030	lb/(secVE/chg)/hr

			Batteries 7-9	Battery C	NET (C minus 7-9)	NOTES	Batteries 7-9	Battery C
		sec VE/chg	TPY	TPY	TPY		lb/hr	lb/hr
Charging	Benzene	1.8702	2.45E-02	2.46E-02	5.73E-05	0% reduction due to PROven	5.60E-03	5.61E-03
	Cyanide Compounds	0.1309	1.72E-03	1.72E-03	4.01E-06		3.92E-04	3.93E-04
	Naphthalene	0.7481	9.81E-03	9.83E-03	2.29E-05		2.24E-03	2.24E-03
	7-PAH	0.0561	7.36E-04	7.37E-04	1.72E-06		1.68E-04	1.68E-04
	POM	2.9923	3.92E-02	3.93E-02	9.17E-05		8.96E-03	8.98E-03
	Styrene	0.0281	3.68E-04	3.69E-04	8.60E-07		8.40E-05	8.42E-05
	Toluene	0.1496	1.96E-03	1.97E-03	4.59E-06		4.48E-04	4.49E-04
	Xylene	0.0748	9.81E-04	9.83E-04	2.29E-06		2.24E-04	2.24E-04
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Doors	Ammonia	0.1380	1.38E-01	6.90E-02	-6.90E-02	50% reduction due to the integrated hood and PROven. Lb/hr-leak = 0.022; Ratio to BSO from AP-42.	3.15E-02	1.58E-02
	Benzene	0.4599	4.60E-01	2.30E-01	-2.30E-01		1.05E-01	5.25E-02
	Cyanide Compounds	0.0322	3.22E-02	1.61E-02	-1.61E-02		7.35E-03	3.68E-03
	Ethylene	0.0368	3.68E-02	1.84E-02	-1.84E-02		8.40E-03	4.20E-03
	Naphthalene	0.1840	1.84E-01	9.20E-02	-9.20E-02		4.20E-02	2.10E-02
	7-PAH	0.0000	7.50E-06	3.75E-06	-3.75E-06		1.71E-06	8.56E-07
	POM	0.7358	7.36E-01	3.68E-01	-3.68E-01		1.68E-01	8.40E-02
	Propylene	0.0736	7.36E-02	3.68E-02	-3.68E-02		1.68E-02	8.40E-03
	Toluene	0.0368	3.68E-02	1.84E-02	-1.84E-02		8.40E-03	4.20E-03
	Xylene	0.0046	4.60E-03	2.30E-03	-2.30E-03		1.05E-03	5.25E-04
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Lids	Ammonia	0.0048	4.77E-03	4.29E-03	-4.77E-04	10% reduction due to PROven. Lb/hr-leak = 0.0073; Ratio to BSO from AP-42.	1.09E-03	9.80E-04
	Benzene	0.0159	1.59E-02	1.43E-02	-1.59E-03		3.63E-03	3.27E-03
	Cyanide Compounds	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
	Ethylene	0.0127	1.27E-02	1.14E-02	-1.27E-03		2.90E-03	2.61E-03
	Hydrogen Cyanide	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
	Naphthalene	0.0064	6.36E-03	5.72E-03	-6.36E-04		1.45E-03	1.31E-03
	7-PAH	0.0000	7.50E-06	6.75E-06	-7.50E-07		1.71E-06	1.54E-06
	POM	0.0254	2.54E-02	2.29E-02	-2.54E-03		5.81E-03	5.23E-03
	Propylene	0.0025	2.54E-03	2.29E-03	-2.54E-04		5.81E-04	5.23E-04
	Toluene	0.0013	1.27E-03	1.14E-03	-1.27E-04		2.90E-04	2.61E-04
	Xylene	0.0002	1.59E-04	1.43E-04	-1.59E-05		3.63E-05	3.27E-05
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Offtakes	Ammonia	0.0048	4.77E-03	4.29E-03	-4.77E-04	10% reduction due to PROven. Lb/hr-leak = 0.0073; Ratio to BSO from AP-42.	1.09E-03	9.80E-04
	Benzene	0.0159	1.59E-02	1.43E-02	-1.59E-03		3.63E-03	3.27E-03
	Cyanide Compounds	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
	Ethylene	0.0127	1.27E-02	1.14E-02	-1.27E-03		2.90E-03	2.61E-03
	Hydrogen Cyanide	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
	Naphthalene	0.0064	6.36E-03	5.72E-03	-6.36E-04		1.45E-03	1.31E-03
	7-PAH	0.0000	7.50E-06	6.75E-06	-7.50E-07		1.71E-06	1.54E-06
	POM	0.0254	2.54E-02	2.29E-02	-2.54E-03		5.81E-03	5.23E-03
	Propylene	0.0025	2.54E-03	2.29E-03	-2.54E-04		5.81E-04	5.23E-04
	Toluene	0.0013	1.27E-03	1.14E-03	-1.27E-04		2.90E-04	2.61E-04
	Xylene	0.0002	1.59E-04	1.43E-04	-1.59E-05		3.63E-05	3.27E-05

		lb/ton or lb/mmcf	TPY	TPY			lb/hr	lb/hr
Stacks	Ammonia (lb/mmcf)	0.0140	4.68E-02	4.29E-02	-3.97E-03	25% reduction in emissions of organic compounds due to better combustion practices.	1.07E-02	9.79E-03
	Benzene (lb/ton)	0.0004	2.19E-01	1.67E-01	-5.15E-02		4.99E-02	3.82E-02
	Chlorine (lb/mmcf)	0.0761	2.55E-01	2.33E-01	-2.16E-02		5.81E-02	5.32E-02
	Ethylbenzene (lb/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Hydrochloric Acid (lb/mmcf)	3.2067	1.07E+01	9.82E+00	-9.09E-01		2.45E+00	2.24E+00
	Naphthalene (lb/ton)	0.0010	5.96E-01	4.56E-01	-1.40E-01		1.36E-01	1.04E-01
	7-PAH (lb/mmcf)	0.0000	4.68E-05	3.21E-05	-1.47E-05		1.07E-05	7.34E-06
	POM (lb/ton)	0.0001	4.00E-02	3.06E-02	-9.40E-03		9.12E-03	6.98E-03
	Toluene (lb/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Xylene (lb/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00

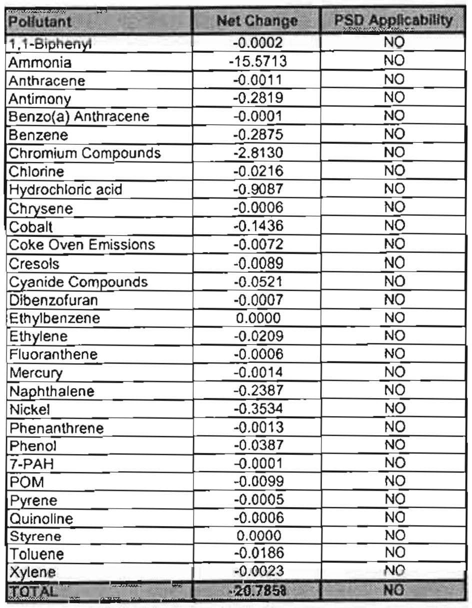
		lb/ton coal	TPY	TPY			lb/hr	lb/hr
PEC BH	Ammonia	0.0002	1.23E-01	1.25E-01	2.41E-03	PEC BH cannot capture organic compounds; so no change in efficiency between baseline and future predicted emissions.	2.81E-02	2.86E-02
	Anthracene	0.0000	2.77E-04	2.82E-04	5.43E-06		6.32E-05	6.44E-05
	Benzene	0.0003	1.71E-01	1.74E-01	3.35E-03		3.90E-02	3.97E-02
	Cyanide Compounds	0.0006	3.46E-01	3.53E-01	6.80E-03		7.91E-02	8.06E-02
	Coke Oven Emissions	0.0002	1.16E-01	1.18E-01	2.27E-03		2.64E-02	2.69E-02
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.23E-02	1.25E-02	2.41E-04		2.81E-03	2.86E-03
	Phenanthrene	0.0000	8.61E-03	8.78E-03	1.69E-04		1.97E-03	2.00E-03
	7-PAH	0.0000	6.15E-03	6.27E-03	1.21E-04		1.40E-03	1.43E-03
	POM	0.0000	8.61E-03	8.78E-03	1.69E-04		1.97E-03	2.00E-03
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY			lb/hr	lb/hr
Traveling	Ammonia	0.0000	1.23E-02	7.45E-03	-4.85E-03	40.6% reduction in travel emissions due to shorter travel times.	2.81E-03	1.70E-03
	Anthracene	0.0000	2.77E-05	1.68E-05	-1.09E-05		6.32E-06	3.83E-06
	Benzene	0.0000	1.71E-02	1.03E-02	-6.73E-03		3.90E-03	2.36E-03
	Cyanide Compounds	0.0001	3.46E-02	2.10E-02	-1.37E-02		7.91E-03	4.79E-03
	Coke Oven Emissions	0.0000	1.16E-02	7.01E-03	-4.56E-03		2.64E-03	1.60E-03
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.23E-03	7.45E-04	-4.85E-04		2.81E-04	1.70E-04
	Phenanthrene	0.0000	8.61E-04	5.21E-04	-3.39E-04		1.97E-04	1.19E-04
	7-PAH	0.0000	6.15E-04	3.72E-04	-2.42E-04		1.40E-04	8.50E-05
	POM	0.0000	8.61E-04	5.21E-04	-3.39E-04		1.97E-04	1.19E-04
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY			lb/hr	lb/hr
PEC Fugitives	Ammonia	0.0000	1.68E-02	1.71E-02	3.29E-04	Organic compounds are not captured by the hood and hence the better capture efficiency of hood on Battery C will not cause an emission reduction.	3.83E-03	3.90E-03
	Anthracene	0.0000	3.77E-05	3.85E-05	7.41E-07		8.61E-06	8.78E-06
	Benzene	0.0000	2.33E-02	2.37E-02	4.57E-04		5.31E-03	5.42E-03
	Cyanide Compounds	0.0001	4.72E-02	4.81E-02	9.27E-04		1.08E-02	1.10E-02
	Coke Oven Emissions	0.0000	1.58E-02	1.61E-02	3.10E-04		3.60E-03	3.67E-03
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.68E-03	1.71E-03	3.29E-05		3.83E-04	3.90E-04
	Phenanthrene	0.0000	1.17E-03	1.20E-03	2.30E-05		2.68E-04	2.73E-04
	7-PAH	0.0000	8.38E-04	8.55E-04	1.65E-05		1.91E-04	1.95E-04
	POM	0.0000	1.17E-03	1.20E-03	2.30E-05		2.68E-04	2.73E-04
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY			lb/hr	lb/hr
Uncontrolled Pushir	Ammonia	0.0002	7.60E-04	7.12E-04	-4.78E-05	The percentage uncontrolled pushes in 7-9 are 0.544% whereas in C they reduce to 0.5% leading to a decrease in HAP emissions.	1.74E-04	1.63E-04
	Anthracene	0.0000	1.71E-06	1.60E-06	-1.07E-07		3.90E-07	3.66E-07
	Benzene	0.0003	1.06E-03	9.89E-04	-6.63E-05		2.41E-04	2.26E-04
	Cyanide Compounds	0.0006	2.14E-03	2.01E-03	-1.34E-04		4.89E-04	4.58E-04
	Coke Oven Emissions	0.0002	7.15E-04	6.70E-04	-4.49E-05		1.63E-04	1.53E-04
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Naphthalene	0.0000	7.60E-05	7.12E-05	-4.78E-06		1.74E-05	1.63E-05
	Phenanthrene	0.0000	5.32E-05	4.99E-05	-3.34E-06		1.21E-05	1.14E-05
	7-PAH	0.0000	3.80E-05	3.56E-05	-2.39E-06		8.68E-06	8.13E-06
	POM	0.0000	5.32E-05	4.99E-05	-3.34E-06		1.21E-05	1.14E-05
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY			lb/hr	lb/hr
Quenching	1,1-Biphenyl	0.0000	8.61E-03	8.40E-03	-2.08E-04	VOC emissions are reduced by ~4.3% due to fewer quenches in C as compared to 7-9. The organic HAPs are also expected to undergo a similar decrease. Metals and ammonia are expected to be particulate in nature and are estimated to undergo the same reduction (97%) in C quench tower (due to the better baffle design) as against 7-9.	1.97E-03	1.92E-03
	Ammonia	0.0260	1.60E+01	4.89E-01	-1.55E+01		3.65E+00	1.12E-01
	Anthracene	0.0001	4.61E-02	4.50E-02	-1.12E-03		1.05E-02	1.03E-02
	Antimony	0.0005	2.91E-01	8.89E-03	-2.82E-01		6.64E-02	2.03E-03
	Benzo(a) Anthracene	0.0000	6.02E-03	5.88E-03	-1.46E-04		1.38E-03	1.34E-03
	Chromium Compounds	0.0047	2.90E+00	8.88E-02	-2.81E+00		6.62E-01	2.03E-02
	Chrysene	0.0000	2.64E-02	2.58E-02	-6.40E-04		6.04E-03	5.89E-03
	Cobalt	0.0002	1.48E-01	4.53E-03	-1.44E-01		3.38E-02	1.03E-03
	Coke Oven Emissions	0.0003	2.12E-01	2.07E-01	-5.14E-03		4.84E-02	4.73E-02
	Cresols	0.0006	3.69E-01	3.60E-01	-8.93E-03		8.42E-02	8.22E-02
	Cyanide Compounds	0.0020	1.23E+00	1.20E+00	-2.98E-02		2.81E-01	2.74E-01
	Dibenzofuran	0.0000	2.77E-02	2.70E-02	-6.70E-04		6.32E-03	6.16E-03
	Fluoranthene	0.0000	2.64E-02	2.58E-02	-6.40E-04		6.04E-03	5.89E-03
	Mercury	0.0000	1.48E-03	4.51E-05	-1.43E-03		3.37E-04	1.03E-05
	Naphthalene	0.0003	2.03E-01	1.98E-01	-4.91E-03		4.63E-02	4.52E-02
	Nickel	0.0006	3.65E-01	1.12E-02	-3.53E-01		8.32E-02	2.55E-03
	Phenanthrene	0.0001	4.61E-02	4.50E-02	-1.12E-03		1.05E-02	1.03E-02
	Phenol	0.0026	1.60E+00	1.56E+00	-3.87E-02		3.65E-01	3.56E-01
	7-PAH	0.0000	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
	POM	0.0000	1.41E-02	1.38E-02	-3.42E-04		3.23E-03	3.15E-03
	Pyrene	0.0000	2.21E-02	2.16E-02	-5.36E-04		5.05E-03	4.93E-03
	Quinoline	0.0000	2.58E-02	2.52E-02	-6.25E-04		5.90E-03	5.75E-03



Pollutant	Net Change	PSD Applicability
1,1-Biphenyl	-0.0002	NO
Ammonia	-15.5713	NO
Anthracene	-0.0011	NO
Antimony	-0.2819	NO
Benzo(a) Anthracene	-0.0001	NO
Benzene	-0.2875	NO
Chromium Compounds	-2.8130	NO
Chlorine	-0.0216	NO
Hydrochloric acid	-0.9087	NO
Chrysene	-0.0006	NO
Cobalt	-0.1436	NO
Coke Oven Emissions	-0.0072	NO
Cresols	-0.0089	NO
Cyanide Compounds	-0.0521	NO
Dibenzofuran	-0.0007	NO
Ethylbenzene	0.0000	NO
Ethylene	-0.0209	NO
Fluoranthene	-0.0006	NO
Mercury	-0.0014	NO
Naphthalene	-0.2387	NO
Nickel	-0.3534	NO
Phenanthrene	-0.0013	NO
Phenol	-0.0387	NO
7-PAH	-0.0001	NO
POM	-0.0099	NO
Pyrene	-0.0005	NO
Quinoline	-0.0006	NO
Styrene	0.0000	NO
Toluene	-0.0186	NO
Xylene	-0.0023	NO
TOTAL	**-20.7858**	**NO**

Table C2 - 1 Decarbonization Emissions

Estimate Heat Release During Decarb
June 25, 2007 updated for C Battery 12/11/2006
(C Battery Oven Dimensions Assumed the Same as B Battery)

Input Options Key:	**Input: Oven Dimensions & Capacities**
	Input: Carbon Removal Estimates
	Input: Technical Data & Estimates

Estimate amount of C burned from internal surfaces during Decarbonization:			Clairton Batteries 7-9	Clairton Battery C
Tunnel Head Areas	Height, coal line to roof	(ft)	**1.07**	**1.17**
	Length between doors	(ft)	**37.38**	**52.96**
	Average width	(ft)	**1.56**	**1.50**
	SURFACE AREA	**(ft^2)**	**138.4**	**203.0**
Other Wall Areas	Height to coal line	(ft)	**10.78**	**18.83**
	Length between doors	(ft)	**37.38**	**52.96**
	Average width	(ft)	**1.56**	**1.50**
	SURFACE AREA	**(ft^2)**	**864.1**	**2074.2**
Charging Holes	Height, roof to battery top	(ft)	**4.65**	**5.52**
	Average length (est)	(ft)	**2.75**	**2.75**
	Width	(ft)	**1.17**	**1.17**
	SURFACE AREA	**(ft^2)**	**36.4**	**43.2**

C Removed, Tunnel Head (average thickness / cycle)	(in)	**0.03**	**0.03**
=	(ft)	0.0025	0.0025
C Removed, Other Wall Areas (average thickness / cycle)	(in)	**0.01**	**0.01**
=	(ft)	0.0008	0.0008
C Removed, Charging Holes (average thickness / cycle)	(in)	**0.03**	**0.03**
=	(ft)	0.0025	0.0025

C Removed (average volume / cycle)	(ft^3)	1.2	2.3
C Density (Graphite, Perry 7th Ed)	(lb / ft^3)	**135**	**135**
C Removed (average weight / cycle)	(lb)	156	316
Coal Charge / oven	(tons)	**15.7**	**36.8**
Ovens pushed / battery / day	(Ovens / battery / day)	**86**	**110**
Coal Charge (t/day)		**4040**	**4048**
C Consumed	(lb / ton coal)	10.0	8.6
CO Produced	(lb / ton coal)	23.3	20.1

Check: AP-42 CO Emissions from decarb = 29 lb of CO emitted / ton coal

Above Calculation:		(lb/cycle)	(Lb C / ton coal)	**(Equiv lb CO / ton coal)**
C Removed	7-9 Batts	156	9.98	**23.3**
	C Battery	316	8.60	**20.1**
CO Emissions, 95% burned at SP exit	7-9 Batts			**1.16**
	C Battery			**1.00**

RATIO CO Emissions from C Battery to 7-9 Batteries	**0.862**

CO Emissions Reduction from Decarbonizing =	**14%**

Table C3 - 1
Estimated BSO Emissions Rates -- Doors, Lids, Offtakes & Charging
Based on AP-42 Draft, July, 2007

Revised 1/18/08

Revised 1/31/08

Door Leaks

Enter Values for Shaded Cells

		Batteries 7-9					Battery C w/o PROven					Battery C w/ PROven	
	PLD (%)	**E_{DOORS} (lb/hr)**	E_{DOORS} (kg/hr)	N_{DOORS} (number)	N_{OVENS} (number)	F_b (fract)	**E_{DOORS} (lb/hr)**	E_{DOORS} (kg/hr)	N_{DOORS} (number)	N_{OVENS} (number)	F_b (fract)	**E_{DOORS} (lb/hr)**	E_{DOORS} (kg/hr)
	0	**0.559**	0.253	384	192	0.06	**0.244**	0.111	168	84	0.06	**0.122**	0.055
	1	**0.720**	0.326	384	192	0.06	**0.315**	0.143	168	84	0.06	**0.157**	0.071
	2	**0.881**	0.399	384	192	0.06	**0.385**	0.175	168	84	0.06	**0.193**	0.087
	3	**1.041**	0.472	384	192	0.06	**0.456**	0.207	168	84	0.06	**0.228**	0.103
NESHAP Limit 1- 3	3.8	**1.170**	0.531	384	192	0.06	**0.512**	0.232	168	84	0.06	**0.256**	0.116
	4						**0.526**	0.239	168	84	0.06	**0.263**	0.119
NESHAP Limit C	4.3						**0.547**	0.248	168	84	0.06	**0.274**	0.124
ACTUAL PLD	0.9	**0.704**	0.319	384	192	0.06							

AP 42	E_{DOORS} =	BSO Emission Rate, Doors
	PLD =	Average Percent Leaking Doors as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
	N_{DOORS} =	Total number of doors on the battery
	F_b =	Fraction of the doors with visible leaks from the bench but not from the yard
	0.06	F_b default = 0.06 in the absence of battery-specific bench observations
	0.011	= Typical door leak rate for doors that from the bench have visible leaks, kg/hr
	0.000	= Door leak rate for doors without visible leaks, kg/hr
USS	50.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLD)	
Batteries 7-9	3.8
Battery C, (6M, brownfield battery)	4.3

Batteries 7-9 Actual PLD, base period	**0.90**	**Rev 01-31-08**

Table C3 - 1
Estimated BSO Emissions Rates -- Doors, Lids, Offtakes & Charging
Based on AP-42 Draft, July, 2007

Lid Leaks

Enter Values for Shaded Cells

		Batteries 7-9				Battery C				Battery C w/ PROven	
	PLL	E_{LIDS}	E_{LIDS}	N_{LIDS}	N_{OVENS}	E_{LIDS}	E_{LIDS}	N_{LIDS}	N_{OVENS}	E_{LIDS}	E_{LIDS}
	(%)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)
	0	0.000	0.000	768	192	0.000	0.000	336	84	0.000	0.000
	0.1	0.006	0.003	768	192	0.002	0.001	336	84	0.002	0.001
	0.2	0.011	0.005	768	192	0.005	0.002	336	84	0.004	0.002
	0.3	0.017	0.008	768	192	0.007	0.003	336	84	0.007	0.003
NESHAP Limit	0.4	0.022	0.010	768	192	0.010	0.004	336	84	0.009	0.004
ACTUAL PLL	0.03	0.002	0.001	768	192						

A	E_{LIDS} =	BSO Emission Rate, Lids
P	PLL =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
4	N_{LIDS} =	Total number of lids on the battery
2	0.0033	= Typical lid leak rate, kg/hr
USS	10.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLL)	
Batteries 7-9	0.4
Battery C, (6M, brownfield battery)	0.4

Batteries 7-9 Actual PLL, base period	**0.03**	**Rev 01-31-08**

Table C3 - 1
Estimated BSO Emissions Rates -- Doors, Lids, Offtakes & Charging
Based on AP-42 Draft, July, 2007

Offtake Leaks

Enter Values for Shaded Cells

		Batteries 7-9				Battery C				Battery C w/ PROven	
	PLO	$E_{OFFTAKES}$	$E_{OFFTAKES}$	N_{OFFTKS}	N_{OVENS}	$E_{OFFTAKES}$	$E_{OFFTAKES}$	N_{OFFTKS} *	N_{OVENS}	$E_{OFFTAKES}$	$E_{OFFTAKES}$
	(%)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)
	0.0	0.000	0.000	384	192	0.000	0.000	84	84	0.000	0.000
	1.0	0.028	0.013	384	192	0.006	0.003	84	84	0.006	0.002
	1.5	0.042	0.019	384	192	0.009	0.004	84	84	0.008	0.004
	2.0	0.056	0.025	384	192	0.012	0.006	84	84	0.011	0.005
NESHAP Limit	2.5	0.070	0.032	384	192	0.015	0.007	84	84	0.014	0.006
ACTUAL PLO	0.7	0.020	0.009	384	192						

*NOTE: REVISED FOR ONE OFFTAKE PER OVEN ON C BATTERY, NO JUMPER PIPE

A	E_{OFFTKS} =	BSO Emission Rate, Offtakes
P	PLO =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
4	N_{OFFTKS} =	Total number of lids on the battery
2	0.0033	= Typical lid leak rate, kg/hr
USS	10.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLO)	
Batteries 7-9	2.5
Battery C, (6M, brownfield battery)	2.5

Batteries 7-9 Actual PLO, base period	0.71	Rev 01-31-08

Table C3 - 1
Estimated BSO Emissions Rates -- Doors, Lids, Offtakes & Charging
Based on AP-42 Draft, July, 2007

Charging Emissions

Enter Values for Shaded Cells

		Batteries 7-9				**Battery C**				**Battery C w/ PROven**	
	VE (sec)	E_{CHG} (lb/hr)	E_{CHG} (kg/hr)	T (hr)	N_{OVENS} (number)	E_{CHG} (lb/hr)	E_{CHG} (kg/hr)	T (hr)	N_{OVENS} (number)	E_{CHG} (lb/hr)	E_{CHG} (kg/hr)
	0.0	0.000	0.000	18	192	0.000	0.000	18	84	0.000	0.000
	3.0	0.030	0.013	18	192	0.013	0.006	18	84	0.013	0.006
	6.0	0.059	0.027	18	192	0.026	0.012	18	84	0.026	0.012
	9.0	0.089	0.040	18	192	0.039	0.018	18	84	0.039	0.018
NESHAP Limit	12.0	0.119	0.054	18	192	0.052	0.024	18	84	0.052	0.024
ACTUAL Sec/chg	5.0	0.049	0.022	18	192						

A P 4 2	E_{CHG} =	BSO Emission Rate, Charging
	Chg Sec =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
	T =	Coking cycle time, hr
	VE =	Average seconds of visible emissions per charge
	0.0042	= Typical emission rate per charge, kg/charge *
USS	0.0%	= Percent reduction attributable to PROven

* According to AP42 nomenclature these units are kg/charge. Proper units are kg/sec of VE.

NESHAP Limits (Sec/chg)		
	Batteries 7-9	12
	Battery C, (6M, brownfield battery)	12

Batteries 7-9 Actual Sec/chg, base period	**4.95**	**Rev 01-31-08**

Table C4 - 1

SUMMARY -- Effect of C Battery PEC Hood, Capture of Emissions from CS During Prep for Push

		7-9 Batteries		C Battery		Reductions Resulting from C Battery		
Emissions Location	Pollutant	Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (%)
Coke Face	PM10	0.487	6.8E-04	0.021	2.9E-05	0.47	0.0007	95.6%
	PM2.5	0.127	1.8E-04	0.006	7.6E-06	0.12	0.0002	95.6%
Fallout [Note 2]	PM10	0.137	1.9E-04	0.004	4.9E-06	0.13	0.0002	97.4%
	PM2.5	0.036	5.0E-05	0.001	1.3E-06	0.03	0.0000	97.4%
Jamb	BSO	1.11	1.6E-03	0.04	5.8E-05	1.06	0.0015	96.1%
Gas Channel	BSO	1.38	1.9E-03	0.05	7.3E-05	1.33	0.0019	96.1%
Door Plug	BSO	4.04	5.7E-03	0.17	2.3E-04	3.87	0.0054	95.8%
TOTAL [Note 3]	**$PM_{2.5}$**	**6.69**	**0.00939**	**0.27**	**0.00037**	**6.42**	**0.009**	**95.9%**
TOTAL [Note 3]	**PM_{10}**	**7.16**	**0.01004**	**0.29**	**0.00040**	**6.86**	**0.010**	**95.9%**

Notes

1 When the oven door is off and the SP open, draft from the open SP draws a portion of the emissions generated on the CS into the oven and through the open SP. Some of those emissions will be burned as they pass through the tunnel head & SP. It is assumed that there is no change in the quantity or nature of those emissions in C Battery. This table addresses only the emissions not drawn into the SP.

2 Often, when the CS door is removed a small amount of coke falls from the coke face onto the bench. Generally this coke burns until it is returned to the oven or removed.

3 Assumes BSO is 100% PM2.5

NOTE 12/19/2007: C BATTERY WILL BE A SINGLE COLLECTOR MAIN BATTERY WITH THE MAIN LOCATED ON THE PS OF THE OVENS. THE CALCULATIONS SUMMARIZED ABOVE ASSUME A STANDPIPE LOCATED ON THE CS OF THE BATTERY INDUCING A DRAFT & DRAWING SOME OF THE EMISSIONS FROM THE COKE FACE & CS JAMB INTO THE SP. THOSE EMISSIONS MAY BE BURNED IN THE SP OR EMITTED TO ATMOSPHERE UNCHANGED. HAVING NO SP OR JUMPER PIPE ON THE CS IS LIKELY TO REDUCE THE DRAFT EFFECT AND RESULT IN MORE EFFICIENT CAPTURE OF EMISSIONS FROM THE COKE FACE & CS JAMB. THAT ADDITIONAL CAPTURE IS NOT REFLECTED IN THE ABOVE ESTIMATE. THEREFORE THE C BATTERY EMISSION RATE IS SOMEWHAT CONSERVATIVE (HIGH).

SUMMARY -- Effect of C Battery PEC Hood, Capture of Emissions from CS During Prep for Push

Table C4 -1 (cont.)

Detailed Summary:

		7-9 Batteries						
Emissions Location	Pollutant	CS PM & BSO Generated Before Push Begins (ton/yr)	Destroyed in SP or Exit via SP (ton/yr)	Rest of PM & BSO (ton/yr)	Released at CS (Not Captured by Hood) (ton/yr)	Released at Baghouse Stacks (ton/yr)	Total Emissions (Excl via SP) (ton/yr)	Total Emissions (Excl via SP) (lb/ton coal)
Coke Face	PM10	4.87	4.39	0.49	0.49	0.00	0.49	6.8E-04
	PM2.5	1.27	1.14	0.13	0.13	0.00	0.13	1.8E-04
Fallout	PM10	0.18	0.05	0.14	0.14	0.00	0.14	1.9E-04
	PM2.5	0.05	0.01	0.04	0.04	0.00	0.04	5.0E-05
Jamb	BSO	5.5	4.4	1.1	1.1	0.0	1.1	1.6E-03
Gas Channel	BSO	1.4	0.0	1.4	1.4	0.0	1.4	1.9E-03
Door Plug	BSO	4.0	0.0	4.0	4.0	0.0	4.0	5.7E-03

		C Battery						
Emissions Location	Pollutant	CS PM & BSO Generated Before Push Begins (ton/yr)	Destroyed in SP or Exit via SP (ton/yr)	Rest of PM & BSO (ton/yr)	Released at CS (Not Captured by Hood) (ton/yr)	Released at Baghouse Stacks (ton/yr)	Total Emissions (Excl via SP) (ton/yr)	Total Emissions (Excl via SP) (lb/ton coal)
Coke Face	PM10	3.60	3.24	0.36	0.02	0.00	0.02	2.9E-05
	PM2.5	0.94	0.84	0.09	0.00	0.00	0.01	7.6E-06
Fallout	PM10	0.08	0.02	0.06	0.00	0.00	0.00	4.9E-06
	PM2.5	0.02	0.01	0.02	0.00	0.00	0.00	1.3E-06
Jamb	BSO	3.6	2.9	0.7	0.0	0.0	0.0	5.8E-05
Gas Channel	BSO	0.9	0.0	0.9	0.0	0.0	0.1	7.3E-05
Door Plug	BSO	2.9	0.0	2.9	0.1	0.0	0.2	2.3E-04

Appendix C 5-1 Travel Emission Factors

	ABC Test		BSC Test		Average		
~Sec/ Push[1]		65		65			Coke S
	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	0.70%
Hydrogen	0.90	0.0139	0.67	0.0103	0.79	0.0121	
Carbon	6.83	0.1051	5.26	0.0810	6.05	0.0930	

	NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO_2
Emission Factors[2]	lb / ton[5]							
	7.5	6	16	6	2.2	0.04	16.04	28.0
	lb/ sec/ ton coke							
Referenced Cells	**3.94E-04**	**3.15E-04**	**8.41E-04**	**3.15E-04**	**1.16E-04**	**2.10E-06**	**8.43E-04**	**0.001472**

7-9 Batteries

NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
lb/ day							
59.5	47.6	127.0	47.6	17.5	0.32	127.3	222.2
ton/ yr							
10.9	8.7	23.2	8.7	3.2	0.06	23.2	40.6

C Battery ≈ B Battery

NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
lb/ day							
35.3	28.3	75.4	28.3	10.4	0.19	75.6	131.9
ton/ yr							
6.4	5.2	13.8	5.2	1.9	0.03	13.8	24.1

Reduction

NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
ton/ yr							
4.4	3.5	9.4	3.5	1.3	0.02	9.4	16.5
40.6%	40.6%	40.6%	40.6%	40.6%	40.6%	40.6%	40.6%

---

[1] Elapsed time from coke face begins to move until hot car leaves hood

[2] Estimated from AP42, Combustion of bituminous coal in overfeed stoker boilers.

[3] N/A

[4] See size distribution

[5] AP42, Overfeed stoker-fired boiler

Table C6 - 1

Ratio of Battery Stack Emission Rates in One PROven-Equipped 6M Battery vs. Three Conventional 3.6M Batteries with Equal Capacity (e.g Clairton Batteries 7-9)	
November 14, 2007	
Pressure differential effect (Same value as doors)	0.613
Wall area effect	1.005
Total effect	0.616

Difference in Wall Area per Ton of Coal - 6M Battery v 3.6 M Battery

		Battery "Size"	
		6M	3.6M
Floor to Top of Horizontal	(ft)	17.74	9.93
Width of Roof	(ft)	1.50	1.56
Length of Oven - Face to Face of Brick	(ft)	54.75	40.04
Total Wall Area	(ft^2)	2024.6	857.4
Working Volume	(ft^3)	1472.0	626.3
Bulk Density	(lb/ft^3)	48.0	48.0
Coal Charge	(tons)	35.3	15.0
Wall Area per Ton of Coal	(ft^2/ton coal)	57.3	57.0
Wall Area Effect	Ratio 6M/3.6M	1.005	

Appendix C7

Notes: Travel Emissions Clairton Batteries 7-9 vs. Battery C

December 18, 2007

1. EPA's AP42 pushing emissions estimates use 74.1% capture efficiency. However that efficiency includes uncontrolled travel which according to the NESHAP BID justifies using the low value. It is important for USS to treat pushing and travel separately because C Battery with a significantly shorter average travel distance (oven to Q tower) compared to 7-9 Batteries will realize a substantial reduction in travel emissions.
2. From an emissions perspective, pushing and travel are two entirely different components of the coking operation.

   During pushing the coke mass is moving, breaking apart, falling a significant distance, landing in the hot car while being exposed to high velocity air and combustion gasses as air is drawn into the PEC hood and coke burns. A large quantity of particulate matter is generated mechanically. The PEC hood design is properly intended to provide as tight a seal as practical to maximize capture efficiency. However, minimizing air infiltration leads to inefficient combustion of coke and residual VM and consequently PM generation.

   Travel, on the other hand, is a relatively tranquil operation. Only combustion, influenced by the draft induce by the burning coke and the motion of the hot car, affects emissions. Therefore, travel should be treated strictly as a combustion source.
3. Travel emissions can be estimated using two parameters: an emissions rate (expressed in lb/ton of coke/second of travel) and travel time from the oven to the quench tower.
4. Little, if any, testing of travel emissions has been published. However, EPA conducted tests of PEC baghouse inlet and outlet streams at ABC Coke (Birmingham, Alabama, August 11 – 13, 1998) and at Bethlehem Steel (Chesterton, Indiana, aka Burns Harbor). Those tests included extensive testing of the inlet and outlet streams of the baghouse including their water and carbon dioxide content. From those test results it is possible to calculate the hydrogen and carbon consumed by combustion during the push and to express the H & C combustion in terms of pound consumed per ton of coke per second. That result provides a conservative estimate of the combustion that occurs during travel.
5. Emission rates for coal combustion are applied to the combustion during travel to estimate travel emissions.
6. Using this method, a reduction in emissions of approximately 40% is demonstrated.
7. Comparing to the USS factor estimated to be 10% of pushing emissions:

Estimating Method	Travel Emissions (tons/yr)			
	NOX	CO	PM10	SO2
10% of Pushing, 7-9 Batts	1.1	NA	16.5	42.8
Equivalent Coal combustion, 7-9 Batts	12.5	10.0	10.0	46.7
Equivalent Coal combustion, C Batt	7.4	5.9	5.9	27.7

Appendix C8

Discussion of Leak Rates from Battery Stacks with PROven® Technology as Compared to Conventional Oven Pressure Control – Replacement of Three Short Conventional Batteries with One Tall PROven®-Equipped Battery

November 16, 2007

I. Executive Summary

There are three significant factors affecting coke oven stacks emissions when three old, short (3.6M) batteries are replaced by one modern, tall (6M) battery. The three factors are: (1) the overall condition of the refractory, (2) the higher fuel efficiency that will be achieved with the larger battery equipped with an advanced heating system design including modern heating controls and (3) the PROven® oven pressure control system. The assumption is made here that three short batteries at USS Clairton would be replaced with one modern tall battery.

For purposes of calculating the emissions benefit associated with the aforementioned battery replacement, no credit is taken for the emissions reduction that will certainly result from replacing old batteries with a new battery that has not experienced the wear and tear of 50+ years of operation.

A fuel savings (Btu / pound of coal charged) of approximately 10% has been projected by battery designers. A conservative (low side) estimate of the emissions reduction that will result from this factor assumes that stack emissions will fall in proportion to the change in fuel consumption – assuming a starting point of good combustion, e.g. a well-operated COG- fired source.

PROven® oven pressure control technology controls gas pressure at the gooseneck of each oven. The pressure set point for each oven is varied according to a program that maintains the proper gas pressure within the oven as the coking cycle proceeds. By controlling pressure in this manner, PROven® is able to minimize high gas pressures that occur early in the coking cycle and thereby minimize leakage from the oven into the combustion flues. In a separate calculation, the emissions impact of PROven® technology on door emissions was estimated. The estimated decrease in door emissions from PROven®'s improved oven pressure control was 39%.

II. Description of Process

In batteries with conventional oven pressure control systems, the pressure is controlled by maintaining the collector main at a regulated, constant pressure. The regulated collector main pressure must be kept as low as possible to avoid coke oven gas (COG) leaking from doors, lids and offtakes and to avoid COG leaking into the combustion flues where it causes localized overheating and stack emissions. The minimum required pressure in the main is dictated by the need to avoid allowing the gauge pressure at the base of the oven to become negative. A negative gauge pressure is possible because of the difference in the density of hot coke oven gas in the interior of the oven and the density of air at ambient temperature outside of the oven. That difference in densities causes a difference in static head of the fluids inside and outside of the oven of about 1.2 mmWG per meter of elevation [difference between the oven floor and collector main] at the end of the coking cycle. If the gauge pressure at the oven floor were allowed to become negative, air would infiltrate the oven at the bottom of the doors causing combustion of the COG and coke in the oven – overheating and damaging refractory, doors and door jambs. This phenomenon requires taller batteries to operate with a higher collector main pressure to maintain a positive pressure at the foot of the door.

The PROven® system is an innovation that allows control of the pressure in individual ovens by means of a regulated opening between the collector main and the gooseneck. PROven® is operated with a negative pressure in the collector main. During the early stages of the coking cycle, the pressure in the gooseneck is controlled to just slightly above atmospheric to minimize pressure at the oven floor and consequently reduces door leaks and leaks of COG from the oven into the combustion flues. As the coking cycle proceeds pressure drop from the oven floor to the oven top decreases because coke has a higher porosity that coal, the COG produced has a lower density and the gas production rate decreases. As the coking cycle progresses, PROven® gradually increases the set point for pressure at the gooseneck. At the end of the cycle the gooseneck pressure is just high enough to avoid a negative pressure at the foot of the door.

III. Discussion of Stacks Leak Rates

The condition of the battery's refractory and the amount of carbon present to seal cracks that allow oven-to-flue leakage through the oven walls are important to the amount of oven-to-flue leakage that occurs in a battery. However, the significant factor in the amount of leakage pertinent to this discussion is the COG pressure within the oven, i.e. the driving force that causes COG to leak from the oven into the combustion flues.

Leakage from oven to flues is positively related to the difference between the gas pressure inside the oven and the pressure in the combustion flues, generally slightly less than atmospheric pressure. Especially at the beginning of the coking cycle, flow through the coal charge is impeded by the densely packed coal. (The flow pathway through coke is much more porous than the pathway through coal.)

By controlling the pressure in the gooseneck of each oven, PROven® minimizes the peak pressure in the oven at the beginning of the cycle and avoids negative pressure at the end of the cycle. The EPA (July 2007 AP-42 BID, Figure 4-1) shows that door leakage is at its maximum early in the cycle and decreases as coking progresses. The lower pressure differential between the oven and pressure in the flues, especially early in the cycle, is a significant factor leading to reduced stack emissions with the PROven® system as compared to the conventional pressure control technique.

No analogous studies have been found regarding the timing of stack emissions, possibly because the effect of any single oven is masked by the mixing of combustion products from all heating walls in the stack. However, it is generally accepted that oven-to-flue leakage is highest at the beginning of the coking cycle and decreases as coking proceeds. The effect of the improved pressure control with PROven® is analogous to PROven®'s effect on door leaks. Therefore, it is appropriate to estimate that stack emissions will be reduced by the same percentage reduction as the percentage reduction expected for door emissions. Consequently it is estimated that stack emissions from oven-to-flue leakage will be reduced by approximately 39%.

- Combined effect

There is no way to differentiate between emissions that result from oven-to-flue leakage and emissions that occur during normal, well-controlled COG combustion. However it is generally accepted that the large majority of coke battery stack emissions result from leaks. Therefore as a reasonable approximation, a 90/10 split between leaks and normal combustion emissions is assumed.

Combined:

Cause of Emissions	Fraction of Original Emissions	Fraction Reduced	Fraction of Original Emission Remaining	Fraction of Original Emissions with New Battery & PROven®
	A	B	C = 1-B	A x C
Normal, Well-Controlled Combustion	0.10	0.10	0.90	0.090
Oven-to Flue Leaks	0.90	0.39	0.61	0.549
Fraction of Original Emissions Remaining after New Battery & PROven®				**0.639**
Percent Emissions Reduction				**35%**

IV. Conclusions

Replacing three small batteries at USS Clairton Works with one tall battery equipped with PROven® technology would reduce stack emissions per ton of coal charged by about 35%, without taking any credit for the pristine refractory condition that would be present in a new battery.

It is certain that initially, a new battery could achieve a better stack emissions performance than batteries that are 50+ years old. Although normal wear and tear on the new battery is unavoidable, PROven® technology will have long term performance benefits. By minimizing COG leaks into the combustion flues, damage from localized overheating is avoided, and by maintaining a positive pressure at the foot of the doors, PROven® can avoid temperature-related refractory damage that might result from combustion of COG and coke that results from air infiltration.

Appendix C9

Discussion of Coke Oven Door Leak Rates with PROven® Technology as Compared to Conventional Oven Pressure Control – Replacement of Three Short Conventional Batteries with One Tall PROven®-Equipped Battery

November 16, 2007

I. Executive Summary

Three factors affecting coke oven door emissions are addressed under the assumption that three short batteries at USS Clairton would be replaced with one tall battery. The three factors are: (1) the PROven® oven pressure control system, (2) the fact that larger ovens have a significantly lower length of door seal per ton of coal charge and (3) the assumption that tall oven doors are more difficult to seal effectively as recognized in the federal door leak standards.

PROven® technology avoids high internal oven pressure that occurs especially at the foot of the oven doors near the beginning of the coking cycle. The resulting decrease in door emissions from this factor is estimated to be 39%.

Based on a linear relationship between the length of door seal per ton of coal, a reduction in emissions of 33% is projected.

The projected effect of reduced door sealing efficiency on tall versus short batteries is calculated based on the ratio of federal standards for the two classes of batteries and is estimated to be an emissions increase of about 20%.

The combined effect of these three factors is a reduction of 50% in door emissions on an "emissions per ton of coal" basis.

II. Description of Process

In batteries with conventional oven pressure control systems oven pressure is controlled by maintaining the collector main at a regulated, constant pressure. The regulated collector main pressure must be kept as low as possible to avoid coke oven gas (COG) leaking from doors, lids and offtakes and to avoid COG leaking into the combustion flues where it would cause localized overheating and stack emissions. The minimum required pressure in the main is dictated by the need to avoid allowing the gauge pressure at the base of the oven to become negative. A negative gauge pressure is possible because of the difference in the density of hot coke oven gas in the interior of the oven and the density of air at ambient temperature outside of the oven. That difference in densities causes a difference in static head of the fluids inside and outside of the oven of about 1.2 mmWG per meter of elevation [difference between the oven floor and collector main] at the end of the coking cycle. If the gauge pressure at the oven floor were allowed to become negative, air would infiltrate the oven causing combustion of the COG and coke in the oven and damaging refractory, doors and door jambs. This phenomenon requires taller batteries to operate with a higher collector main pressure to maintain a positive pressure at the foot of the door.

The PROven® system is an innovation that allows control of the pressure in individual ovens by means of a regulated opening between the collector main and the gooseneck. PROven® is operated with a negative pressure in the collector main. During the early stages of the coking cycle, the pressure in the gooseneck is controlled to just slightly above atmospheric to minimize pressure at the oven floor and consequently reduce door leaks. As the coking cycle proceeds pressure drop from the oven floor to the oven top decreases because coke has a higher porosity that coal, the COG produced has a lower density and the gas production rate decreases. PROven® gradually increases the oven pressure as the coking cycle progresses. At the end of the cycle the gooseneck pressure is just high enough to avoid a negative pressure at the foot of the door.

III. Factors Influencing Door Leak Rates

Three factors in the amount of door leakage are pertinent to this discussion: COG pressure within the oven, the length of door sealing edge per ton of coal charged and the increased difficulty sealing taller doors.

- Leakage from oven doors is positively related to the difference between the gas pressure inside the oven and ambient pressure outside the oven. Oven doors are designed with a "gas channel" to allow COG to flow from the base of the door to the top of the oven. However, at the beginning of the coking cycle, the pressure drop in the gas channel is high because the rate of COG generation is high and flow through the coal charge is impeded by the densely packed coal. (The flow pathway through coke is much more porous than the pathway through coal.)

  By controlling the pressure in the gooseneck of each oven, PROven® minimizes the peak pressure at the foot of the doors at the beginning of the cycle and avoids negative pressure at the end of the cycle. The EPA (July 2007 AP42 BID, Figure 4-1) shows that door leakage is at its maximum early in the cycle and decreases as coking progresses. The lower pressure differential between the oven and ambient, especially early in the cycle is a significant factor leading to reduced door emissions with the PROven® system as compared to the conventional pressure control technique.

- The relative size of coke ovens is an important factor affecting emission rates. Ovens in modern batteries are generally both taller and longer (PS to CS) than ovens in batteries built in the 1950s. For example, an oven in USS Clairton Works' 1, 2 and 3 Batteries are 3.6 meters tall and have a design coal volume of 626 ft^3; B Battery is 6 meters tall and has a design coal volume of 1,472 ft^3. Relating the oven capacity to the length of door sealing edge, Batteries 1-3 have 0.089 feet of sealing edge per ton of coal charge, and B Battery has only 0.060 feet of sealing edge per ton of coal charge.

  The relative length of sealing edge will lead to a proportional reduction in door emissions partially offset by the increased difficulty related to taller doors as discussed below.

- In order to obtain the best emissions performance from doors the doors' sealing edges must conform closely to its jamb. Taller doors present a more difficult challenge in this regard because they must conform to taller jambs. Current door leak standards recognize this difficulty by allowing a slightly higher percent leaking doors (PLD) for tall batteries than for short batteries. The current standards are 4.0 and 3.3 PLD respectively.

IV. Calculations and Assumptions

- Effect of Oven Internal Pressure

Information from the paper "Reduction of Emissions During Coking, Application of PROven® for Conventional Coking – an Alternative to Heat Recovery Coking? By Martin Reinke et al, Dortmund, Germany (Reinke) was used to compare oven internal pressures.

For short batteries, e.g. Clairton 1-3, pressure at the foot of the door is based on Reinke, but adjusted for the lower collector main pressure required in shorter batteries (as described above) and for the fact that Clairton is typically able to operate at fairly low collector main pressure because their well-sealed doors help to exclude air infiltration even if the pressure becomes slightly negative at the foot of the doors at the end of coking. Also, for short batteries the pressure at the foot of the door is adjusted downward from the tall-battery values in Reinke to recognize that less COG is generated and the pressure drop through coal, coke and the doors' gas channels is lower because less coal is charged in the short batteries.

The equation used to calculate the pressure at the foot of the door in a short battery:

$$P_{FDS} = P_{SPS} - H_S + 0.183(P_{FDT} - P_{SPT})$$

Where:

P_{FDS} = Pressure at the foot of the door, short battery

P_{FDT} = Pressure at the foot of the door, tall battery

H_S = Difference in static head of ambient air and COG in oven

P_{SPS} = Pressure in the standpipe, short battery

P_{SPT} = Pressure in the standpipe, tall battery

0.183 = Calculated ratio of ΔP for COG flowing through the gas channels and coal mass in a short battery to the ΔP for COG flowing through the gas channels and coal mass in a tall battery taking into account the higher superficial velocity caused by the extra gas generated in a tall oven as well as the longer flow path through coal and the gas channels in a tall battery.

The relative leak rate of a PROven®-equipped oven to a conventional oven is calculated as the square root of the ratio of pressures within the oven, i.e. the ratio of the ΔP between the oven and atmosphere. This calculation was performed for each 5% increment of time through the coking cycle. Chart 2 shows the relationship between the ratio of PROven® and conventional leak rates as a function of % through the coking cycle. The best fit 2nd order polynomial is also shown on Chart 2.

The emission rate from oven doors decreases as the coking cycle progresses as shown in Figure 4-1 (AP42 BID, July 2007) The decline of emission rate was calculated from Figure 4-1 and expressed as a faction of the maximum (initial) leak rate. The equation derived from Figure 4-1 is:

$$y = e^{-0.0605X}$$

Where: y = Emission rate expressed as a fraction of maximum rate

X = Percent through coking cycle

The calculated relative leak rates of PROven®-equipped ovens and conventional ovens (equation from Chart 2) are combined with the leak rates through time into the coking cycle (via the equation from Chart 1) to calculate the relative PROven® and conventional leak rates at each increment through the cycle. The PROven® values are summed, and conventional values are summed; the ratio of the two sums is the effect of the difference in oven pressures.

If 1-3 Batteries were replaced by a single 6M battery equipped with PROven® technology and with the same total production capacity, the calculated effect of the differences in internal oven pressure on door emissions, is an emissions reduction of about 39%.

- Effect of Door Seal Length

Comparing Clairton Batteries 1-3 with Clairton Battery B: The length of the seals around the perimeter on the doors on Batteries 1-3 is about 27.8 feet (55.6 feet for two doors); the length of the seals around the perimeter on the doors on Battery B is about 44.0 feet (88.0 feet for two doors). The working volumes of 1-3 and B are 626 ft^3 and 1,472 ft^3, respectively. At 48 pounds per ft^3, the length of seal per ton of coal is:

0.089 feet of sealing edge per ton of coal charge at Batteries 1-3 and

0.060 feet of sealing edge per ton of coal charge at B Battery.

The effect of seal length is proportional to the length of seal per ton of coal or 0.060 / 0.089 = 0.67 for the present case. That is, if 1-3 Batteries were replaced by a single 6M battery with the same total production capacity the effect of seal length per ton of coal on door emissions is to reduce emissions by about 33%.

- Sealing Efficiency of Taller Doors

In order to obtain maximum performance from doors the door's sealing edge must conform closely to its jamb. Taller doors present a more difficult challenge in this regard because they must conform to taller jambs. Current door leak standards recognize this difficulty by allowing a slightly higher percent leaking doors (PLD) for tall batteries than for short batteries. The current standards are 4.0 and 3.3 PLD respectively. Therefore, if 1-3 Batteries were replaced by a single 6M battery with the same total production capacity the effect of reduced sealing efficiency on door emissions is estimated to be an emissions increase of about 20%.

- Combined effect

The combined effect of the three factors discussed above, is the product of the three ratios:

Internal Oven Pressure	0.61
Door Seal Length	0.67
Sealing Efficiency	1.20
Combined	0.50

Total Door Emissions Reduction: 50%

V. Conclusions

Replacing three small batteries at USS Clairton Works with one tall battery equipped with PROven® technology would reduce door emissions per ton of coal charged by about 50% even recognizing that federal emissions standards allow higher PLD for tall batteries than for short batteries.

It is likely that initially, a new battery could achieve a better PLD performance than batteries that are approximately 50 years old. However, PROven® technology might have long term emissions performance benefits. For example, by maintaining a positive pressure at the foot of the doors, PROven® can avoid temperature-related refractory, jamb and door damage that might result from combustion of COG and coke which results from air infiltration.

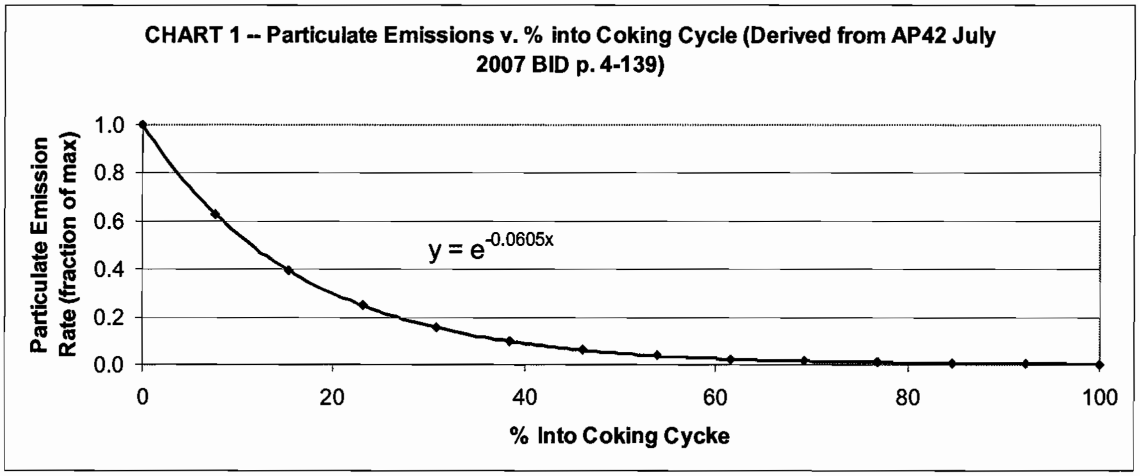


CHART 1 -- Particulate Emissions v. % into Coking Cycle (Derived from AP42 July 2007 BID p. 4-139)

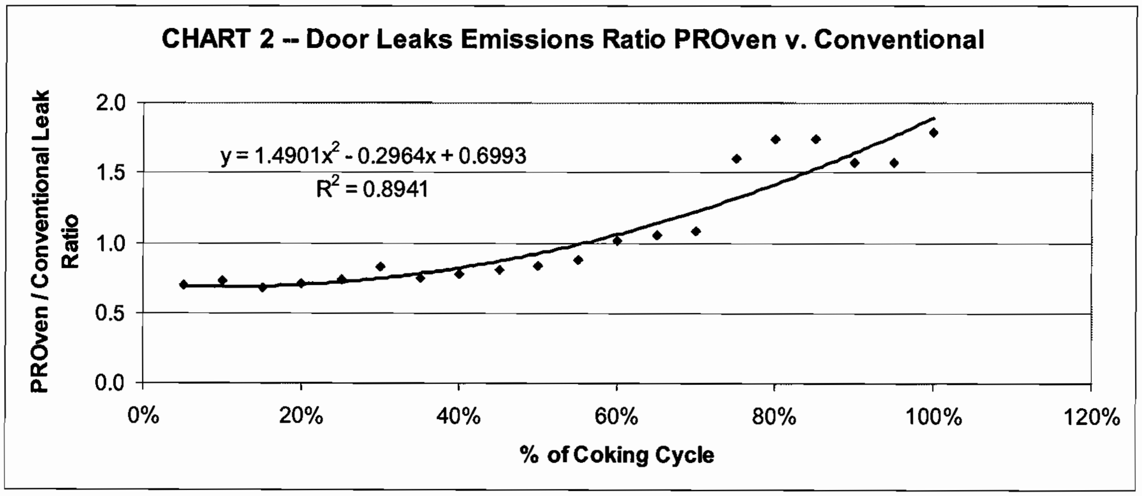


CHART 2 -- Door Leaks Emissions Ratio PROven v. Conventional

Table C10 - 1

NOX & SO2 Calcs -- Consistent with PM EF's Based on ABC & BSC PEC Tests
Dec 26, 2007

	ABC Test		BSC Test		Average		
~Sec/ Push[1]	65		65				Coke S
	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	0.70%
Hydrogen	1.04	0.0160	0.77	0.0119	0.91	0.0139	
Carbon	7.87	0.1210	6.06	0.0933	6.96	0.1072	

Emission Factors[2]	NOX	SO_2
	lb / ton	
	7.5	28.0
	lb/ sec/ ton coke	
	4.54E-04	0.0016954

	lb / ton coke	
Total	0.030	0.110

Batts 7-9	NOX	SO_2
Capture Eff'y	74.1%	74.1%
Coke Yield	75.0%	75.0%
Fugitives (lb/ton coal)	**0.0057**	**0.0214**
PEC B'house (lb/ton coal)	**0.0164**	**0.0612**
Total (lb/ton coal)	**0.0221**	**0.0827**

Batt C	NOX	SO_2
Capture Eff'y	90.0%	90.0%
Coke Yield	78.0%	78.0%
Fugitives (lb/ton coal)	**0.0023**	**0.0086**
PEC B'house (lb/ton coal)	**0.0207**	**0.0774**
Total (lb/ton coal)	**0.0230**	**0.0860**

Batts 7-9	NOX	SO_2
Capture Eff'y	80.0%	80.0%
Coke Yield	75.0%	75.0%
Fugitives (lb/ton coal)	**0.0221**	**0.0827**
PEC B'house (lb/ton coal)	**0.0221**	**0.0827**
Total (lb/ton coal)	**0.0443**	**0.1653**

Batt C	NOX	SO_2
Capture Eff'y	90.0%	90.0%
Coke Yield	78.0%	78.0%
Fugitives (lb/ton coal)	**0.0230**	**0.0860**
PEC B'house (lb/ton coal)	**0.0230**	**0.0860**
Total (lb/ton coal)	**0.0460**	**0.1719**

The capture efficiency will not apply to Nox and SO2 since they are not captured by the hood or the BH.

SUMMARY -- Effect of C Battery PEC Hood, Capture of Emissions from CS During Prep for Push, NOX, SOX, CO & VOC

Revised 1/30/2008

		7-9 Batteries						
		CS NOX, SOX, CO & VOC Generated Before Push Begins	Destroyed in SP or Exit via SP	Rest of NOX, SOX, CO & VOC	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks
		(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(lb/ton coal)	(lb/ton coal)
Coke Face	NOX	1.59	1.430	0.159	0.159	0.000	2.23E-04	0.00E+00
Fallout	NOX	0.06	0.015	0.045	0.045	0.000	6.27E-05	0
TOTAL	NOX						**2.86E-04**	**0.00E+00**
Coke Face	SOX	5.64	5.072	0.564	0.564	0.000	7.91E-04	0.00E+00
Fallout	SOX	0.21	0.053	0.158	0.158	0.000	2.22E-04	0
TOTAL	SOX						**1.01E-03**	**0.00E+00**
Coke Face	CO	1.27	1.144	0.127	0.127	0.000	1.78E-04	0.00E+00
Fallout	CO	0.048	0.012	0.036	0.036	0.000	5.02E-05	0
TOTAL	CO						**2.29E-04**	**0.00E+00**
Jamb	VOC	0.11	0.088	0.022	0.022	0.000	3.10E-05	0
Gas Channel	VOC	0.03	0.000	0.028	0.028	0.000	3.88E-05	0
Door Plug	VOC	0.08	0.000	0.081	0.081	0.000	1.13E-04	0
TOTAL	VOC						**1.83E-04**	**0.00E+00**

		C Battery						
		CS NOX, SOX, CO & VOC Generated Before Push Begins	Destroyed in SP or Exit via SP	Rest of NOX, SOX, CO & VOC	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks
		(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(lb/ton coal)	(lb/ton coal)
Coke Face	NOX	1.17	1.056	0.117	0.006	0.111	8.00E-06	1.52E-04
Fallout	NOX	0.03	0.007	0.020	0.001	0.019	1.33E-06	2.5342E-05
TOTAL	NOX				0.007	0.130	**9.34E-06**	**1.77E-04**
Coke Face	SOX	4.16	3.744	0.416	0.021	0.395	2.84E-05	5.39E-04
Fallout	SOX	0.09	0.023	0.069	0.003	0.066	4.73E-06	8.9881E-05
TOTAL	SOX				0.024	0.461	**3.31E-05**	**6.29E-04**
Coke Face	CO	0.94	0.844	0.094	0.005	0.089	6.40E-06	1.22E-04
Fallout	CO	0.021	0.005	0.016	0.001	0.015	1.07E-06	2.0274E-05
TOTAL	CO				0.005	0.104	**7.47E-06**	**1.42E-04**
Jamb	VOC	0.07	0.058	0.014	0.001	0.014	9.82E-07	1.8662E-05
Gas Channel	VOC	0.02	0.000	0.018	0.001	0.017	1.23E-06	2.3327E-05
Door Plug	VOC	0.06	0.000	0.057	0.003	0.055	3.92E-06	7.4536E-05
TOTAL	VOC				0.004	0.072	**6.13E-06**	**1.17E-04**

Discussion of Emissions Rates from Battery "Pre-Push" with Proposed C Battery Technology as Compared to Batteries 7-9

January 21, 2008

I. Description of Process

From the time an oven door is removed from the battery's coke side (CS) in preparation for pushing until the door is replaced there is a possibility of emissions from the vicinity of the open door. These emissions sources can be put into categories corresponding to five areas of the operating unit:

- Combustion at the coke face,
- Combustion of "fallout" coke,
- Evaporation of tar from the CS jamb,
- Evaporation of tar from the sealing components of the door (sealing edge and gas channel) and
- Evaporation of tar from the door plug and retainer

Each of the areas is affected by a different set of conditions that result in different types and quantities of emissions.

At Batteries 7-9, there is no mechanism for capture of these emissions. C Battery however, will be equipped with a better PEC hood design that will capture those emissions.

Some parameters used in the calculation of these emissions are shown in the table below.

	7-9 Batteries		C Battery	
Coal Charge @ 50lb/ft^3 (6% H_2O)	15.7	Tons/oven	36.8	Tons/oven
Coke Produced @ 69% TC Yield	10.5	Tons/oven	24.7	Tons/oven
Length of Time from Door Off to Push	10	min	10	min
Length of Time from Push to Door On	2	min	2	min
Pushes per Day @ 18 hr CT	256	pushes	112	pushes
Capture Efficiency	0.0%		95.0%	
Baghouse Efficiency	0.0%		99.0%	

II. Combustion at the Coke Face

When the door is off the oven, the hot coke at the CS face is exposed to the atmosphere and burns. The hot coke (at Batteries 7-9, the open standpipe above the CS face) induces a draft along the coke face. Some of the emissions generated by the combustion are drawn into the oven and either burned or emitted from the top of the standpipe. At batteries 7-9 the emissions that are not drawn into the oven are emitted to atmosphere, on C battery they will be captured by the PEC hood.

Estimates of how much coke is burned at the CS face and the fraction of the emission flowing to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering judgment. The estimates used in the current calculations are shown below. Emissions generation rates are based on combustion of anthracite, AP42 Table 1.2-4.

Combustion at CS Face	**7-9 Batteries**		**C Battery**	
Area of Coke Face	18.1 ft^2		30.6 ft^2	
Coke Burned at Coke Face (CS)	0.05 lb/min/ft^2		0.05 lb/min/ft^2	
	Percent of Emissions		Percent of missions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	90.0%	10.0%	90.0%	10.0%

III. Combustion of "Fallout"

Often when the CS door is removed, some coke falls from the oven onto the bench and remains there until returned to the oven or quenched. Also, after the push some, coke remains in the coke guide. Similar to the hot coke face, some of the fallout burns, generating emissions that are either drawn into the oven, emitted to atmosphere or, in the case of C Battery, captured by the PEC hood.

Estimates of how much of the fallout coke is burned and the fractions of the emission that flow to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering judgment. The estimates used in the current calculations are shown below. Emissions generation rates are based on combustion of anthracite, AP42 Table 1.2-4.

Combustion of "Fallout"	**7-9 Batteries**		**C Battery**	
Average "Fallout" per Oven	17.0 lb		17.0 lb	
Fraction of "Fallout" Burned	0.02		0.02	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	25.0%	75.0%	25.0%	75.0%

IV. Evaporation of Tar from the CS Jamb

Tar accumulates on the jamb face during the coking cycle. Even though the majority of tar is cleaned from the jamb each cycle, some remains on the jamb. The jamb is hot when the door is removed and is constantly in contact with the heated refractory. Typically there is no combustion, but the jamb temperature remains high causing some tar to evaporate from the jamb.

Estimates of how much tar evaporates and the fractions of the emission that flow to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering judgment. The estimates used in the current calculations are shown below.

VM from Jamb	**7-9 Batteries**		**C Battery**	
Area of Jamb Face	9.5 ft^2		14.1 ft^2	
Tar Volatilized from Jamb	0.00 in/cycle		0.00 in/cycle	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	80.0%	20.0%	80.0%	20.0%

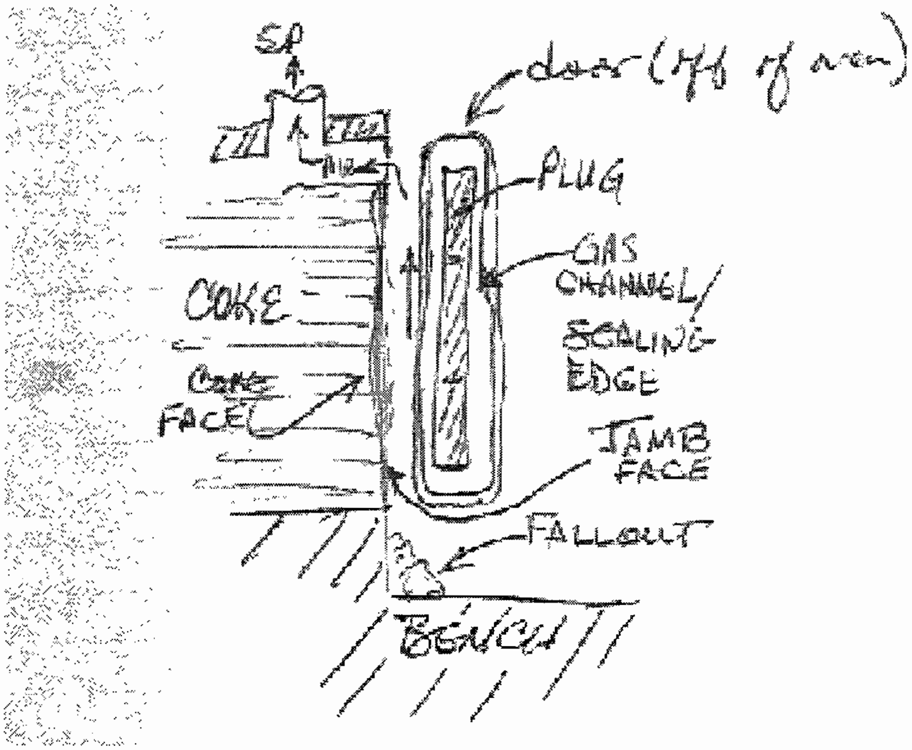
V. Evaporation of Tar from the Gas Channel, Sealing Edge and Door Plug

Tar accumulates in the gas channel, on the door sealing edges and on the door plug and retainer during the coking cycle. Even though the majority of tar is cleaned each cycle, some remains on these surfaces. The door components are hot when the door is removed and have considerable mass to retain heat. However, they are not in contact with the heated portion of the battery and will cool more quickly than the jambs. Typically there is no combustion, but the temperature remains high causing some tar to evaporate.

Estimates of how much tar evaporates have been made based on coke plant experience and engineering judgment. An insignificant fraction of the emissions flow to the CS standpipe because the door is physically removed from the oven and rests at a distance of several feet from the oven; all emissions are emitted to atmosphere (7-9) or captured by the PEC (C Battery, at the capture efficiency). The estimates used in the current calculations are shown below.

VM from Door Plug & Gas Channel	**7-9 Batteries**		**C Battery**	
Area of Door Plug	27.7 ft^2		45.0 ft^2	
Tar Volatilized from Door Plug	0.0005 in/cycle		0.0005 in/cycle	
Area of Gas Channel & Sealing Strip	9.5 ft^2		14.1 ft^2	
Tar Volatilized from Sealing Strip & Gas Channel	0.0005 in/cycle		0.0005 in/cycle	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
VM from Door Plug	0.0%	100.0%	0.0%	100.0%
VM from Gas Channel & Sealing Strip	0.0%	100.0%	0.0%	100.0%

Emissions from door, jamb, coke face and “fallout” prior to push (CS)



Appendix D

Literature on the PROven® System

COKE OVEN CHAMBER PRESSURE CONTROL – A NEW EMISSION CONTROL SYSTEM

By

J. Giertz and A S Jessup

Read before the Midland Section on 15 April 1999
at Corus Conference Centre, Scunthorpe

Background

Coke works in Britain are regulated by the Environmental Protection Act, under the watchful eye of the environmental inspector. The EPA does give the inspector some flexibility in determining the requirements for each site. This is because the Act recognises that pollution control comes at a financial cost and there is a balance to be struck in achieving the best possible environmental improvements without jeopardising the economic viability of the works. These compromises are summarised by the terms "Best Available Techniques Not Entailing Excessive Cost" and "Best Practice Environmental Option": BATNEEC & BPEO.

Coke works are being subjected to evertightening constraints on emissions, whether they be liquid effluents or emissions to atmosphere. The guidance for inspectors is regularly revised to incorporate new "best" technology, and applicants for authorisations are expected to keep abreast of such developments. This applies to existing, as well as new plant.

The incorporation of new techniques into existing plant must of course give achievable levels of improvement. It is no good incorporating new equipment to solve a problem if there is a more fundamental problem which will prevent any benefits from the supposed "improvement" being realised.

Any new development for use in the coking industry must meet the BATNEEC requirements and above all be robust. It is also desirable that someone else has proven it to work first!

Mr Giertz is a Project Engineer with Deutsche Montan Technologie, Essen, Germany.

Mr Jessup is a Senior Process Engineer for OSC Process Engineering Limited, Stockport England.

Introduction

In dealing with leaks from ovens, several process techniques are now widely used to help control charging emissions. These include sequential charging to moderate the initial rate of gas evolution, charging on the main and the use of steam aspiration to ensure that evolved gases are drawn into the gas collecting main especially when the charge car is disconnected. The sudden evolution of gases during charging, however, causes pressure surges in the gas collecting main which in turn affects the pressure in other ovens, risking emissions, albeit smaller ones, there.

Other previous attempts to reduce oven leakages during the carbonisation period have mostly been centred on the mechanical design of equipment rather than process design. For example there have been improvements to door designs such as seals and gas channels. Water sealed ascension pipe lids are also now widely used to prevent emissions. In the case of oven door emissions, the success with which they are controlled is usually dependent upon the effectiveness of the door seal and this in turn depends on how well it is cleaned and maintained.

Any further progress has, however, been hampered by the fact that ovens have to run at a positive pressure to avoid ingress of air, which causes damage to the ovens and affects gas quality. This unfortunately gives rise to emissions from any weak points in oven sealing; typically doors.

This paper deals with a new system being developed to control leaks from ovens by enabling their operation at a steady pressure, only just above normal atmospheric pressure, irrespective of conditions in the gas collecting main. The system, which incorporates a new type of valve within the gooseneck, was first successfully tested on 5 ovens of a 4m battery where it was proven to give good control of oven pressure and also showed a significant reduction in the build up of tar deposits in the goosenecks.

Since then, a programme of continuing development has followed with all 30 ovens of the 4m test battery being fitted with the new valve and this year a complete oven pressure regulation system being installed on 52 ovens of a 6m battery.

Typical Current Oven Operation

The top curve in Fig 1 shows a typical relationship between the pressure behind a coke oven door with respect to coking time. The oven must be kept at a positive pressure to prevent ingress of air and the subsequent damage to the oven ends and poor gas quality that would otherwise result. The higher the oven pressure, the more leakage that will occur through a given leakage path. Any shortcomings in the door sealing strips will be especially noticeable at the start of the coking cycle when the oven pressure is highest.

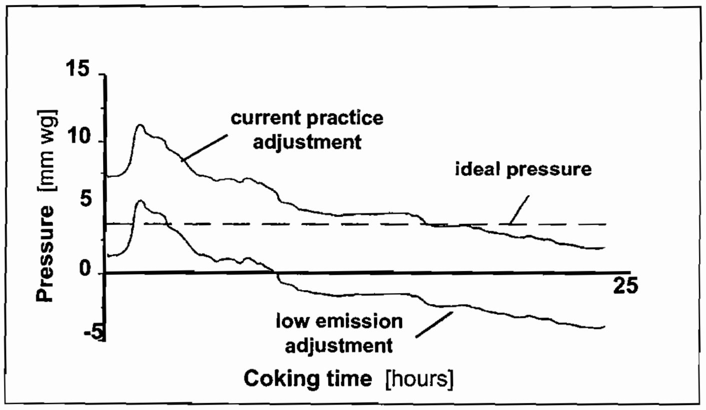


Fig. 1
Typical Pressure at Coke Oven Door

If the gas collecting main were to be put under suction, the pressure in the oven could be reduced, as shown in the bottom curve in Fig 1, and hence the emissions would be reduced. Simply doing this would however lead to air ingress into the oven during the latter part of the coking cycle.

Ideally the oven pressure should be kept low and constant. Just enough pressure to avoid air ingress, but low enough to avoid emissions. This ideal is represented by the horizontal line in Fig 1.

The Solution

To solve this problem, DMT (Deutsche Montan Technologie) have co-operated with Thyssen Stahl AG in the development of an individual chamber pressure regulation system using a variable depth water seal in the gooseneck. Varying the depth of the seal enables the oven pressure to be controlled independently of the gas collecting main pressure.

Functional Description

The conventional Pullman Valve shown in Fig 2 is an open or shut valve, its position cannot be modulated to regulate the oven pressure. Furthermore, when the oven is on the main, the valve is not fully flushed by the liquor spray and is therefore susceptible to tar build-up.

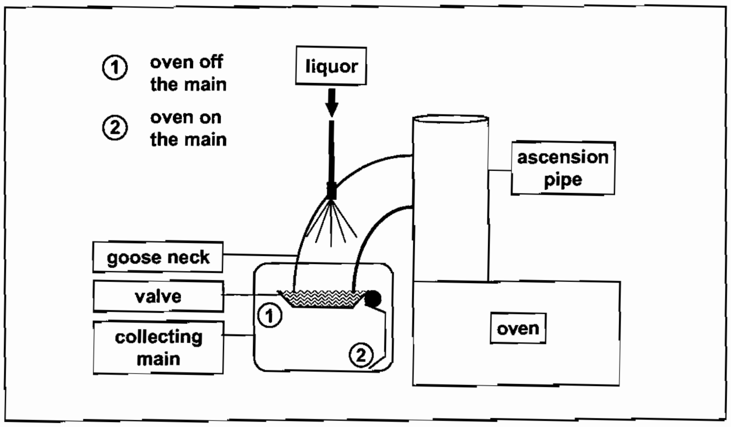


Fig. 2
Conventional Collecting Main Valve

In the new design the Pullman valve is replaced by a device called the "FixCup" valve and is shown schematically in Fig 3.

The FixCup valve is a simple device fitted with two spray nozzles. One supplies a permanent flow and the other a controllable flow of flushing liquor. The cup is kept continually flushed and is therefore not susceptible to blockage. The oven can be taken off the main by opening the control valve full, thus filling the seal with liquor until it is overflowing, rather than by swivelling a Pullman Valve into position and supplying sealing liquor to it.

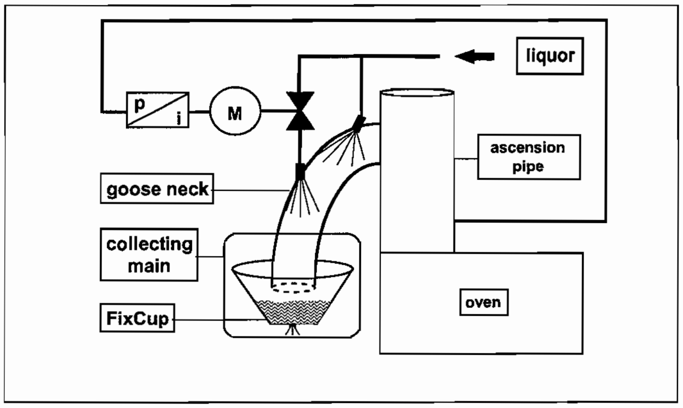


Fig. 3
Pressure Regulated Oven Using FixCup Valve

At the start of the coking period, the high rate of gas evolution tends to increase the oven chamber pressure. This is detected by a pressure transmitter at the foot of the ascension pipe which sends a signal to the control system to reduce the liquor flow through the control valve.

As liquor continually leaves the cup through a drain hole, the level in the cup falls, thus providing a greater flow path for gases through the cup. The liquor supply is reduced until the pressure in the ascension pipe reaches the set-point.

As carbonisation continues, less and less gas is produced and the oven pressure tends to reduce. In response to this, the control system therefore gradually increases the supply of liquor to the cup, raising the level of the liquid seal and restricting the flow of gas until the pressure at the bottom of the ascension pipe again reaches the set-point. Thus a constant pressure is maintained in the oven throughout the carbonisation period.

The FixCup has a drain hole, visible in Fig 4, which has a wide diameter to enable any large lumps to pass through it without becoming blocked. A stopper is used to close the hole when required. An important feature is that the drain and stopper are kept continually flushed.

Fig. 4
FixCup Drain Hole

Fig 5 shows the liquor level in the FixCup in its pressure regulating mode and when the oven is off the main. During coking the flow of liquor to the FixCup can be varied according to the pressure in the oven. If the oven pressure is too high, such as at the start of coking, the liquor rate can be dropped and the level in the cup falls, increasing the gas flow area and therefore reducing the oven pressure. Conversely, if the oven pressure starts to fall, as it does towards the end of the coking time, the liquor rate can be increased and the level in the cup rises, restricting the flow of gas and therefore maintaining the required slightly positive oven pressure.

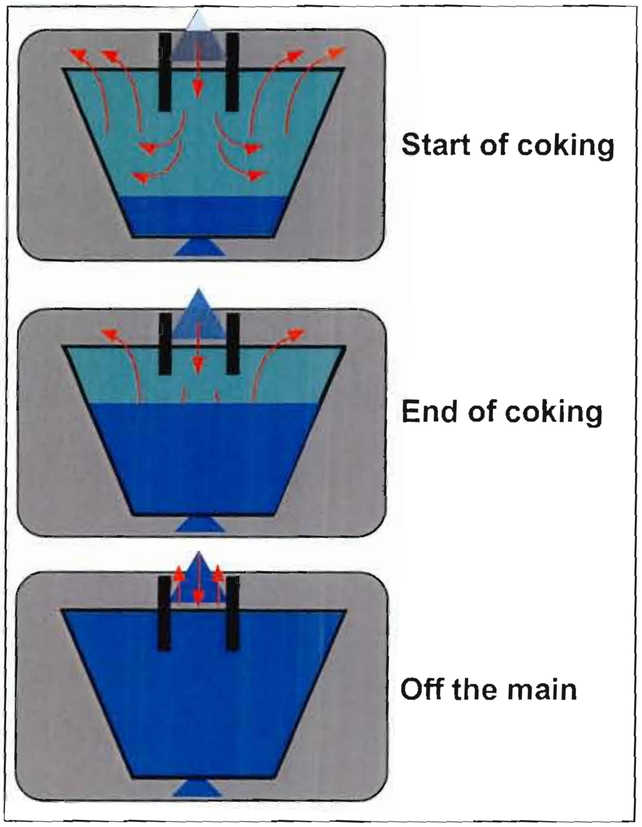


Fig. 5
Different Water Levels in the FixCup Valve

The set point for the oven pressure can be freely selected, being only limited by the suction available and the range of seal depths in the cup. The ovens can be controlled using individual controllers, or through a common computer control system catering for all the ovens on a battery. The advantage of a computer controlled system is that it lends itself to data logging (hence fault diagnosis) and possible battery automation.

The FixCup can be easily retrofitted to existing applications, even those with very narrow goosenecks. It can be used with oven pressure regulation, or without it if a solution to fouling problems only is desired.

Field Testing

Following a series of extensive laboratory testing using a full size cold model at the DMT research facility, the new system was successfully tried out at the August-Thyssen Coke Works in Duisburg, Germany.

The 4m No 3a battery, built in the 1950s had a poor emissions record. It was however chosen for the tests as it has been built with two single collecting mains; one serving only 5 ovens and the other serving the remaining 25. These five coke ovens were fitted with the pressure control system.

The features of the test ovens are given in Table 1.

Oven Design	Compound Oven
Dimensions	Gas Gun
Length between door plugs	11980 mm
Height from sole to crown	3635 mm
Average chamber width	393 mm
Oven door	Plug type (negligible gas channels)
Ascension pipe lid design	Water Sealed
Operational Data	
Normal coking time (push to push)	15 hours
Average nozzle brick temperature	1262 °C

Table 1
Test Oven Characteristics

A set of preliminary investigations was first carried out without individual oven chamber pressure regulation. This was to characterise the pressure conditions at the oven doors, in the ascension pipes, the gas-spaces and in the collecting main.

The results showed comparable pressures in the ascension pipes compared with the gas spaces. At the door, the pressures were substantially different from the ascension pipes and gas spaces. This was due to the old type of door design which had very narrow gas channels. For ovens equipped with larger gas channels it is expected that the differentials will be significantly reduced to a point where the door pressure can be confidently characterised predominantly by the ascension pipe pressure.

Fig 6 shows a graph of the number 2 oven ascension pipe and corresponding collection main pressures taken over 20 hours of normal operation. Noticeable are the clear positive and negative spikes.

The two negative spikes are caused by steam ejection during charging of number 2 oven. Steam ejection causes an increase in the volumetric flow into the collecting main and therefore an increase in main pressure which is represented by the positive spikes on the lower chart.

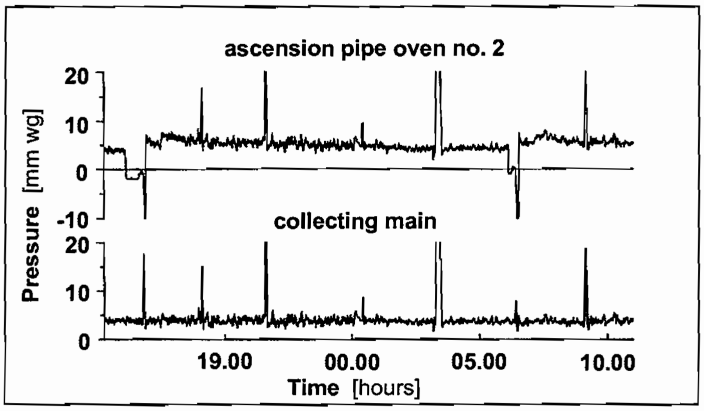


Fig. 6
Pressure Conditions during Normal Operation

During the carbonisation period, further peaks in pressure occur in the collecting main due to steam ejection from neighbouring ovens. These pressure rises are transmitted to oven 2. The increase in oven pressure caused by the charging of other ovens resulted in additional emissions from the ascension pipe lids and the upper parts of oven doors and leveller doors.

A magnification of the graph around the oven pushing and charging period is given in Fig 7. This shows more clearly how the pressure in the collecting main is affected by the pressure in the ascension pipes.

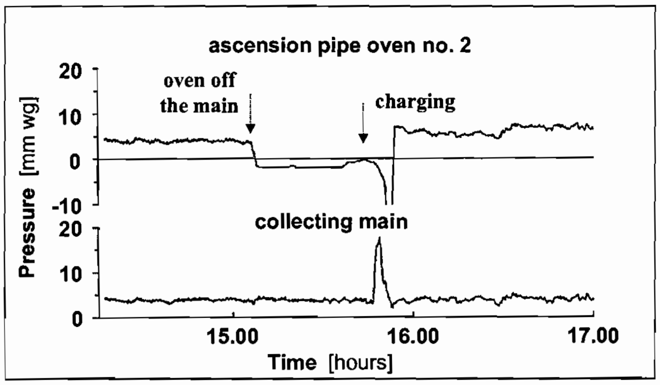


Fig. 7
Pressure Conditions during Normal Operation

At the end of the coking period, no more gas is being produced and the pressures in the ascension pipe and collecting main are the same - about 4mm WG.

When the oven is taken off the main and the ascension pipe lid is opened, the pressure at the bottom of the ascension pipe immediately drops to just below atmospheric. Pressures stay relatively constant during the push.

When charging takes place, the aid of steam ejection causes the pressure in the ascension pipe to drop steeply, causing a corresponding increase in GC main pressure, which, as was seen in the previous figure, causes pressure peaks in adjacent ovens.

At the end of charging, and aspiration, conditions stabilise, although the ascension pipe pressure is, at 7 mm WG, almost double that in the GC main.

The test ovens were then operated with the new chamber pressure regulation system.

For the first series of tests on the new system, the collecting main was operated at a suction of 5 mm WG, with the system set to control ascension pipe pressure at + 9 mm WG.

Fig 8 shows how, when the collecting main pressure was reset to - 1mm WG, the pressure regulation kept the oven pressure at + 9 mm WG. In the diagram, this period is followed by the charging of a neighbouring oven under steam aspiration. Unfortunately this still leads to a short-term rise in the oven pressure. This is because the collecting main pressure has itself risen above the control set point of the chamber regulation system. Following charging, the control set point was dropped to 0 mm WG and the chamber pressure held constant. Resetting the collecting main to a suction of 5 mm WG and making step change increases to the control set point shows that the regulation system works well in principle. However, for the system to work effectively under all conditions, the collection main must always operate below the desired chamber pressure.

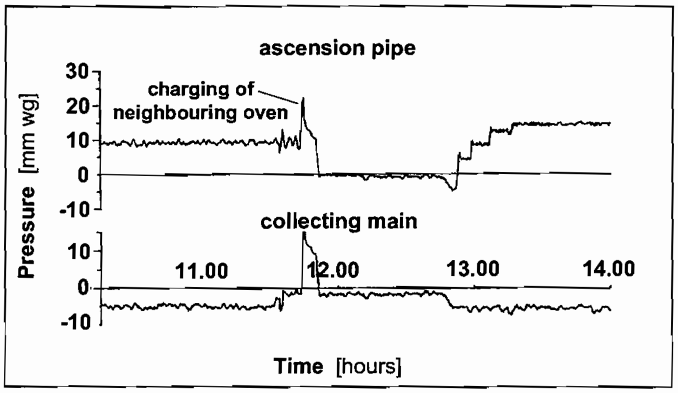


Fig. 8
Pressure Regulated Ovens: Different Set Points

If the pressure in the collecting main could be lowered far enough, it follows that the regulation system can be applied with greatest success. This is demonstrated in Fig 9. The collecting main pressure here was set to - 12 mm WG. Reducing the pressure this far meant that steam ejection was no longer required during charging. The oven is taken off the main simply by adjusting the liquor flow to the FixCup to its maximum value, hence filling the cup. During pushing the pressure in the oven is essentially 0 mm WG which is below the controller set point value. This forces the pressure regulator to keep the flushing liquor supply valve open at its maximum position.

Prior to the start of coal charging, the ascension pipe lid is closed and the oven is connected to the main by opening the drain hole in the bottom of the cup. This allows the full flow of gases released during charging to pass into the GC main. At the end of coal charging, the oven pressure is maintained at the set point, albeit from a temporary overshoot of the controller.

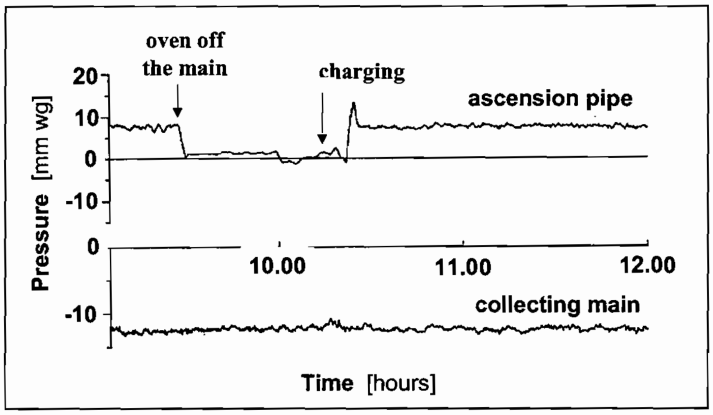


Fig. 9
Vacuum in Main Replaces Steam Ejection

It should also be noted that charging does not give rise to a pressure peak in the gas collecting main. This means that there are no pressure peaks in adjacent ovens.

Here one can see the possibilities for automated battery top operations: Table 2 shows how this might be achieved, with the computer initiating operation of the FixCup valve and ascension pipe lid once the pusher is in place. After the oven has been pushed and the charge car is ready to charge, the computer could then reverse the sequence of lid and FixCup operations and activate the pressure regulation system.

Aspiration no longer necessary
This leads to savings in terms of steam (or liquor), the infrastructure (boilers, pumps, pipework) and the maintenance which they require.

Automation
Enabling disconnection from and re-connection to the GC main.

Controlled double collecting main operation
Flow of gas in the oven space can be directed in a specified direction for a specified duration.

Reduced Gooseneck cleaning.

Improved Emission Control:
From doors and frames (especially when used with doors incorporating modern gas channels.
From leveler doors.
From charge hole lids and frames.
From ascension pipes.
From adjacent ovens when charging.

Table 2
Summary

When studying Fig 9, it must be remembered that the ascension pipe pressures were being measured as opposed to oven door pressures. The ovens in the test have traditional plug-type doors with virtually ineffective gas channels. A comparison of ascension pipe and door pressures, as given in Fig 10, shows the differences.

Here the collecting main was run at an essentially constant pressure. (The pressure spikes have been omitted for clarity.) For the first 12.5 hours the pressure control was turned off. During this period, the pressure at the ascension pipe is constant. At the oven sole, however, the pressure behind the door drops significantly from its initial pressure, when the rate of gas evolution is greatest. After half the cycle time the door pressure becomes negative, resulting in air ingress into the ovens. Once this condition had been reached, it was possible to adjust the set point to give zero pressure at the oven door, thus stopping air ingress. Unfortunately the ascension pipe pressure had risen to + 8 mm WG. At such a late point in the carbonisation of the coal, this does not give rise to emissions from oven tops and leveller doors. This would not be the case if the same set point had been applied at the start of carbonisation.

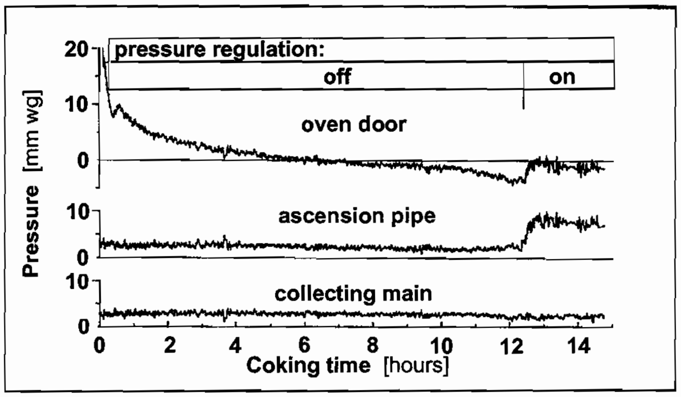


Fig. 10
Without and With Pressure Regulation

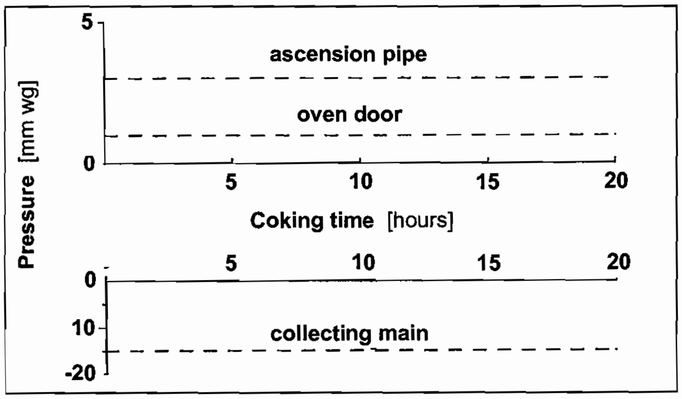


Fig. 11
Pressures Expected with Optimised Doors

Applying the same technology to ovens fitted with modern doors, incorporating full size gas channels, the full advantages of the system can be realised. In this case the pressures at the ascension pipe and behind the oven door are proportional to each other. This will enable the entire oven to be controlled at the optimum pressure as shown in Fig 11.

Further Developments of the FixCup Valve

Since carrying out the tests on Battery 3a, further developments have occurred. These are shown in the timeline given in Fig 12.

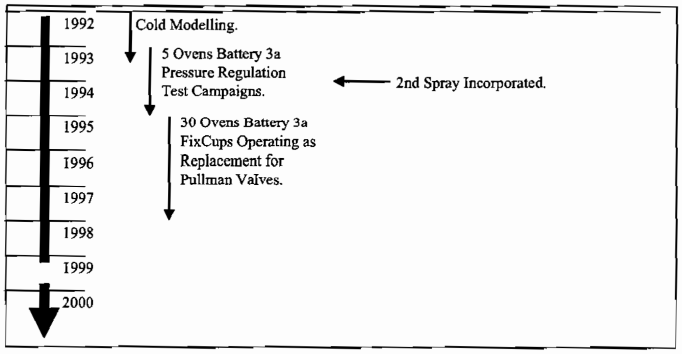


Fig. 12
PROven and FixCup Development on Battery No 3

Work on the system, which DMT call "PROven" (Pressure Regulated Oven), has taken the best part of 8 years, starting with cold modelling in 1992 and progressing through the Battery 3a tests up to 1995.

Following experience gained from the tests, Thyssen Stahl equipped all 30 ovens of their No 3a battery with FixCup valves. Although the valves were not integrated with a pressure regulation system, they still gave significant improvements to battery operation.

The conventional system used at August-Thyssen was susceptible to severe fouling: The liquor sprays would only keep a small part of the gooseneck clean, leaving a build-up of tarry material deposited around the periphery of spray contact area. Furthermore, the spray nozzle which projected about 10 cm into the gooseneck, being a cold unwetted surface, allowed tarry deposits to condense upon it. As the amount of deposits grew around the nozzle, the effective cone angle of the spray was reduced more and more, leading to more deposits and hence a restriction to the gas flow from the oven. Consequently the pressures would build up in the oven, leading to increased emission problems.

Continual operator intervention was required to keep the goosenecks clean. A difficult job in uncomfortable conditions. Without cleaning, the gooseneck would become plugged, inhibiting the operation of the Pullman valve and giving rise to significant operational problems. Frequently the deposit could not be removed in situ and it became necessary to exchange goosenecks. Fig 13 shows such a fouled gooseneck.

The new FixCup valves avoid the problems highlighted by providing a spray system which almost completely wets the entire gooseneck and avoids regions that are not flushed. This is achieved by incorporating two, rather than one spray nozzle. Fig 14 shows the condition of a gooseneck, fitted with SelfClean sprays, which hasn't been manually cleaned for 30 days.

The build-up of tar deposits was monitored for 6 months. Fig 15 shows a plot summarising these results. Installation of the FixCup has reduced cleaning frequency from daily to every 10 days.

On this battery, operation of the FixCup was simple. A lever located at the top of the oven was pulled down to close the drain hole. The seal took effect and the ascension pipe lid could be opened. The actions were reversed to put the oven back on the main.

This simple retrofit rectified the problems of blockages to the Pullman valve mechanisms and an improved liquor spray system ensured a much reduced rate of deposition.

In 1998 Battery 3 was, as a result of old age, shut down after some 40 years of service. August-Thyssen had achieved a notable level of success with the FixCup on this 4m battery and had already started a programme to incorporate it on their 6m batteries. Fig 12a shows that a scaled-up version was first fitted to 1 oven on Battery 6a in 1996 where it has since operated as a replacement for a Pullman valve

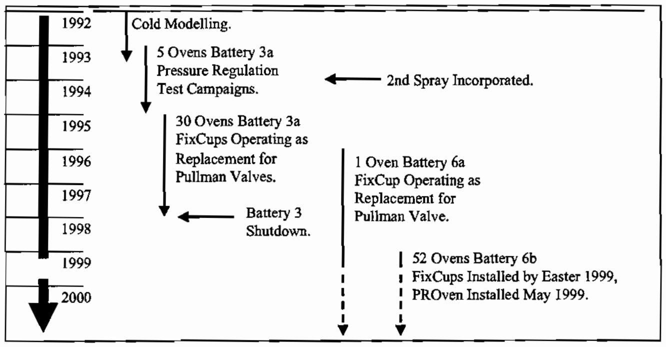


Fig. 12a
PROven and FixCup Development on Battery No 6

The confidence gained has resulted this year in equipping the 52 ovens of battery 6b with FixCups. The installation of the valves was completed just before Easter and August-Thyssen expects to have the complete PROven system installed by the end of May. DMT will carry out tests on the new installation as well as continuing with cold modelling at their laboratory.

Although DMT will need to perform a controlled study of gooseneck fouling, preliminary indications are that the cleaning frequency will be further reduced, beyond the 10-day interval experienced on battery 3.

DMT will also investigate other possible benefits of the PROven system including operation of water-sealed ascension pipe lids without water and chargehole lids without grouting.

These further tests will include studying outflow control as opposed to controlling the supply of liquor. This change in philosophy will allow the system to run continually with the full flowrate of flushing liquor which is expected to give benefits in terms of maximum gas cooling and maximum cup cleaning.

Fig. 13
Conventional Gooseneck Plugged by Tar

Fig. 14
Gooseneck Fitted with SelfClean Sprays after 30 Days
Without Any Cleaning

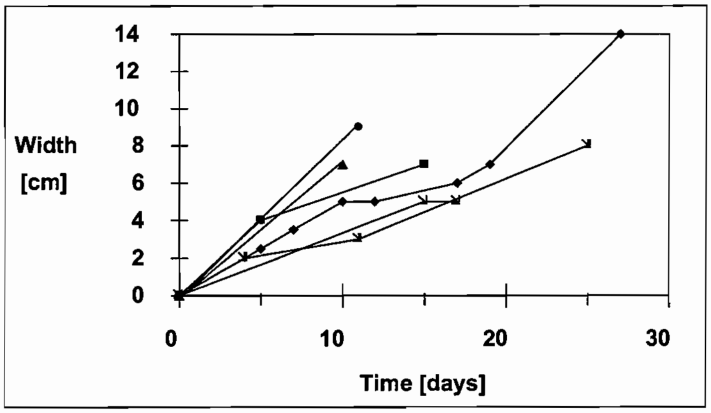


Fig. 15
Growth of Tar Deposits at Gooseneck Inlet

Although no trials on batteries with double collector mains have been proposed, they too may benefit from an automated system in which a FixCup is installed in each gooseneck. This is shown in Fig 16. At any one time during normal coking, one of the cups would remain filled with liquor for a given duration. This would force the gas across the oven to only one of the GC mains via the FixCup, providing pressure control for that oven. After the required period the roles of the FixCups for the oven in question could then be reversed to give gas flow in the opposite direction.

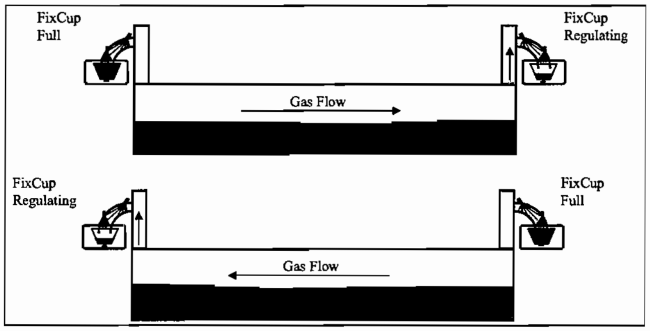


Fig. 16
Double Collector Main Operation

Conclusions

The experiments carried out at the August-Thyssen plant have demonstrated how oven chamber pressure control can be used to give constant oven pressures.

Operating such a system in conjunction with a gas collecting main under partial suction can keep oven pressures consistently at a minimum, virtually eliminating leakage emissions, whilst also avoiding air ingress into the ovens.

The potential improvements can be summarised in Table 2.

Above all, the system uses a robust and simple and proven concept to give significant emission control improvements, which in the future may come to be the norm; thus being regarded as meeting the Environment Inspector's criteria for "Best Available Techniques Not Entailing Excessive Cost" and "Best Practice Environmental Option".

References

1. Giertz J, Huhn F, Hofherr K.; "New Process to Avoid Emissions: Constant Pressure in Coke Ovens" (AIME Ironmaking Conference, 1995).
2. Giertz J, Huhn F, Spitz J.; "Operational Experience Using the Novel FixCup Collecting Main Valve" (AIME Ironmaking Conference, 1996).
3. Spitz J, Hofherr K, Giertz J, Huhn F.; "Negative Pressure Within The Collecting Main - A New Way to Reduce Coke Oven Emissions by Means of a Novel Chamber Pressure Regulation" (International Cokemaking Congress, 1996).

Reduction of Emissions during Coking
Application of PROven® for Conventional Coking – an Alternative to Heat Recovery Coking ?

Martin Reinke, Rainer Worberg
Uhde GmbH
Friedrich Uhde Strasse 15
D-44141 Dortmund, Germany
Tel: +49 231 547 2810
Fax: +49 231 547 2070
E-mail: Martin.Reinke@thyssenkrupp.com

Key words: Coke ovens, Emissions, Environmental, Pressure control, Gas collecting main

INTRODUCTION

For the conventional coking process, typical emissions during pushing, quenching and at the chimney stack are reduced by means of well known practices such as the installation of PEC-systems, improved quench tower arrangements and low NOx combustion systems and desulfurization processes for COG and BF-gas. In some cases the strict regulations, which have been promulgated by the EPA with regard to diffuse emissions at chamber closures and during charging, may not be fulfilled. Especially with regard to diffuse emissions at doors and charging holes the Non- respectively Heat Recovery Coking System has been developed and established and at least acknowledged by the EPA as an environmentally friendly coking system.

At some locations, especially in integrated iron and steel works, the compound operation between conventional by-product coking plants, blast furnaces and downstream steel production facilities provides great advantage in terms of energy savings, since the surplus gases from the BOF, BF and coking plant can be utilized in most cases without any need for further gas imports. To maintain this advantage while fulfilling the stringent environmental regulations, the application of the PROven® - System to conventional coking plants represents a serious alternative.

BASIC PROCESS PARAMETERS OF PROVEN®

To describe the PROven® process, which stands for **P**ressure **R**egulated **O**ven for each individual oven chamber, a comparison with the conventional coking will be made, see Figure 1. As demonstrated, one of the main differences between coking with PROven® and conventional operation is the pressure level in the collecting main, showing values of approximately +14 mm WG for the conventional system and – 30 mm WG for operation with the new system.

In conventionally operated coke oven batteries, the pressure inside each oven chamber of a battery changes individually during coking. Pressure values in Figure 1 refer to measurements at the foot of the door. The pressure condition at this point is of high importance, since positive values must be maintained to the end of the coking period to avoid air ingress into the oven chambers. Air drawn into the oven chamber would otherwise result in combustion of carbonaceous material and overheating of the oven refractory.

As is well known, a pressure peak occurs during and immediately after charging, as the highest amount of raw gas is generated in the early stages of the carbonization time, creating a higher potential for emissions during these periods. By applying the PROven® - system the pressure in each oven chamber, and of course also at the foot of each door, shows almost constant and always positive values at a low level throughput the entire coking period. This pressure behavior results in emission-free operation for the oven doors, charging holes and standpipes during the whole coking process.

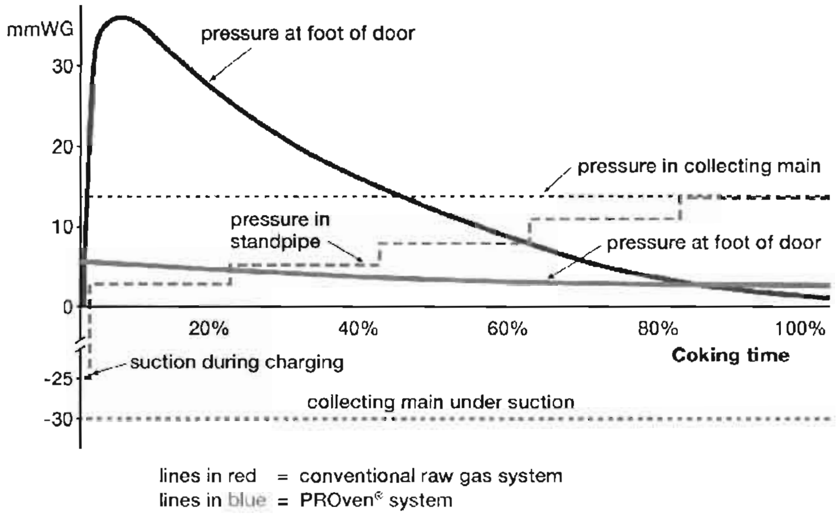


Figure 1: Comparison of conventional raw gas system and PROven®

Figure 1 provides further information, referred to as "pressure in standpipe" which relates to the function of PROven® . This value represents the set-point for the pressure control of the system. As can be seen, this set-point shows a stepwise increase during coking. The reason for this increase of set-pressure in the standpipe is a decrease of the flow resistance of the coke cake towards the end of the coking period. If the pressure at the standpipe, which represents the nearest point to the oven charge, were maintained at the low level required at the beginning of coking, a negative pressure would then result at the foot of the oven door at the end of the coking period. This would create undesired air ingress into the oven chamber. During charging the full suction in the collection main is available for emission-free operation.

DESIGN AND FUNCTION OF PROVEN®

As previously mentioned, the basic principle of the PROven® system is to operate the gas collecting main under suction approximately –30 mm WG and to install pressure controllers for each single oven. In Figures 2 to 5 the schematic arrangement and function of these pressure controllers is illustrated in their different states of operation.

The PROven® arrangement mainly consists of:

- The crown tube, being a pipe with calibrated slots cut into its end, fitted to the downstream end of the standpipe elbow.
- The FixCup which is a conical shaped vessel with a drain hole at its bottom, being suspended inside of the gas collecting main. The water level in the FixCup is used for partly or completely closing the slots at the end of the crown tube.
- The overflow regulation device, comprising of the regulation part for the water level and the plug for the drain hole in the FixCup. This device is actuated by a pneumatic cylinder.
- The pressure controller, taking a pressure measurement in the standpipe elbow and, by a control valve, controlling the position of the pneumatic cylinder for the actuation of the overflow regulation device.
- The fast flooding pipe which supplies ammonia liquor to quickly fill the FixCup to allow the oven to be disconnected from the gas collecting main.

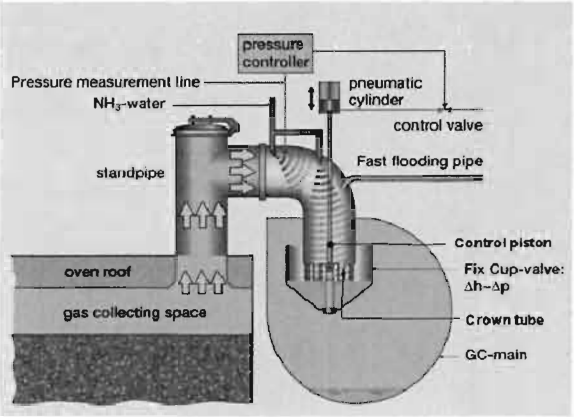


Figure 2: Schematic arrangement of PROven®

During charging of an oven, the overflow regulation device including the plug is lifted to its uppermost position. The FixCup is drained completely and the raw gas can flow undisturbed into the Gas collecting main. In this position the full suction of the gas collecting main is available in the standpipe elbow, providing for a perfect discharge of the large initial gas amounts during charging. Oven aspiration by high pressure water or steam injection is not required.

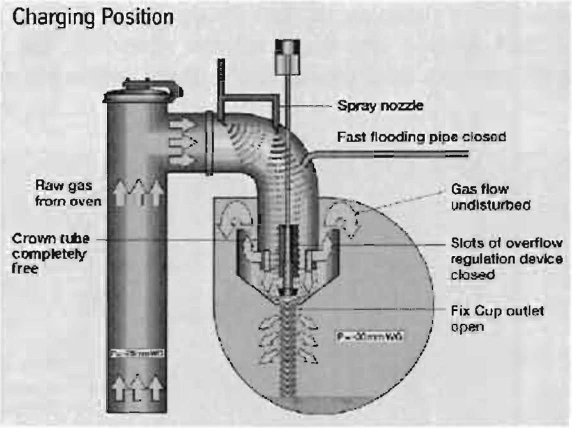


Figure 3: Oven connected for charging

After charging the overflow regulation device is lowered, closing the drain hole of the FixCup by the plug. The ammonia liquor sprayed into the standpipe elbow is collected in the FixCup and the water level slowly rises up to the overflow level adjusted by the overflow regulation device. In this control position, the slots of the crown tube are partly immersed into the water, reducing the free space through which the raw gas can be drawn into the gas collecting main. With rising water level the free space is reduced, while by lowering the water level the free space is increased. The pressure controller constantly compares the actual pressure in the standpipe elbow with the desired set point, regulating the water level in the FixCup via the control valve, pneumatic cylinder and overflow regulation device accordingly.

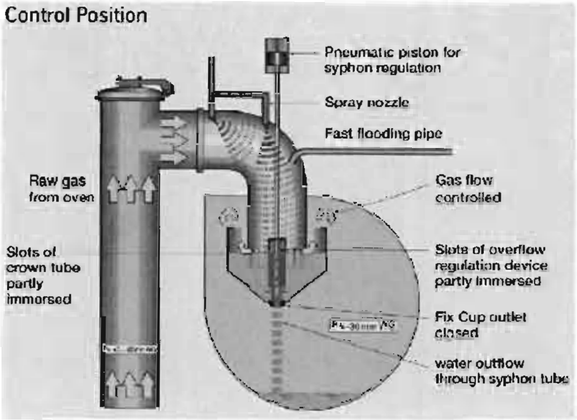


Figure 4: Control position of the PROVen® system

When the coal in an oven chamber is fully carbonized and there is no further raw gas produced, which is indicated by the position of the actuator for the overflow regulation device, the slots in the overflow regulation device are completely closed, effecting a further rise of the water level until the water is overflowing at the top level of the FixCup. By the rising water level, the slots in the crown tube are flooded completely, disconnecting the oven from the gas collecting main.

In order to shorten the time for the disconnection of the oven, the fast flooding pipe is opened to supply ammonia liquor for filling of the FixCup in addition to the flow of liquor sprayed into the standpipe elbow. At the same time, the standpipe lid is opened automatically by a pneumatic cylinder which will then close the lid after pushing, before the next coal charge.

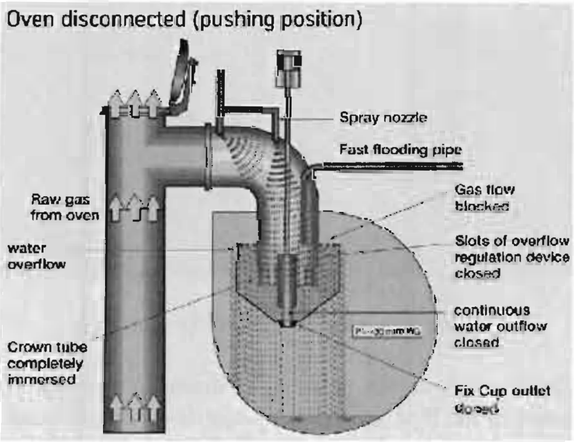


Figure 5: Oven disconnected from the gas collecting main

OPERATIONAL EXPERIENCE

The two batteries of the new Schwelgern coking plant have been operated using the PROven® - system since commissioning in March 2003. Based on satisfactory results gained from earlier investigations and development work at an old battery of the August Thyssen coking plant, the decision was made to completely forego additional emission control devices such as U-tubes, jumper pipes, high pressure flushing liquor aspiration or steam injection for the new batteries at Schwelgern. The charging process is carried out with almost zero emissions and the battery front on PS and CS as well as all charging holes and standpipes do not show any raw gas leakage.

The ability of PROven® to reduce emissions has also been proven by measurements during which PAH – concentrations have been determined. The measurements were taken on the pusher side and on the coke side of the battery, in the periods 0 to 2 hours and 2 to 5 hours after coal charging. The result, which is displayed in Figure 6, shows a reduction of the PAH-emissions of approximately 70%.

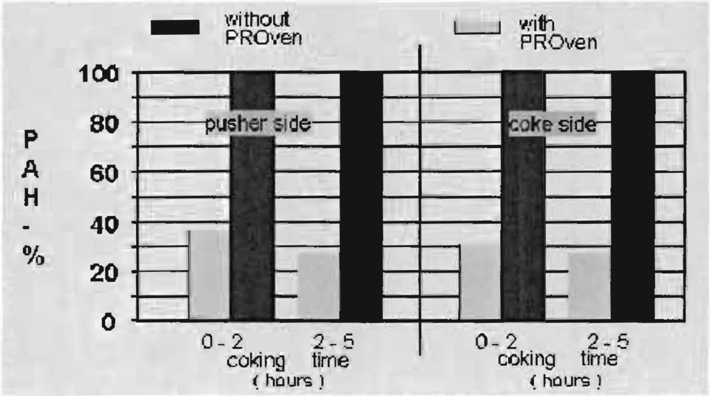


Figure 6: Measured PAH-concentrations with and without PROven®

A further advantage created by the operation of the new system should be mentioned. Due to the individual control of the oven pressure, no excessive suction is created in the goosenecks and standpipes. This results in a tremendous reduction of carry over of coal during charging and therefore improves the tar quality. The raw tar from the decanters contains approximately 50% fewer particles in comparison to other plants.

For safety reasons, for example in case of exhauster malfunction, the collecting main pressure is automatically adjusted to positive pressure values when actuating the bleeders at the battery.

INSTALLATION OF PROVEN® ON EXISTING BATTERIES

As mentioned above, the PROven® system has been installed for testing purposes on an old battery of ThyssenKrupp Steel, a fact which proves generally that this type of retrofit is possible. Recently a contract was placed for the installation of PROven® at one coke plant in Brazil. In total three batteries with a total of 147 ovens will be equipped with PROven® in connection with the renewal of goose necks at the standpipes. The installation will be carried out oven by oven, anticipating normal positive pressure operation of the collecting mains initially. After total completion of the installation work the system will be switched over to negative pressure values in the collecting main and full PROven® system operation. In the case of retrofit installations of the system at old batteries one additional important advantage has to be mentioned. Raw gas leakage from the oven chambers into the heating flues, creating visible grey plumes at the chimney stack after charging will be minimised due to the reduced chamber pressure from the very beginning of the coking period. Apart from improved environmental aspects this operating condition will reduce the amount of damage to the refractory material.

ACCEPTANCE OF PROVEN® BY ENVIRONMENTAL AUTHORITIES

In the USA, the EPA has acknowleged the PROven® System for the pad-up-rebuild of the former LTV (now Beemsterboer) 6 meter battery in South Chicago. In Germany new batteries will be granted an operating permit only if they are equipped with PROven®, and a comparable development may be expected for Europe 25.

SUMMARY AND OUTLOOK

The experiences collected during the trial phase and actual operation of the PROven® system prove that the following advantages are provided by the system:

- Reduction and precise, automatic control of the pressure in each single oven chamber according to the varying amounts of raw gas evolved during the carbonization time.
- Substantial reduction of emissions at all oven closures
- Avoidance of the use of mini standpipes or jumper pipes during coal charging
- Avoidance of high pressure water or steam injection due to the operation of the gas collecting main under pressure.
- The PROven® system can also be retrofitted at existing plants, as demonstrated at an old battery of the August Thyssen coke plant .

Clearly the above-mentioned advantages are very convincing. In total six new PROven® - equipped batteries have been ordered including one in South Korea for POSCO, four in Mainland China and one in Germany. Further batteries are under negotiation including one for a German coke plant.

CONCEPT AND ERECTION OF THE SCHWELGERN COKING PLANT

By

Dr.-Ing. Rainer Worberg
&
Dipl.-Ing. Peter Liszio

Presented to the Midland Section on 21 March 2002
at the Corus Conference Centre, Scunthorpe

Industrial Concept of Thyssen Krupp Stahl AG and the Coke Supply

After the merger of Thyssen Stahl AG, Duisburg, and Krupp-Hoesch Stahl AG, Dortmund, to form Thyssen Krupp Stahl AG (TKS), the industrial concept of the new company was to concentrate the hot metal production in Duisburg at the Rhine river and to shut down the blast furnaces in the Dortmund location.

According to this concept, the four blast furnaces in Duisburg will produce approx. 11.4 million mt of hot metal per year. For this production about 3.8 million mt/a blast furnace coke is required.

As you know, apart from playing the role of reducing agent in the blast furnace, coke has to fulfil other functions which are important for the stability of the blast furnace operation. Owing to its lump shape, it ensures a high voidage over the whole furnace height, a function which is essential for the gas permeability which influences the processes in the different zones of the blast furnace.

For dimensional reasons, the coke used in TKS's large blast furnaces in Schwelgern is subjected to the pressure of a burden column, which is 4 to 5m higher than in the smaller blast furnaces in Hamborn. Fig.1 illustrates the blast furnace outlines and their main dimensional differences.

If the necessary voidage is to be maintained under that enhanced pressure, the coke has to meet higher quality standards in terms of cold and hot strength (I_{40} values; CSR values) and also in terms of homogeneity and size distribution.

Dr-Jng Rainer Worberg – ThyssenKrupp EnCoke GmbH, Bochum, Germany
Dipl-Jng Peter Liszio – Thyssen Krupp Stahl AG, Duisburg, Germany

It is known from operational experience that a 5% reduction in the CSR value of the coke results in around 5% reduction in hot metal production in the blast furnaces. In Duisberg this would translate to a loss of around 600,000mt/a on the targeted hot metal production of 11.4 million mt/a.

Accordingly high coke quality for the big blast furnaces is very important.

In the past, the coke demand at Duisberg has been satisfied by the production from the coking plant August Thyssen with some additional quantities of coke purchased from DSK (former Ruhrkohle) coking plants.

Coke Supply from the Coking Plant August Thyssen

Since 1896, blast furnace coke has been produced by the coking plant August Thyssen in Duisburg-Bruckhausen for the nearby blast furnaces. The layout and configuration of the existing plant is more or less as it was in 1937 when the plant was conceived. In the years 1972 and 1974, the 6m-batteries VIa and VIb were put into operation.

When the battery II was rebuilt in 1983, the authorities set the permit for coking coal throughput to 10,600 mt of coal (wet)/d which corresponds to an annual coke production of 2.5 million mt.

Since that time, six coke oven batteries with a total of 354 ovens of different dimensions were operated at the coking plant August Thyssen. Up to 530 ovens per day were pushed by five operating teams.

From 1983 to date, there has been no major capital investment or “state of the art developments” at the coking plant August Thyssen, although the demands placed on coke quality have been increasing at the blast furnaces 1 and 2 in Schwelgern.

Due to the high age of the coke oven batteries, the coke production has steadily dropped to below 2 million mt/a since the beginning of the nineties.

In addition emission problems became increasingly hard to manage, especially at the batteries I, III and IV, all of which dated from the Fifties. Finally, this resulted in the shutdown of the batteries in 1998/99. The remaining part of the coking plant which was left after those shutdowns, produces 1.2 million mt of blast furnace coke per year with the battery units II and VIa and VIb operated by two operating teams. On the basis of economic and environmental considerations, the management of TKS decided that the service life of the remaining coking plant would end in the year 2005.

When it came to deciding upon the future strategic coke supply for the TKS blast furnaces, the capacity and the limited residual service life of TKS's own coking plant gave rise to an intensive analysis of the national and the international coke markets.

National and International Coke Supply

Traditionally, TKS's remaining requirements of blast furnace coke could be fully covered by the Ruhrkohle AG from the production of the coking plants Kaiserstuhl and Prosper. These two coking plants also supplied the blast furnaces of Hüttenwerke Krupp Mannesmann (HKM) and Stahlwerke Bremen. The coking plant Prosper whose large-capacity batteries dated from 1985 and 1989 was granted the long-term prospect of staying in operation up to 2010.

On the other hand, the coking plant Kaiserstuhl which was put into operation in 1992 as the world's most modern plant, promised to ensure a strategically secured coke supply. This coking plant is, however, 80 km away from the Duisburg metallurgical plants, would have to be supplied in the long run with imported coal by rail and had lost the advantages of the energy linkage with the metallurgical plant in Dortmund since the hot metal facilities had been shut down. In 2000, the coking plant Kaiserstuhl was shut down.

Against this background, it would no longer have been possible to source TKS's coke demand of 3.8 million mt/a from German coking plants in the long term after the shutdown of the coking plant August Thyssen. Consequently, coke would have to be sourced from the world market.

In the process of deciding upon the new construction of a coking plant, TKS undertook a detailed evaluation of the international coke trade market.

To summarise the study:

Poland

Based on TKS's experiences from the current five-year contract with Polski Koks covering about 1 million mt of blast furnace coke per year, the qualities are sufficiently known. The cold and hot strengths required by TKS cannot be furnished from those coking plants, so that the Polish coke can be used exclusively by TKS's smaller blast furnaces.

Japan

The Japanese supply is to a high degree dependent on the domestic economic situation in Japan. As a consequence of the Japanese blast furnace philosophy, the quality of the freely available coke is below the quality standards fixed by TKS. From a strategic standpoint Japanese coke imports are considered as high risk.

China

The Chinese commercial coke qualities are extremely variable. Because of the nature and location of their coal reserves, the Chinese are in a good position to produce coke in horizontal chamber ovens, coke which meets high quality standards in terms of CSR and I_{40}. However, the coke often has high ash contents and also tends to have high water contents because of poor transport and intermediate storage facilities.

Since the Chinese intend to strengthen their position in the international coke market, an increase of the supply quantity and quality is to be expected. On the other hand, however, the Chinese will increase their own hot metal production, thereby consuming more high quality coke. For this reason it is difficult to foresee what commercial quantities of good blast furnace coke will be available from China in the long term.

Importance of the Energy Balance within the Integrated Steelworks

A very important additional factor has to be considered; the energy link between the coke plant and the steelworks. Exclusive sourcing of coke from external suppliers would mean abandoning the energy linkage between coke production and the integrated metallurgical plant in Duisburg.

The fully integrated TKS iron and steel works in Duisburg purchases the following energy sources from outside suppliers (Fig.2):

- Coking coal for TKS's own coking plant and coke, respectively
- Injection coal
- Natural gas
- Electric power

As all production processes are optimised, the energy required for the operation of the production plants is utilised in the best possible way. Coking coal, injection coal and purchased coke do not only deliver the process heat for the production of coke in TKS's own coking plant and, respectively, of hot metal and steel at the blast furnace and in the oxygen steel mill, but also other energy carriers which can be used in other production stages. Ideally, an integrated iron and steel works could almost work independently, except for the purchase of coal.

The gaseous products of coke oven gas, top gas and converter gas which are produced in the individual process stages in the metallurgical plant are exchanged between the individual production stages and economically utilised in the best possible way. Any surplus gas from the metallurgical plant is used in TKS's own power stations for process steam generation and for conversion into electric power.

Operation without a coking plant would mean operation without a centralised "energy transformer" able to "transform" the low-caloric mixture of blast furnace and converter gas into a high-caloric coke oven gas, which in its turn replaces natural gas which would have to be purchased from outside suppliers.

If the coke demand of the iron and steel works were completely sourced from outside, the natural gas purchases of TKS would double and the power purchase would increase by one fifth.

For TKS, the energy balance within the steelworks and the contribution of the coke plant was a major issue in determining the strategy for coke production at Schwelgern.

Coking Plant Schwelgern

Only by operating a company-owned coking plant with an upstream coal blending capability and access to the low cost overseas coking coal market it is possible to influence in the long-term the coke quantity available to the blast furnace on a day to day basis.

Only the operating of a company-owned coking plant offers this possibility – via the purchase of the required coking coals – of a strategic procurement of coke qualities for the blast furnace operation.

Only a coking plant which is linked to the iron and steel works can ultimately safeguard the energy balance which is valuable both to the coking plant and to the iron and steel works, and thereby safeguard against changes in the energy market.

Against this background, the task was to design a new coking plant according to the latest state of the art and, above all, to the most recent environmental regulations, which offers not only the above-mentioned strategic advantages, but also optimum profitability for the company.

The Site of the New Coking Plant

In the TKS-owned Rhine port Schwelgern, a peninsular of about 30 ha would be an appropriate site for the new coking plant. The direct position on the river permits to ship the imported coal at low cost on the Rhine from Dutch Sea ports. The proximity to the large blast furnaces Schwelgern 1 and 2 as well as to the sinter plant permit to produce hot metal in the Schwelgern works according to update standards (Fig.3).

While the coking plant August Thyssen had sourced German and international coking coals by rail, coking coals can be transported to Schwelgern either by rail or by ship. Coke and coke breeze are transported to the blast furnaces and to the sinter plant in Schwelgern by belt conveyors; they can also be transported by rail, if required for security reasons.

At this point, the Schwelgern coking plant has considerable cost advantages as compared with the coking plant August Thyssen where not only the coal transport, but also the coke transport was burdened by the handling costs of rail transport.

Fundamental Environmental Aspects

The coke oven batteries of the coking plant August Thyssen are only about 200m away from the neighbourhood Duisburg-Bruckhausen. The increasing age of the batteries – three of the six batteries date from the Fifties – led to emission problems, which became more and more hard to manage.

An essential advantage of the new coking plant in the Schwelgern port is the distance of 1200m to the nearest residential area. This distance will secure the new coking plant against tightening emission limits for the next decades, and thus represents a considerable locational advantage.

Because of the intense ecopolitical discussion about the coking plant August Thyssen, Thyssen Stahl AG applied for a coking coal throughput of 10,600 mt_{wet}/d for the coking plant in Schwelgern in 1994. This throughput corresponds exactly to what was authorised in 1982 for the coking plant August Thyssen. The notice of permit effective August 16, 1999, authorises the construction of the most modern coking plant in the world, which meets all German environmental protection standards in terms of air, soil and water.

Coke Oven Design of the Coking Plant Schwelgern

The design of the coke oven had to take into account that the coking coal throughput of 10,600 mt_{wet}/d had to be operated by only one operating team. Discussion with TKEC resulted in the consensus that this could be realised with one machine set and with 135 oven cycles per day.

On the basis of this key data, a useful oven volume of 93 m^3 was calculated, assuming a filling weight of about 79 mt per oven and an expected bulk density of 845 kg_{wet}/m^3. The chamber width was fixed to 590 mm, so as to be able to push fully carbonised coke at a medium flue temperature of 1,320 °C after 24.9 hrs. The temperature measured in the flue at the nozzle brick – especially in case of mixed gas underfiring, which is intended to be used in 95% of the annual availability, allow low NO_x values in the exhaust gas.

The oven length with a taper of 50mm was fixed to 20.8m. The useful oven length of 20m is thus 2m longer than the hitherto longest oven at the coking plant Kaiserstuhl. The useful oven height of 7,880m is 450mm higher than the hitherto highest oven at HKM's coking plant in Huckingen. The comparison with large-compartment batteries of other companies shows that the oven dimension concept of the coking plant Schwelgern was developed very carefully (Table 1).

For lack of other criteria to evaluate the security and the stability of the ovens, reference was made to the SUGA value. For the ovens built in the past, these values are given in Table 2. The ovens of the coking plant Schwelgern has to have the same stability as the ovens of the coking plant Kaiserstuhl. The stability is attained by the greater oven-distance from centre to centre, a greater heating wall width, a stronger binder brick and by a somewhat deeper oven roof. The gun fired regenerative double staged twin flue compound oven is at present the latest state of the art in coke oven construction (Figure 4).

Environment Protection Measures

While at the coking plant August Thyssen, more than 700 coke oven doors with a sealing length of almost 7,500m and over 1,500 charging holes had to be sealed, the Schwelgern coking plant only has 280 coke oven doors with just over 5,000m sealing length and 560 charging holes (Table 3).

The Pressure Regulated Oven System (PROven) which has been developed at the coking plant August Thyssen and to be used at the coking plant Schwelgern has particular importance with a view to environment protection, since it facilitates a substantial reduction in battery emissions. The classic Pullman valve is replaced by the fix cup (Fig.5) developed by Deutsche Montan Technologie (DMT), Essen, in conjunction with the coking plant August Thyssen. This fix cup with an adjustable water level effectively decouples the pressure of each oven of a battery from that of the gas collecting main. In this process, the gas collecting main is operated at negative pressure so that the ovens can be charged without the necessity to use high-pressure water. This process employed at the battery VIb of the coking plant August Thyssen to large technical scale led to measurable improvements in terms of emissions (Fig.6). Visible emissions are completely avoided.

The sealing systems at the coke oven doors has been further improved.

The original permit for the Schwelgern coking plant covers the operation of two coke dry quenching plants with a throughput of 170 mt/h each, as well as of an emergency quenching tower.

Based on the good experiences gathered at HKM's coking plant in Huckingen where the wet quenching system of TKEC is used, the sump quenching process was further developed with the focus not only on the reduction of emissions of hydrogen sulphide and carbon monoxide, but particularly on the reduction of dusty emissions.

The further developed CSQ process (Coke Stabilisation Quenching) is the process engineering combination of a one-point quenching car with sump and top quenching as well as an enlarged quenching tower with two built-in emission protection devices and other scrubbing stages for dust removal (Fig.7).

The revised permit was given at the beginning of March this year

The gas treatment and the coal by-products recovery plants are located on the side of the coke plant facing the Rhine. The raw gas coming from the batteries (Fig.8) is cooled in two precooling groups. In downstream electro filters, the tar mist is removed, and the gas supplied by the batteries is compressed and conducted to the gas scrubber. The gas condensates are fed into the condenser plant, the crude tar is recuperated in the tar extractor. The coke oven gas is conventionally purified in the hydrogen sulphide (H_2S) and in the ammonia (NH_3) scrubber, respectively, with wash water. As washing solution, ammonia water is used, which is extracted from the coke oven gas. The absorption of the gas in the aqueous phase takes place in two absorption columns. The enriched washing water is distilled in the desorption plant. The enriched exhaust vapours from the distillation are conducted to the Claus plants where the hydrogen sulphide is converted into sulphur, and the residual gas is fed into the crude gas supply network of the coke plant.

The H_2S/NH_3-scrubbers are followed by benzene scrubbers. The scrubbing oil of the benzene scrubber which is loaded with benzene and its homologues, is treated in the benzene desorption plant, the cooled scrubbing oil is reconducted to the scrubber, and the crude benzene is intermediately stored in the tank farm. The purified coke gas flow of 155,000 m^3_n/h is fed into the gas supply network of the steelworks at a pressure of 125 mbar.

Personnel

In case of full use of the capacity of all six coke oven batteries, the coking plant August Thyssen needed in total five machine teams for battery operation. In total, 755 persons, including the white-collar workers, were employed at the coking plant before the shutdown measures in 1998.

In planning the coking plant Schwelgern, the rationalisation potential in terms of staff played an essential role. At the coking plant Schwelgern where only one operating team is needed for the battery handling, less than 400 persons will be employed (Fig.9).

Financing

The Schwelgern coking plant comprises an operative investment volume of about Euro 700 million. The supervisory board of ThyssenKrupp AG has decided on the grounds of strategic considerations to finance this coking plant completely "off balance sheet" within the scope of a so-called BOO-Model. This complex arrangement is described in Fig.10. The leasing subsidiaries of a consortium of banks founded a possessor company, the "Carbonaria" which leased the TKS estate in the Schwelgern port and will build the coking plant there.

Within the scope of a construction attendance contract, the building of this plant is the duty of TKS, which works on behalf and on account of Carbonaria. The company ThyssenKrupp EnCoke provides the engineering. Procurement and installation of the plant is undertaken exclusively by TKS as the construction attendance company. Lessee and operator of this coking plant is the company "PRUNA" which will supply the TKS blast furnaces with coke within the scope of a long-term coke supply contract. The management of the coking plant is provided by Kokereibetriebsgesellschaft Schwelgern mbH (KBS) which will also be the employer of the former personnel of the coking plant August Thyssen. The shares of "PRUNA" will be held by the leasing companies, while the Kokereibetriebsgesellschaft Schwelgern mbH is a wholly owned subsidiary of TKS.

Summary

Since the remaining lifetime of the coking plant August Thyssen is limited to the year 2005 for technical reasons, TKS had to take a strategic decision as to the medium and long-term coke supply of the blast furnaces.

An extensive feasibility study revealed that the most cost effective way forward for TKS is offered by the construction of the new coking plant Schwelgern, as compared with the procurement of coke from external sources, even though the construction of the new coking plant will involve a capital investment of Euro 700 million.

In order to underpin the hot metal production in Duisburg, the coking plant Schwelgern will produce 2.5 million mt/a of high-quality blast furnace coke, with a maximum degree of rationalisation and a minimum technical risk.

As a consequence of its geographic location and state-of-the-art environmental protection technology, the coking plant Schwelgern will facilitate the long-term production of coke on the Duisburg site.

The Project will be financed for TKS "off balance sheet" within the scope of a complex financing model on the basis of a long-term coke supply contract and via a leasing structure, and run by a plant management company which will at the same time be the future employer for the personnel of the coking plant August Thyssen.

The construction of the coke plant started on March 30, 2000. After a sludge pit dating back to the fifties had been removed and seven 250-kg bombs from World War II had been unearthed, the cornerstone ceremony was celebrated on July 26, 2000. Battery 2 and 1 are scheduled to be commissioned in March and June 2003 respectively.

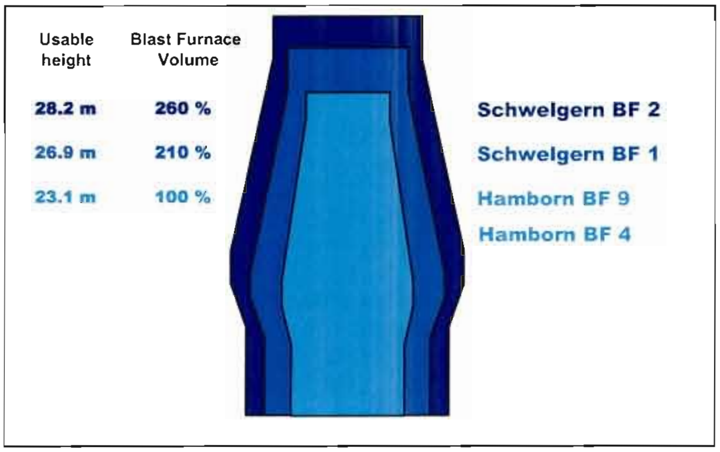


Fig. 1
Profiles of the Blast Furnace

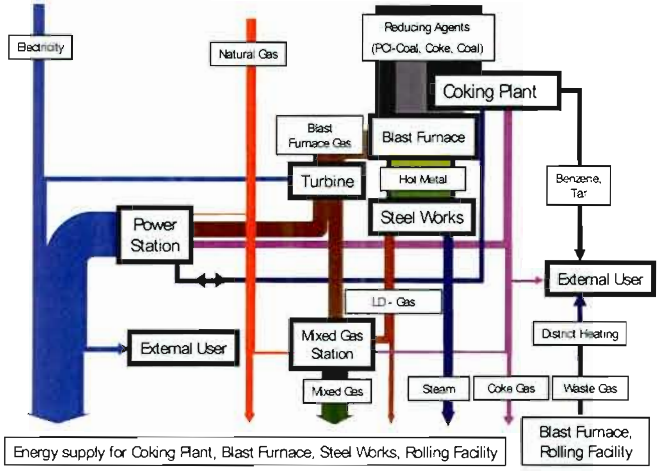


Fig. 2
Modern Integrated Energy Balance within an
Integrated Iron and Steel Works

Fig. 3
Situation of the new Coking Plant Schwelgern

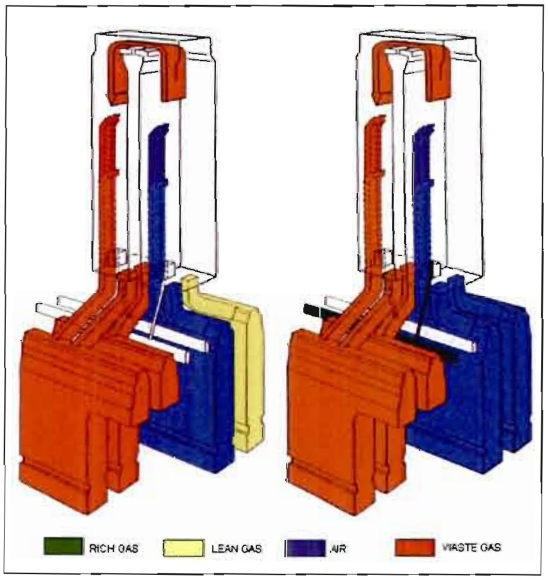


Fig. 4
Heating Unit

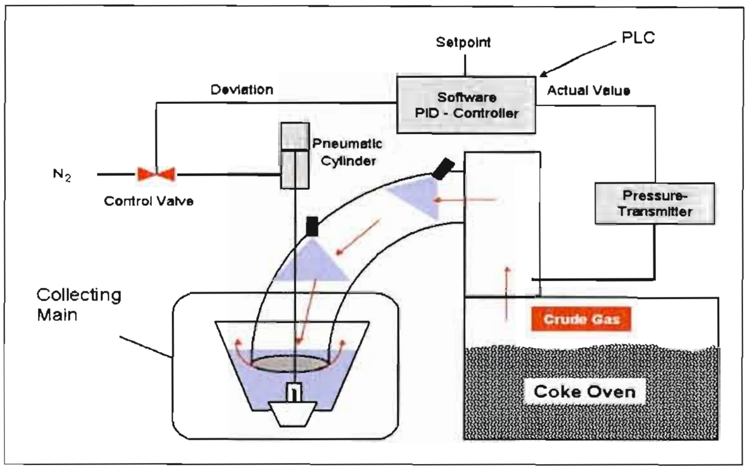


Fig. 5
Function Mode of the Single Chamber Pressure Control

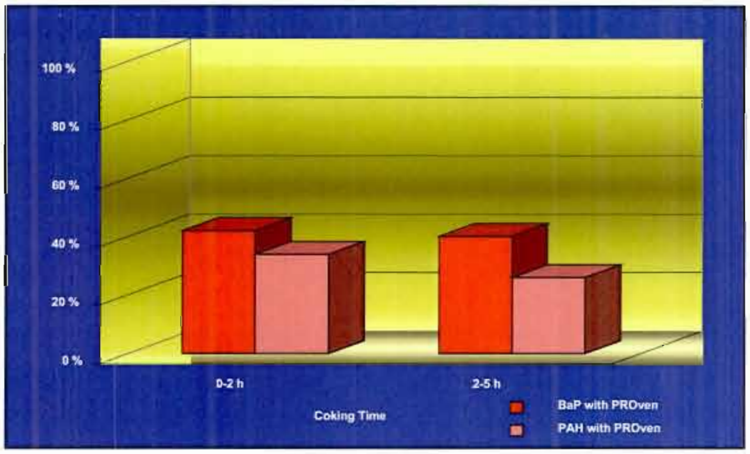


Fig. 6
PAK – resp. BaP-Emissions with and without PROven

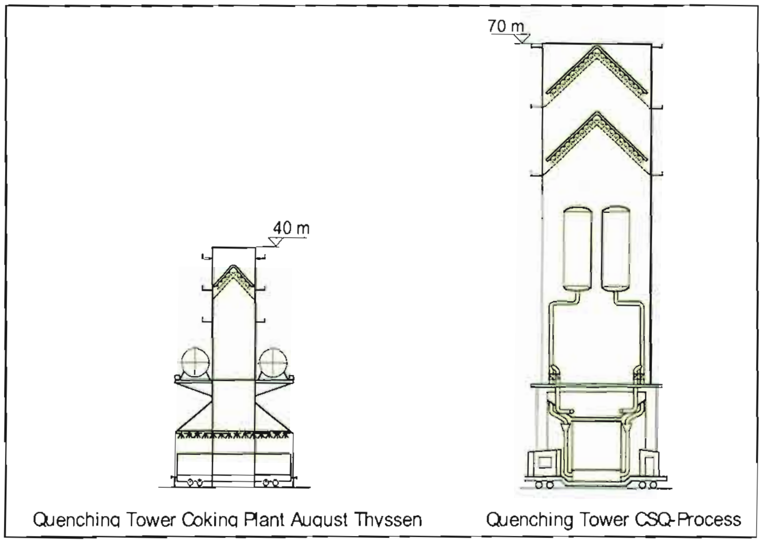


Fig. 7
Comparison of Quenching Towers

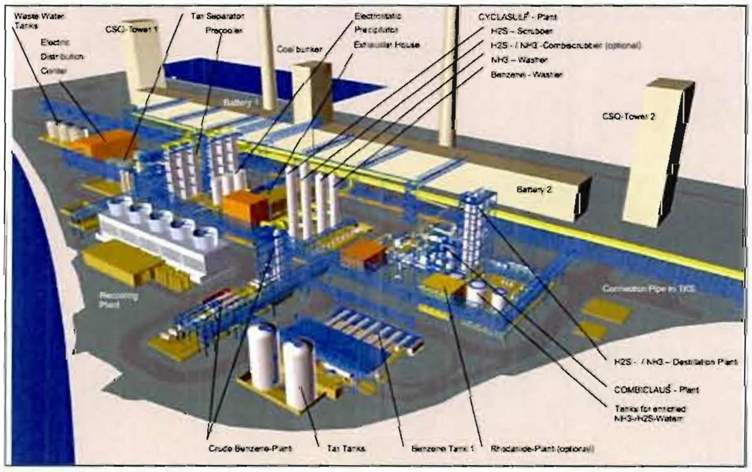


Fig. 8
Gas Treatment Plant

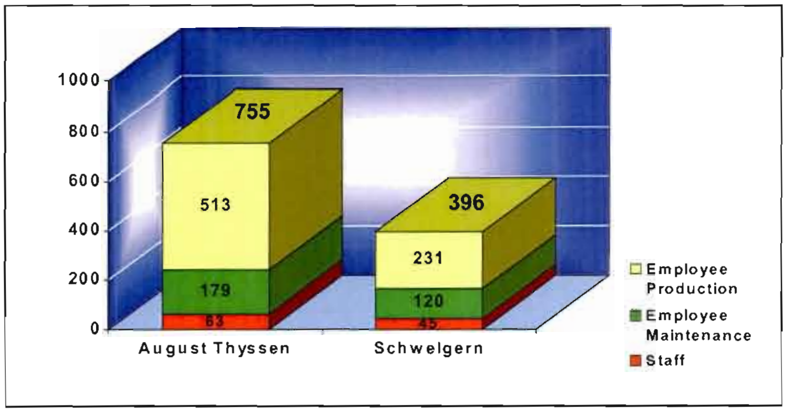


Fig. 9
Comparison of the Staff between the Coking Plants
August Thyssen and Schwelgern

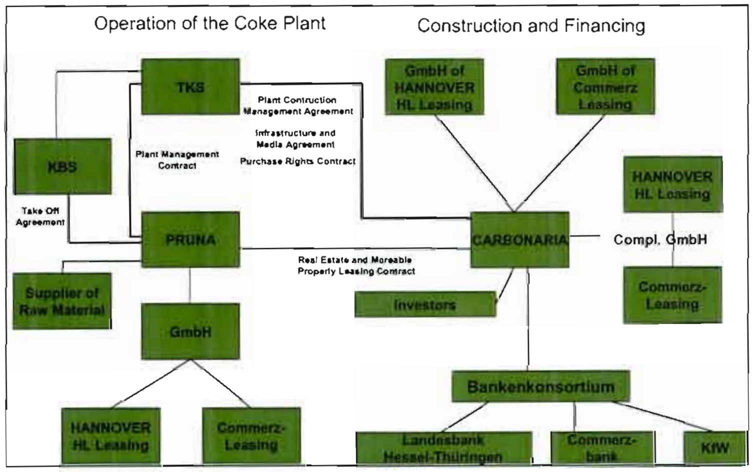
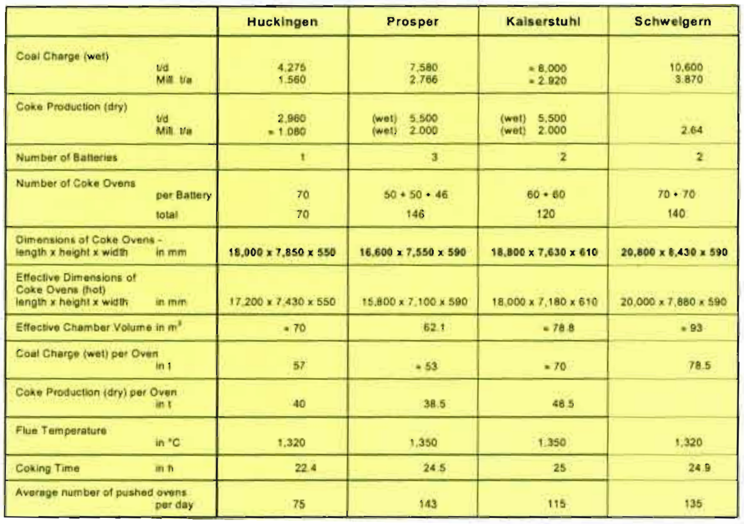
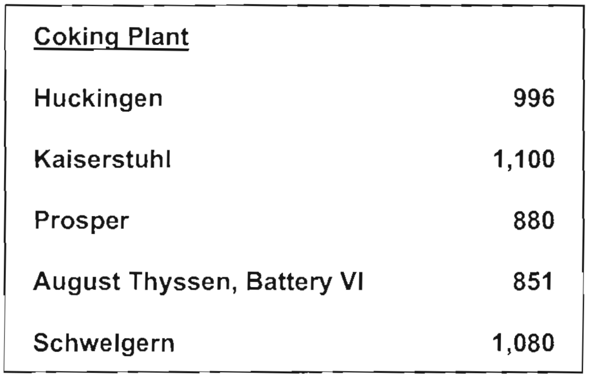


Fig. 10
Concept and Erection of the Schwelgern Coking Plant



		Huckingen	Prosper	Kaiserstuhl	Schwelgern
Coal Charge (wet)	t/d	4,275	7,580	≈ 8,000	10,600
	Mill. t/a	1.560	2.766	≈ 2.920	3.870
Coke Production (dry)	t/d	2,960	(wet) 5,500	(wet) 5,500	
	Mill. t/a	≈ 1.080	(wet) 2.000	(wet) 2.000	2.64
Number of Batteries		1	3	2	2
Number of Coke Ovens	per Battery	70	50 + 50 + 46	60 + 60	70 + 70
	total	70	146	120	140
Dimensions of Coke Ovens - length x height x width	in mm	**18,000 x 7,850 x 550**	**16,600 x 7,550 x 590**	**18,800 x 7,630 x 610**	**20,800 x 8,430 x 590**
Effective Dimensions of Coke Ovens (hot) length x height x width	in mm	17,200 x 7,430 x 550	15,800 x 7,100 x 590	18,000 x 7,180 x 610	20,000 x 7,880 x 590
Effective Chamber Volume in m³		≈ 70	62.1	≈ 78.8	≈ 93
Coal Charge (wet) per Oven	in t	57	≈ 53	≈ 70	78.5
Coke Production (dry) per Oven	in t	40	38.5	48.5	
Flue Temperature	in °C	1,320	1,350	1,350	1,320
Coking Time	in h	22.4	24.5	25	24.9
Average number of pushed ovens	per day	75	143	115	135

Table 1
Comparison of Coke Oven Plants



Coking Plant	
Huckingen	996
Kaiserstuhl	1,100
Prosper	880
August Thyssen, Battery VI	851
Schwelgern	1,080

Table 2
Coke Oven Wall Stability
SUGA-Value in mm WC

	August Thyssen	Schwelgern
BF-Coke Production in Mill. t/a	2.5	2.5
Coke Chamber	354	140
Pushing in 24 hours	560	135
Oven Doors	708	280
Total Length of Door-Sealing in m	7,464	5,040
Charging Hole Lids	1,520	560

Table 3
Dimensional Comparison between the August Thyssen
and the Schwelgern Coke Plants

Appendix E
Best Available Control Technology Backup

UNITED STATES STEEL CORPORATION
CLAIRTON WORKS - Clairton, PA
INSTALLATION PERMIT APPLICATION FOR THE PROPOSED C BATTERY REPLACEMENT PROJECT

APPENDIX E-1

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
SUMMARY OF DESIGN INFORMATION

Mill / Location	Merchant or Integrated Plant	Battery	Number of Ovens	Oven Height (m)	Furnace Coke Production (1,000 tons/yr)	Foundry Coke Production (1,000 tons/yr)	Other Coke Production (1,000 tons/yr)	Notes
BYPRODUCT COKE OVEN BATTERIES								
ABC Coke / Tarrant, AL	Merchant	1A	78	5.0	0.0	536.0	0.0	
		5	25	4.0	12.0	89.0	0.0	
		6	29	4.0	14.0	103.0	0.0	
Acme Steel / Chicago, IL	Integrated	1	50	4.0	246.8	10.0	0.0	**Plant shut down in 2001.**
		2	50	4.0	246.8	10.0	0.0	Formerly Interlake, Inc.
AK Steel / Ashland, KY	Integrated	3	76	4.0	355.4	0.0	0.0	
		4	70	5.0	587.5	0.0	0.0	
AK Steel / Middletown, OH	Integrated	3	76	4.0	410.0	0.0	0.0	
Chicago Coke / Chicago, IL	Integrated	2	60	6.0	590.2	0.0	0.0	**Permitted, but not built** Formerly LTV and Republic Steel.
Citizens Gas / Indianapolis, IN	Merchant	E	47	3.5	0.0	89.0	16.0	
		H	41	3.5	173.0	78.0	14.0	
		1	72	5.0	0.0	201.0	64.0	
EES Coke Battery, LLC / Ecorse, MI	Integrated	5	85	6.0	908.7	0.0	0.0	• Formerly National Steel; the steel mill is now owned by U.S. Steel. The battery and byproducts plant, however, are now owned and operated by Detroit Energy Services. • Battery 5 was rebuilt in 1992.
Empire Coke / Holt, AL	Merchant	1	40	2.49	0.0	95.0	0.0	**Plant was shut down**
		2	20	2.49	0.0	48.0	0.0	
Erie Coke / Erie, PA	Merchant	A	23	3.5	0.0	48.0	8.0	
		B	35	3.5	0.0	74.0	12.0	
Geneva Steel / Provo, UT	Integrated	1	63	4.0	189.4	4.4	0.0	**Plant was shut down.**
		2	63	4.0	115.3	2.7	0.0	Formerly US Steel
		3	63	4.0	222.3	5.2	0.0	
		4	63	4.0	173.0	4.0	0.0	
Gulf States Steel / Gadsden, AL	Integrated	2	65	4.0	208.4	0.0	0.0	**Plant was shut down.**
		3	65	4.0	312.6	0.0	0.0	Formerly Republic Steel
Koppers / Monessen, PA	Merchant	1B	37	4.0	237.0	0.0	0.0	Formerly Wheeling-Pittsburgh.
		2	19	4.0	122.0	0.0	0.0	Battery 1 was rebuilt in 1981, Battery 2 in 1979.
Mittal Steel / Burns Harbor, IN	Integrated	1	82	6.0	814.0	40.4	0.0	Formerly Bethlehem Steel.
		2	82	6.0	858.3	42.4	0.0	Battery 1 was rebuilt in 1983.
Mittal Steel / Lackawanna, NY	Integrated	7	76	3.5	375.8	0.0	0.0	**Plant was shut down in 2001.**
		8	76	3.5	371.9	0.0	0.0	Formerly Bethlehem Steel. Battery 8 was rebuilt in 1981
Mittal Steel / Warren, OH	Integrated	4	85	4.0	543.2	0.0	0.0	Formerly Republic Steel

UNITED STATES STEEL CORPORATION
CLAIRTON WORKS - Clairton, PA
INSTALLATION PERMIT APPLICATION FOR THE PROPOSED C BATTERY REPLACEMENT PROJECT

APPENDIX E-1

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
SUMMARY OF DESIGN INFORMATION

BYPRODUCT COKE OVEN BATTERIES (continued)

Mill / Location	Merchant or Integrated Plant	Battery	Number of Ovens	Oven Height (m)	Furnace Coke Production (1,000 tons/yr)	Foundry Coke Production (1,000 tons/yr)	Other Coke Production (1,000 tons/yr)	Notes
Mountain State Carbon / Follansbee , WV	Integrated	1	47	3.0	137.4	4.0	0.0	Formerly Wheeling-Pittsburgh Steel
		2	47	3.0	137.4	4.0	0.0	
		3	51	3.0	137.4	4.0	0.0	
		8	79	6.0	837.2	24.3	0.0	
New Boston Coke / Portsmouth, OH	Merchant	2	70	4.0	318.0	0.0	5.0	**Plant was shut down in 2002.**
Shenango / Pittsburgh, PA	Merchant	1	56	4.0	354.0	0.0	0.0	
Sloss Industries / Birmingham, AL	Merchant	3	30	3.7	127.0	0.0	34.0	
		4	30	3.7	127.0	0.0	0.0	
		5	60	3.7	15.0	131.0	0.0	
Tonawanda Coke / Buffalo, NY	Merchant	2	60	4.0	0.0	136.0	64.0	
United States Steel / Clairton, PA	Integrated	1	64	3.6	315.0	0.0	0.0	
		2	64	3.6	315.0	0.0	0.0	
		3	64	3.6	315.0	0.0	0.0	
		7	62	3.6	320.0	0.0	0.0	
		8	64	3.6	320.0	0.0	0.0	
		9	64	3.6	320.0	0.0	0.0	
		13	61	3.6	332.3	0.0	0.0	
		14	61	3.6	332.3	0.0	0.0	
		15	61	3.6	332.3	0.0	0.0	
		19	87	4.3	537.0	0.0	0.0	
		20	87	4.3	537.0	0.0	0.0	
		B	75	6.1	878.3	0.0	0.0	
United States Steel / Gary, IN	Integrated	2	57	6.0	640.0	0.0	0.0	
		3	57	6.0	619.0	0.0	0.0	
		5	77	3.0	269.5	0.0	0.0	
		7	77	3.0	284.9	0.0	0.0	
United States Steel / Granite City, IL	Integrated	A	45	4.0	285.3	0.0	0.0	
		B	45	4.0	285.4	0.0	0.0	

Total:

58 Byproduct Coke Oven Batteries
44 are currently operating
13 were shut down since February 2001
1 have been permitted but have not been built

UNITED STATES STEEL CORPORATION
CLAIRTON WORKS - Clairton, PA
INSTALLATION PERMIT APPLICATION FOR THE PROPOSED C BATTERY REPLACEMENT PROJECT

APPENDIX E-1

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
SUMMARY OF DESIGN INFORMATION

NON-RECOVERY COKE OVEN BATTERIES

Mill / Location	Merchant or Integrated Plant	Battery	Number of Ovens	Oven Height (m)	Furnace Coke Production (1,000 tons/yr)	Foundry Coke Production (1,000 tons/yr)	Other Coke Production (1,000 tons/yr)	Notes
Indiana Harbor Coke / East Chicago, IN	Merchant	A	67	2.7	325.0	0.0	0.0	
		B	67	2.7	325.0	0.0	0.0	
		C	67	2.7	325.0	0.0	0.0	
		D	67	2.7	325.0	0.0	0.0	
Jewell Coal and Coke / Vansant, VA	Merchant	2D	18	2.82	90.0	0.0	0.0	
		2E	27	2.82	135.0	0.0	0.0	
		3B	26	3.13	130.0	0.0	0.0	
		3C	36	3.13	180.0	0.0	0.0	
		3F	17	2.82	85.0	0.0	0.0	
		3G	18	2.82	90.0	0.0	0.0	
FDS Coke Plant, LLC / Toledo, OH	Merchant	A	84	10.0	0.0	720.0	0.0	**Permitted, but not built**
		B	84	10.0	0.0	720.0	0.0	

Total:	12 Non-Recovery Coke Oven Batteries
	10 are currently operating
	0 were shut down since February 2001
	2 have been permitted but have not been built
COMBINED TOTAL:	70 Coke Oven Batteries
	54 are currently operating
	13 were shut down since February 2001
	3 have been permitted but have not been built

NOTES:

1. This summary presents information for coke oven batteries that was listed in USEPA's Background Information document (referred to herein as USEPA's BID) for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Coke Ovens: Pushing, Quenching, and Battery Stacks, published in February 2001, (supporting the standards under 40 CFR Part 63, Subpart CCCCC). The information from the USEPA's BID was supplemented by information obtained through additional research, including from USEPA's RACT/BACT/LAER Clearinghouse, permit files, and consultation with agency and industry staff.

APPENDIX E-2

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
CHARGING

Mill / Location	Battery	Charging Emissions Control			Charging Emissions Limit (lb/ton Coke)	Charging Opacity Limit (%)	Notes
		Charging Type	Discharge Type	Lid Lifting			
BYPRODUCT COKE OVEN BATTERIES - TALL OVENS							
EES Coke Battery, LLC / Ecorse, MI	5	Stage	Screw feed	Manual	See note	See note	• Subject to LAER for particulate matter • Charging of coal is limited on a dry tons basis to 125,000 tons/month, 1,300,000 tons/yr • Particulate emissions from charging are limited in combination with particulate from door leaks and quenching. • Visible emissions are not limited to a numerical value, but are limited to 55 seconds in any consecutive 5 charges
AK Steel / Ashland, KY	4	No information	No information	No information			
Chicago Coke / Chicago, IL	2	Combination car	Screw feed	Automatic			• Will employ the PROven® system to minimize fugitive emissions, including charging emissions. • Visible emissions are limited to 10 sec/charge and 55 sec during 5 consecutive charges • Visible emissions from are also limited to 1.5% of the standpipe lids and 2% of the topside lids • The amount of dry coal charged to the coke oven battery shall not exceed 2,765 tons/day (monthly average) and 900,000 tons/year.
Citizens Gas / Indianapolis, IN	1	No information	No information	No information			
Mittal Steel / Burns Harbor, IN	1	Stage	Screw feed	Automatic			
	2	Stage	Screw feed	Automatic			
ABC Coke / Tarrant, AL	1A	No information	No information	No information			
United States Steel / Clairton, PA	B	Stage	Gravity feed	Automatic			
United States Steel / Gary, IN	2	No information	Turntable	Automatic			Batteries 2 and 3 employ Redler "Precarbon" conveyor system, controlled with ESPs, to control charging emissions.
	3	No information	Turntable	Automatic			
Mountain State Carbon / Follansbee , WV	8	Stage	Screw feed	Automatic			

Totals:		
	11	Tall Byproduct Coke Oven Batteries
	5	employ staged charging
	1	employ a different charging type
	5	no information was found regarding charging type
	5	employ screw feed
	1	employ gravity feed
	2	employ turntable feed
	3	no information was found regarding discharge mechanism
	7	employ automatic lid lifting
	1	employ manual lid lifting
	3	no information was found regarding lid lifting mechanism

APPENDIX E-2

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
CHARGING

Mill / Location	Battery	Charging Emissions Control			Charging Emissions Limit (lb/ton Coke)	Charging Opacity Limit (%)	Notes
		Charging Type	Discharge Type	Lid Lifting			
BYPRODUCT COKE OVEN BATTERIES - SHORT OVENS							
AK Steel / Ashland, KY	3	No information	No information	No information			
Citizens Gas / Indianapolis, IN	E	No information	No information	No information			
	H	No information	No information	No information			
Shenango / Pittsburgh, PA	1	No information	No information	No information			
United States Steel / Granite City, IL	A	Stage	Screw feed	Automatic			
	B	Stage	Screw feed	Automatic			
United States Steel / Clairton, PA	13	Stage	Gravity feed	No information			
	14	Stage	Gravity feed	No information			
	15	Stage	Gravity feed	Automatic			
	19	Stage	Gravity feed	Manual			
	20	Stage	Gravity feed	Manual			
United States Steel / Gary, IN	5	No information	No information	No information			
	7	No information	No information	No information			
Tonawanda Coke / Buffalo, NY	2	No information	No information	No information			• Charging is limited to 407,340 tons coal/yr • Visible emissions are limited to 12 sec/charge and 100 sec during 5 consecutive charges • Visible emissions from are also limited to 0.6% of the topside lids
ABC Coke / Tarrant, AL	5	No information	No information	No information			
	6	No information	No information	No information			
AK Steel / Middletown, OH	3	No information	No information	No information			• Charging is limited to 144 tons coal/hr. • Visible emissions are limited to 12 sec/charge and 125 sec during 5 consecutive charges • Visible emissions from are also limited to 0.6% of the topside lids
Erie Coke / Erie, PA	A	No information	No information	No information			
	B	No information	No information	No information			
Koppers / Monessen, PA	1B	Stage	Gravity feed	Manual			
	2	Stage	Gravity feed	Manual			
Mittal Steel / Warren, OH	4	Stage	Screw feed	Automatic			
Mountain State Carbon / Follansbee , WV	1	Stage	Gravity feed	Manual			
	2	Stage	Gravity feed	Manual			
	3	Stage	Gravity feed	Manual			
Sloss Industries / Birmingham, AL	3	No information	No information	No information			
	4	No information	No information	No information			
	5	No information	No information	No information			
United States Steel / Clairton, PA	1	Stage	Gravity feed	Manual			
	2	Stage	Gravity feed	Manual			
	3	Stage	Gravity feed	Manual			
	7	Stage	Gravity feed	Manual			
	8	Stage	Gravity feed	Manual			
	9	Stage	Gravity feed	Manual			

Totals:

34	Short Byproduct Coke Oven Batteries
17	employ staged charging
0	employ a different charging type
17	no information was found regarding charging type
3	employ screw feed
16	employ gravity feed
0	employ turntable feed
15	no information was found regarding discharge mechanism
4	employ automatic lid lifting
13	employ manual lid lifting
17	no information was found regarding lid lifting mechanism

APPENDIX E-2

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
CHARGING

Mill / Location	Battery	Charging Emissions Control			Charging Emissions Limit (lb/ton Coke)	Charging Opacity Limit (%)	Notes
		Charging Type	Discharge Type	Lid Lifting			
NON-RECOVERY COKE OVEN BATTERIES							
FDS Coke Plant, LLC / Toledo, OH	A	Not relevant for a non-recovery coke oven battery				20%	
	B	Not relevant for a non-recovery coke oven battery				20%	
Indiana Harbor Coke / East Chicago, IN	A	Not relevant for a non-recovery coke oven battery					
	B	Not relevant for a non-recovery coke oven battery					
	C	Not relevant for a non-recovery coke oven battery					
	D	Not relevant for a non-recovery coke oven battery					
Jewell Coal and Coke / Vansant, VA	2D	Not relevant for a non-recovery coke oven battery					
	2E	Not relevant for a non-recovery coke oven battery					
	3B	Not relevant for a non-recovery coke oven battery					
	3C	Not relevant for a non-recovery coke oven battery					
	3F	Not relevant for a non-recovery coke oven battery					
	3G	Not relevant for a non-recovery coke oven battery					

Totals: 12 Non-Recovery Coke Oven Batteries

COMBINED TOTALS:
57 Coke Oven Batteries
22 employ staged charging
1 employ a different charging type
22 no information was found regarding charging type
8 employ screw feed
17 employ gravity feed
2 employ turntable feed
18 no information was found regarding discharge mechanism
11 employ automatic lid lifting
14 employ manual lid lifting
20 no information was found regarding lid lifting mechanism

NOTES:

1. This summary provides information for coke oven batteries that are either in operation or those for which a permit to construct has been issued and are expected to operate in the future. As shown in Appendix E-1, there were several other coke oven batteries that were listed in USEPA's Background Information document for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Coke Ovens: Pushing, Quenching, and Battery Stacks, published in February 2001, (supporting the standards under 40 CFR Part 63, Subpart CCCCC) were subsequently shut down, and therefore information pertinent to those batteries is not presented here.

2. Tall ovens are defined in 40 CFR Part 63, Subpart CCCCC as those with a height of 5 meters or more. This distinction applies to byproduct coke oven batteries only.

APPENDIX E-3

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
PUSHING

Mill / Location	Battery	Pushing Emissions Control	Pushing Emissions Limit (lb/ton Coke)	Pushing Opacity Limit (%)	Traveling Opacity Limit (%)	Notes
BYPRODUCT COKE OVEN BATTERIES - TALL OVENS						
EES Coke Battery, LLC / Ecorse, MI	5	MH-DP-BH	0.02	20%	in push	• Subject to LAER for particulate matter • The opacity limit shown is an instantaneous limit. There is also an opacity limit of 15% applied on a six reading average basis. • The capture efficiency of the control system is estimated to be 98%. This is an estimate, not a permit requirement.
Chicago Coke / Chicago, IL	2	MH-DP-BH	0.02	20%	in push	• The capture efficiency of the control system is estimated to be 90%.
AK Steel / Ashland, KY	4	MH-BSD-BH	0.03	20%	in push	
Citizens Gas / Indianapolis, IN	1	MH-BSD-BH	0.04	20%	in push	Opacity limit is based on an average for the push, not an instantaneous limit.
Mittal Steel / Burns Harbor, IN	1	MH-BSD-WS	0.04	40%	in push	
	2	MH-BSD-BH	0.04	40%	in push	
United States Steel / Clairton, PA	B	CS-BH	0.04	20%	10%	Opacity limit is an instantaneous limit
United States Steel / Gary, IN	2	ECG-SC	0.04	20%	in push	
	3	ECG-SC	0.04	20%	in push	
ABC Coke / Tarrant, AL	1A	MH-BSD-BH	none	40%	in push	
Mountain State Carbon / Follansbee , WV	8	MH-DP-WS	No information	20%	10%	

Totals:

11	Tall Byproduct Coke Oven Batteries
5	employ a moveable hood, equipped with a belt-sealed duct, vented to a baghouse
2	employ a moveable hood, equipped with dampered ports, vented to a baghouse
0	employ a moveable hood, equipped with a belt-sealed duct, vented to wet scrubber
1	employ a moveable hood, equipped with dampered ports, vented to a wet scrubber
1	employ a cokeside shed, vented to a baghouse
0	employ a cokeside shed, vented to a wet scrubber
0	employ a cokeside shed, not vented to a control device
2	employ an enclosed coke guide, coupled with a mobile scrubber car
0	employ no controls

APPENDIX E-3

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
PUSHING

BYPRODUCT COKE OVEN BATTERIES - SHORT OVENS

Mill / Location	Battery	Pushing Emissions Control	Pushing Emissions Limit (lb/ton Coke)	Pushing Opacity Limit (%)	Traveling Opacity Limit (%)	Notes
AK Steel / Ashland, KY	3	MH-BSD-BH	0.03	20%	in push	
AK Steel / Middletown, OH	3	MH-BSD-BH	0.03 gr/dscf	20%	in push	• As an alternative to the 0.03 gr/dscf limit, the visible emissions are limited to 0%. The battery is allowed to comply with whichever limit is less stringent.
Citizens Gas / Indianapolis, IN	E	MH-BSD-BH	0.04	20%	in push	Opacity limit is based on an average for the push, not an instantaneous limit.
	H	MH-BSD-BH	0.04	20%	in push	
Shenango / Pittsburgh, PA	1	CS-BH	0.04	20%	10%	Opacity limit is an instantaneous limit
United States Steel / Granite City, IL	A	ECG-SC	0.04	20%	in push	
	B	ECG-SC	0.04	20%	in push	
United States Steel / Clairton, PA	13	MH-BSD-BH	0.04	20%	10%	Opacity limit is an instantaneous limit
	14	MH-BSD-BH	0.04	20%	10%	
	15	MH-BSD-BH	0.04	20%	10%	
	19	MH-BSD-BH	0.04	20%	10%	
	20	MH-BSD-BH	0.04	20%	10%	
United States Steel / Gary, IN	5	MH-DP-BH	0.04	20%	in push	Opacity limit is based on an average for the push, not an instantaneous limit.
	7	MH-DP-BH	0.04	20%	in push	
Tonawanda Coke / Buffalo, NY	2	MH-BSD-BH	0.07	20%	in push	
ABC Coke / Tarrant, AL	5	MH-BSD-BH	none	40%	in push	
	6	MH-BSD-BH	none	40%	in push	
Erie Coke / Erie, PA	A	ECG-SC	none	20%	10%	
	B	ECG-SC	none	20%	10%	
Koppers / Monessen, PA	1B	MH-BSD-BH	none	20%	10%	
	2	MH-BSD-BH	none	20%	10%	
Mittal Steel / Warren, OH	4	ECG-SC	none	20%	in push	
Mountain State Carbon / Follansbee , WV	1	CS-BH	No information	20%	10%	
	2	CS-BH	No information	20%	10%	
	3	CS-BH	No information	20%	10%	
Sloss Industries / Birmingham, AL	3	MH-BSD-BH	none	40%	in push	Opacity limit is an instantaneous limit
	4	MH-BSD-BH	none	40%	in push	
	5	MH-BSD-BH	none	40%	in push	
United States Steel / Clairton, PA	1	MH-BSD-BH	none	20%	10%	
	2	MH-BSD-BH	none	20%	10%	
	3	MH-BSD-BH	none	20%	10%	
	7	MH-BSD-BH	none	20%	10%	
	8	MH-BSD-BH	none	20%	10%	
	9	MH-BSD-BH	none	20%	10%	

Totals:

34 Short Byproduct Coke Oven Batteries
23 employ a moveable hood, equipped with a belt-sealed duct, vented to a baghouse
2 employ a moveable hood, equipped with dampered ports, vented to a baghouse
0 employ a moveable hood, equipped with a belt-sealed duct, vented to wet scrubber
0 employ a moveable hood, equipped with dampered ports, vented to a wet scrubber
4 employ a cokeside shed, vented to a baghouse
0 employ a cokeside shed, vented to a wet scrubber
0 employ a cokeside shed, not vented to a control device
5 employ an enclosed coke guide, coupled with a mobile scrubber car
0 employ no controls

UNITED STATES STEEL CORPORATION
CLAIRTON WORKS - Clairton, PA
INSTALLATION PERMIT APPLICATION FOR THE PROPOSED C BATTERY REPLACEMENT PROJECT

APPENDIX E-3

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
PUSHING

Mill / Location	Battery	Pushing Emissions Control	Pushing Emissions Limit (lb/ton Coke)	Pushing Opacity Limit (%)	Traveling Opacity Limit (%)	Notes

NON-RECOVERY COKE OVEN BATTERIES

Mill / Location	Battery	Pushing Emissions Control	Pushing Emissions Limit (lb/ton Coke)	Pushing Opacity Limit (%)	Traveling Opacity Limit (%)	Notes
FDS Coke Plant, LLC / Toledo, OH	A	MH-BSD-BH	0.03	20%	in push	Coke push rate is limited to 1,440,000 TPY, rolling 12-month basis, and 88 pushes/day.
	B	MH-BSD-BH	0.03	20%	in push	
Indiana Harbor Coke / East Chicago, IN	A	CS-BH	0.04	20%	in push	
	B	CS-BH	0.04	20%	in push	
	C	CS-BH	0.04	20%	in push	
	D	CS-BH	0.04	20%	in push	
Jewell Coal and Coke / Vansant, VA	2D	CS-none	none	20%	in push	
	2E	CS-none	none	20%	in push	
	3B	CS-none	none	20%	in push	
	3C	CS-none	none	20%	in push	
	3F	CS-none	none	20%	in push	
	3G	CS-none	none	20%	in push	

Totals:

12 Non-Recovery Coke Oven Batteries
2 employ a moveable hood, equipped with a belt-sealed duct, vented to a baghouse
0 employ a moveable hood, equipped with dampered ports, vented to a baghouse
0 employ a moveable hood, equipped with a belt-sealed duct, vented to wet scrubber
0 employ a moveable hood, equipped with dampered ports, vented to a wet scrubber
4 employ a cokeside shed, vented to a baghouse
0 employ a cokeside shed, vented to a wet scrubber
6 employ a cokeside shed, not vented to a control device
0 employ an enclosed coke guide, coupled with a mobile scrubber car
0 employ no controls

APPENDIX E-3

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
PUSHING

Mill / Location	Battery	Pushing Emissions Control	Pushing Emissions Limit (lb/ton Coke)	Pushing Opacity Limit (%)	Traveling Opacity Limit (%)	Notes

COMBINED TOTALS:

57 Coke Oven Batteries
30 employ a moveable hood, equipped with a belt-sealed duct, vented to a baghouse
4 employ a moveable hood, equipped with dampered ports, vented to a baghouse
0 employ a moveable hood, equipped with a belt-sealed duct, vented to wet scrubber
1 employ a moveable hood, equipped with dampered ports, vented to a wet scrubber
9 employ a cokeside shed, vented to a baghouse
0 employ a cokeside shed, vented to a wet scrubber
6 employ a cokeside shed, not vented to a control device
7 employ an enclosed coke guide, coupled with a mobile scrubber car
0 employ no controls

NOTES:

1. This summary provides information for coke oven batteries that are either in operation or those for which a permit to construct has been issued and are expected to operate in the future. As shown in Appendix E-1, there were several other coke oven batteries that were listed in USEPA's Background Information document for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Coke Ovens: Pushing, Quenching, and Battery Stacks, published in February 2001, (supporting the standards under 40 CFR Part 63, Subpart CCCCC) were subsequently shut down, and therefore information pertinent to those batteries is not presented here.

2. Tall ovens are defined in 40 CFR Part 63, Subpart CCCCC as those with a height of 5 meters or more. This distinction applies to byproduct coke oven batteries only.

3. Abbreviations used to describe pushing emissions capture systems are as follows:

MH	Moveable hood
CS	Cokeside shed
ECG	Enclosed coke guide
BSD	Belt-sealed duct
DP	Dampered ports

4. Abbreviations used to describe pushing emissions control systems are as follows:

BH	Baghouse
WS	Wet scrubber
SC	Scrubber car

5. For traveling emissions, the term "in push" iindicates that the traveling emissions are are limited in combination with the pushing emissions, not separately.

APPENDIX E-4

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
QUENCHING

BYPRODUCT COKE OVEN BATTERY QUENCH TOWERS

Mill / Location	Quenching Emissions Control	Quenching Water TDS Limit (mg/L)	Baffle Cleaning Schedule	Baffle Inspection Schedule	Notes
ABC Coke / Tarrant, AL	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
AK Steel / Ashland, KY	Baffles	750	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water
AK Steel / Middletown, OH	Baffles	none	Daily	Monthly	
Chicago Coke / Chicago, IL	Baffles	1,100	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water
Citizens Gas / Indianapolis, IN	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
EES Coke Battery, LLC / Ecorse, MI	Baffles	800	Daily	Monthly	• Quenching water can not contain byproduct plant effluent or process water. • Stainless steel baffles and backwash sprays are employed; these were installed in August 2004. • Particulate emissions from quenching are limited in combination with particulate from door leaks and charging.
Erie Coke / Erie, PA	Baffles	1,100	Daily	Monthly	
Koppers / Monessen, PA	Baffles	1,100	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water
Mittal Steel / Burns Harbor, IN	Baffles	1,100	Daily	Monthly	
	Baffles	500			
Mittal Steel / Warren, OH	Baffles	1,100	Daily	Monthly	
Mountain State Carbon / Follansbee , WV	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
Shenango / Pittsburgh, PA	Baffles	1,100	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water
Sloss Industries / Birmingham, AL	Baffles	1,100	Daily	Monthly	
Tonawanda Coke / Buffalo, NY	Baffles	1,100	Daily	Monthly	
United States Steel / Clairton, PA	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
United States Steel / Gary, IN	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
United States Steel / Granite City, IL	Baffles	1,100	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water

APPENDIX E-4

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
QUENCHING

Mill / Location	Quenching Emissions Control	Quenching Water TDS Limit (mg/L)	Baffle Cleaning Schedule	Baffle Inspection Schedule	Notes
NON-RECOVERY COKE OVEN BATTERY QUENCH TOWERS					
FDS Coke Plant, LLC / Toledo, OH	Baffles	1,100	Daily	Monthly	
	Baffles	1,100	Daily	Monthly	
Indiana Harbor Coke / East Chicago, IN	Baffles	1,100	Daily	Monthly	
Jewell Coal and Coke / Vansant, VA	Baffles	1,100	Daily	Monthly	Quenching water can not contain byproduct plant effluent or process water
	Baffles	1,100	Daily	Monthly	

COMBINED TOTALS:

33 Quench towers
3 are subject to TDS limits for their quench water that are lower than the applicable NESHAPs standard of 1,100 mg/L
1 undergoes a baffle inspection daily, rather than the applicable NESHAPs requirement for daily inspections

NOTES:

1. This summary provides information for coke oven batteries that are either in operation or those for which a permit to construct has been issued and are expected to operate in the future. As shown in Appendix E-1, there were several other coke oven batteries that were listed in USEPA's Background Information document for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Coke Ovens: Pushing, Quenching, and Battery Stacks, published in February 2001, (supporting the standards under 40 CFR Part 63, Subpart CCCCC) were subsequently shut down, and therefore information pertinent to those batteries is not presented here.

APPENDIX E-5

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
COMBUSTION

Mill / Location	Battery	Combustion Emissions Control	Combustion Emissions Limit (gr/dscf)	Combustion Opacity Limit (%)	Notes
BYPRODUCT COKE OVEN BATTERIES - TALL OVENS					
EES Coke Battery, LLC / Ecorse, MI	5	none	0.012	15%	• Subject to LAER for particulate matter • The emissions limit is based on the exclusion of sulfates, and is also based on firing a mixture of 85% COG and 15% blast furnace gas called "rich gas." • The opacity limit applies to a "normal" coking cycle. Opacity is limited to 20% opacity when the battery is on an "extended" coking cycle. • COG combustion is limited to 2.85 x 10^{12} Btu/year, based on a heat value of 500 Btu/cubic feet. • Firing of rich gas is also limited to 20% of the time on a rolling 12-month calendar year basis. • Fuel gas H_2S content is limited to 2.64 gr/dscf, on a 3-hour average basis.
Citizens Gas / Indianapolis, IN	1	none	0.015	30%	
United States Steel / Clairton, PA	B	none	0.015	20%	
AK Steel / Ashland, KY	4	none	0.03	20%	
United States Steel / Gary, IN	2	none	0.03	20%	
	3	none	0.03	20%	
Chicago Coke / Chicago, IL	2	none	0.05	15%	
ABC Coke / Tarrant, AL	1A	none	none	20%	
Mittal Steel / Burns Harbor, IN	1	none	none	40%	
	2	none	none	20%	
Mountain State Carbon / Follansbee , WV	8	none	none	20%	

Totals: 11 Tall Byproduct Coke Oven Batteries

APPENDIX E-5

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
COMBUSTION

BYPRODUCT COKE OVEN BATTERIES - SHORT OVENS

Mill / Location	Battery	Combustion Emissions Control	Combustion Emissions Limit (gr/dscf)	Combustion Opacity Limit (%)	Notes
Shenango / Pittsburgh, PA	1	none	0.015	20%	
United States Steel / Clairton, PA	13	none	0.015	20%	
	14	none	0.015	20%	
	15	none	0.015	20%	
	20	none	0.015	20%	
AK Steel / Ashland, KY	3	none	0.03	20%	
Citizens Gas / Indianapolis, IN	E	none	0.03	30%	
	H	none	0.03	30%	
Mittal Steel / Warren, OH	4	none	0.03	20%	
United States Steel / Granite City, IL	B	none	0.03	30%	
United States Steel / Clairton, PA	1	none	0.03	20%	
	2	none	0.03	20%	
	3	none	0.03	20%	
	7	none	0.03	20%	
	8	none	0.03	20%	
	9	none	0.03	20%	
	19	none	0.03	20%	
United States Steel / Granite City, IL	A	none	0.05	30%	
Koppers / Monessen, PA	1B	none	0.04	20%	
	2	none	0.04	20%	
United States Steel / Gary, IN	5	none	0.05	20%	
	7	none	0.05	20%	
Tonawanda Coke / Buffalo, NY	2	none	0.05	20%	The sulfur content of the coal is limited to 1%, by weight
ABC Coke / Tarrant, AL	5	none	none	20%	
	6	none	none	20%	
AK Steel / Middletown, OH	3	none	none	20%	
Mountain State Carbon / Follansbee , WV	1	none	none	20%	
	2	none	none	20%	
	3	none	none	20%	
Sloss Industries / Birmingham, AL	3	none	none	20%	
	4	none	none	20%	
	5	none	none	20%	
Erie Coke / Erie, PA	A	No information	No information	No information	
	B	No information	No information	No information	

Totals: 34 Short Byproduct Coke Oven Batteries

APPENDIX E-5

COKE OVEN BATTERY EMISSIONS CONTROL TECHNOLOGY INFORMATION
COMBUSTION

Mill / Location	Battery	Combustion Emissions Control	Combustion Emissions Limit (gr/dscf)	Combustion Opacity Limit (%)	Notes
NON-RECOVERY COKE OVEN BATTERIES					
FDS Coke-Plant, LLC / Toledo, OH	A	FGD-DS, BH SC	0.008	10%	• Each battery will be equipped with a dry lime spray tower, followed by an activated carbon injection system and then a baghouse. • In addition to the listed limit for PM, each battery willl be subject to the following BACT limits: SO$_2$: 0.99 lb/ton wet coal, when coal sulfur < 0.9%, by weight SO$_2$: 1.06 lb/ton wet coal, when coal sulfur $\geq$ 0.9%, by weight NO$_x$: 1.00 lb/ton wet coal CO: 20 ppmvd VOCs: 10 ppmvd
	B	FGD-DS, BH, SC	0.008	10%	
Indiana Harbor Coke / East Chicago, IN	A	none	0.008	10%	
	B	none	0.008	10%	
	C	none	0.008	10%	
	D	none	0.008	10%	
Jewell Coal and Coke / Vansant, VA	2D	none	none	20%	
	2E	none	none	20%	
	3B	none	none	20%	
	3C	none	none	20%	
	3F	none	none	20%	
	3G	none	none	20%	

Totals:	12 Non-Recovery Coke Oven Batteries
COMBINED TOTALS:	57 Coke Oven Batteries

NOTES:

1. This summary provides information for coke oven batteries that are either in operation or those for which a permit to construct has been issued and are expected to operate in the future. As shown in Appendix E-1, there were several other coke oven batteries that were listed in USEPA's Background Information document for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Coke Ovens: Pushing, Quenching, and Battery Stacks, published in February 2001, (supporting the standards under 40 CFR Part 63, Subpart CCCCC) were subsequently shut down, and therefore information pertinent to those batteries is not presented here.

2. Tall ovens are defined in 40 CFR Part 63, Subpart CCCCC as those with a height of 5 meters or more. This distinction applies to byproduct coke oven batteries only.

3. Abbreviations used to describe emissions control systems are as follows:

FGD-DS	Flue gas desulfurization - dry scrubber
BH	Baghouse
SC	Staged combustion

UNITED STATES STEE
CLAIRTON WORKS
INSTALLATION PERMIT APPLICATION FOR THE PR

APPENDI

COST ESTIMATE: APPLICATION OF SO_2 SCRUBBE

• Estimated annualized cost for similar application:	$320,000 /yr
• Volumetric flowrate for similar application:	11,000 dscfm
• Volumetric flowrate for C Battery pushing emissions control system:	25,200 dscfm
• Estimated annualized cost for C Battery application:	$526,205 /yr
• Estimated SO_2 PTE for C Battery:	53 TPY
• Estimated SO_2 control efficiency for scrubber:	90%
• Estimated SO_2 emissions reduction for C Battery:	48 TPY
• **Estimated cost-effectiveness for C Battery:**	**$11,032 /ton**

X E-6

R TO PUSHING EMISSIONS CONTROL SYSTEM

Average of estimates received from SO_2 scrubber vendors, for a system designed to control SO_2 from a fly ash beneficiation system.

Annualized cost includes all operating and maintenance costs, including utilities, materials, labor, and overhead, and also includes capital cost, amortized over a 20-year economic life at 8% interest rate

System specification data for similar application

Estimated by US Steel

Estimated via "six-tenths rule," as follows:
$526,205/yr = $320,000/yr * (25,200 / 11,000)^0.6

Estimated by US Steel

Estimated by ENSR: Estimated level of control that can be achieved by a packed-tower type scrubber that employs sodium hydroxide scrubbing reagent

48 TPY = 53 TPY * 0.90

$11,032/ton = $526,205/yr * yr/48 tons

Appendix F
Fugitive Dust Control Plan

Appendix F Fugitive Dust Control Plan

Construction

Fugitive dust and a small amount of vehicle exhaust emissions will be produced during demolition of 7-9 Batteries and during construction of C Battery. Fugitive dust is generated from earthwork, traffic on unpaved roads, and traffic on paved roads. The primary control measure to be used to minimize emissions is watering of exposed surfaces and roads. Additional measures are available and will be employed as necessary. Following is a summary of fugitive dust controls by source.

Controls for Demolition Activities

Periodic watering by trucks commonly used at major construction sites would be the most widespread method of control. One or more trucks would be stationed near equipment being dismantled. Watering would be used to moisten areas as needed during dismantlement. Old equipment would be loaded onto trucks for removal off site to a landfill. Watering would be used during the truck loading process as well. Full trucks would be covered with secured tarps. Each truck would be spray washed prior to leaving the site.

Controls for Earthwork

Periodic watering by trucks would be the most widespread method of control. Watering would be used to moisten areas where dust has the potential to be generated by construction activities. This would be a continuous process during dry weather conditions. Furthermore, all trucks transporting loose dirt would be covered or will have the top layer adequately wetted to minimize loss.

Exposed soils such as embankments would have slope protective coverings applied as necessary to control both erosion from water and dust emissions from the wind. Other exposed soil areas could be similarly protected or kept moist during windy, dust producing conditions.

Dusts suppression measures might also be applied to soil stockpiles, including covering them with vinyl sheets, especially if the stockpile has the potential to generate windblown dust. If a soil stockpile with the potential to produce fugitive emissions is to be left in place for an extended period of time, grass or other protective vegetation could be planted to suppress dust.

The primary objective of these fugitive dust control efforts would be to prevent dust from being a nuisance to the public and nearby offsite residences. As stated above, periodic watering during construction would be the most common method of dust mitigation at the construction site. The use of additives (also known as surfactants) to the water to facilitate wetting unpaved roads and other exposed surfaces is not anticipated. In the unlikely event that it became necessary to improve the dust control measures at the construction site (due to abnormally dry and/or windy conditions), the use of additional dust control measures would be investigated. These measures might include more frequent watering and/or covering of exposed surfaces with vegetation or solid material. If necessary, the use of a state approved liquid wetting agent (dust palliative) would be considered.

Controls for Traffic on Unpaved Roads

In addition to earthwork, other activities would have associated truck traffic and some other mobile equipment. When this equipment operates on unpaved surfaces, the emissions and controls would be similar to those discussed above for earthwork activities. For additional controls, construction laydown and parking areas would be topped with an aggregate surface to help control dust and erosion and to provide a more durable road surface.

Controls for Paved Roads

The most effective method of controlling the emission of fine particulates on paved surfaces is by frequently flushing the road surface with water. A street cleaner provides an effective method of both wetting the surface and removing the dust.

Appendix G
ACHD Permits List

ACHD Permits		**Effective Date**
7035003-010-26320	Coke Battery No. 1	5/24/1977
7035003-010-26318	Coke Battery No. 2	5/24/1977
7035003-010-26317	Coke Battery No. 3	5/24/1977
7035003-010-26312	Coke Battery No. 7	5/24/1977
7035003-010-26313	Coke Battery No. 8	5/24/1977
7035003-010-26319	Coke Battery No. 9	5/24/1977
7035003-010-26309	Coke Battery No. 13	5/24/1977
7035003-010-26307	Coke Battery No. 14	5/24/1977
7035003-010-26306	Coke Battery No. 15	5/24/1977
7035003-010-26304	Coke Battery No. 19	5/24/1977
7035003-010-53800	Coke Battery No. 20	1/26/1981
78-I-0083-P	Coke Battery B and B Quench Tower	7/25/1980
91-I-0021-P	Coke By-Products Recovery Plant	4/29/1991
7035003-010-00801	Boiler No. 1	11/28/1979
7035003-010-00800	Boiler No. 2	11/28/1979
7035003-010-01300	Boiler Nos. R1 and R2	5/9/1977
7035003-010-00600	Boiler Nos. T1 and T2	7/12/1977
7035003-010-25001	Coke Screening No. 1	12/14/1973
7035003-010-25002	Coke Screening No. 2	12/14/1973
0052-I003	Coke Screening No. 3	1/23/1998
0052-I006	Fan Upgrade 1-3 PEC	12/5/2001
0052-I007	Fan Upgrade 7-9 PEC	12/5/2001
0052-I008	Fan Upgrade 13-15 PEC	12/5/2001
0052-I005a	Fan Upgrade 19/20 PEC	7/15/2004
0052-I002b	Ammonia Flare	1/20/2005
0052-I004	Methanol/ MEA Tanks	6/5/2002
73-O-01138-P	Coke Battery 1	8/10/1973
73-O-01136-P	Coke Battery 2	8/10/1973
73-I-1135-P	Coke Battery 3	8/10/1973
73-O-1130-P	Coke Battery 7	8/10/1973
73-O-1131-P	Coke Battery 8	8/10/1973
73-O-1137-P	Coke Battery 9	8/10/1973
73-O-1127-P	Coke Battery 13	8/10/1973
78-I-0009	Coke Batteries 13-15 rebuild	5/21/1979
73-O-1126-P	Coke Battery 14	8/10/1973
73-O-1125-P	Coke Battery 15	8/10/1973
93-I-0010-P	Coke Battery 15	4/30/1993
73-O-1122-P	Coke Battery 19	8/10/1973
73-O-1121-P	Coke Battery 20	8/10/1973
77-I-0019-P	Coke Battery 20	5/31/1979
87-I-0031-P	PEC for 1-3	6/9/1988
87-I-0032-P	PEC for 7-9	6/6/1988
88-I-0037-P	PEC for 13-15	12/8/1988
87-I-0033-P	PEC for 19/20	4/30/1990
78-I-0083-P	Coke Battery B and Quench Tower	6/25/1981
90-I-0031-P	Igniters for 1-3, 7-9, and 13-15	10/25/1990
90-I-0032-P	Igniters for 19/20	10/25/1990

90-I-0033-P	Igniters for B	10/25/1990
73-O-1139-P (7035003-010-25101)	Quench Tower #1	8/10/1973
73-O-1140-P (7035003-010-25102)	Quench Tower #3	8/10/1973
73-O-1142-P (7035003-010-25104)	Quench Tower #5	8/10/1973
73-O-1144P (7035003-010-25106)	Quench Tower #7	8/10/1973
73-O-1148-P	Coke Screening #1	10/30/1973
73-O-1149-P	Coke Screening #2	9/19/1973
GC-80-62	COG Desulfurization	11/8/1973
73-I-3784-P	COG Desulfurization	11/8/1973
7035003-010-8400	Sulfur Production (Claus Carbonate)	11/30/1973
73-O-1153-P	Sulfur Production (Claus Carbonate)	1/14/1974
7035003-010-25600 (73-O-1155-P)	Gas Processing	9/19/1973
91-I-0021-P	Benzene NESHAP By-Product Plant Emission Control	4/29/1991
73-O-1161-P (7035003-010-25501)	Coal Chemical Recovery #1 Unit	9/19/1973
73-I-4035-P	Tanks	10/31/1974
73-O-1162-P (7035003-010-25502)	Coal Chemical Recovery #2 Unit	9/19/1973
73-I-4036-P	Tanks	10/31/1974
94-I-0096-C	Boiler #1	10/19/1995
75-I-0019-C	Boiler #1	6/5/1975
94-I-0092-C	Boiler #2	10/19/1995
75-I-0020-C	Boiler #2	6/5/1975
94-I-0091-C	Boilers R1 & R2	10/19/1995
74-O-6090-C	Boilers R1 & R2	6/13/1974
94-I-0093-C	Boilers T1 & T2	10/19/1995
89-I-0003-C	Boilers T1 & T2	2/17/1989
76-I-0067-C	Boilers T1 & T2	8/12/1976
73-I-4034-P	No. 1 Tar Acid Tanks	10/31/1974
73-I-4030-P	Tar Refining Tanks V-100 & V-101	10/31/1974
73-I-4029-P	Tar Refining Tanks 3-A & 4-A	10/31/1974
73-I-4028-P	Tar Refining Tanks 10, 11, & V-113	10/31/1974
73-I-4027-P	Tar Refining Tanks 3 to 8 & T	10/31/1974
73-I-4026-P	Road Tar Terminal V-200 to V-208 inclusive	10/31/1974

Appendix H
U.S. Steel Compliance Information

U.S. Steel Clairton Works
Pushing / Travel and Stack
Schedule of Compliance
For Batteries 1, 2, and 3
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date	
1. Conduct comprehensive 3rd party battery inspection.	Complete	Complete
2. Complete automation of reversing rooms.	July 31, 2008	
3. Develop and implement advanced patching program.	Ongoing	Ongoing
4. Develop and implement end flue nozzle repair and replacement plan.	Ongoing	Ongoing
5. Submit permit application for C Battery.	January 2, 2008	
6. Begin construction of C Battery.	When final permit issued without appeal.	
7. Begin operations on C Battery.	December 31, 2011*	
8. Shut down 1-3 Batteries.	December 31, 2012*/**	
9. Compliance on C Battery.	December 31, 2012*/**	

* Date contingent on obtaining permit by June 30, 2008.

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

Schedule M Supplement

Issue:

A review of current monitoring data indicates that these batteries do not achieve continuous compliance with applicable opacity requirements for pushing, travel, and stack fugitive visible emissions.

Citation:

ACHD Article XXI, §2105.21(e)(4) and §2105.21(e)(5) and §2105.21(f)(3) and §2105.21(f)(4)

Compliance Plan Description:

After an extensive inspection and review of available compliance data, U. S. Steel has determined that environmental compliance can not be sustained on Batteries 1, 2, or 3. U. S. Steel is preparing a permit application and engineering design of a new battery (C Battery). C Battery is proposed to be a 6-meter battery and will replace the production capacity of Batteries 1, 2, and 3.

U.S. Steel Clairton Works
Pushing / Travel and Stack Schedule of Compliance
For Batteries 7, 8, and 9
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date	
1. Conduct comprehensive 3rd party battery inspection.	Complete	Complete
2. Develop and implement advanced patching program.	Ongoing	Ongoing
3. Develop and implement end-flues and thru-walls program.	Ongoing	Ongoing
4. Develop and implement regenerator repair program.	Ongoing	Ongoing
5. Develop and implement gas gun improvement program.	Ongoing	Ongoing
6. Submit permit application for D Battery.	July 1, 2008	
7. Begin construction of D Battery.	When final permit issued without appeal.	
8. Begin operations on D Battery.	December 31, 2013*	
9. Shut down 7-9 Batteries.	December 31, 2014*/**	
10. Compliance on D Battery.	December 31, 2014*/**	

* Date contingent on obtaining permit by December 31, 2008.

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

Schedule M Supplement

Issue:

A review of current monitoring data indicates that these batteries do not achieve continuous compliance with applicable opacity requirements for pushing, travel, and stack fugitive visible emissions.

Citation:

ACHD Article XXI, §2105.21(e) (4) and §2105.21(e)(5) and §2105.21(f)(3) and §2105.21(f)(4)

Compliance Plan Description:

After an extensive inspection and review of available compliance data, U. S. Steel has determined that environmental compliance can not be sustained on Batteries 7, 8, or 9. U. S. Steel is preparing a permit application and engineering design of a new battery (D Battery). D Battery is proposed to be a 6-meter battery and will replace the production capacity of Batteries 7, 8, and 9.

U.S. Steel Clairton Works
Underfire Combustion Stack Schedule of Compliance
For Battery 15
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date	
1. **Evaluation** a. Conduct a comprehensive study and develop a plan to achieve compliance with the 20% opacity and 60% opacity standards for 15 Battery.	Complete	Complete
2. **The following items of the plan are complete:** a. Clean regenerators b. Clean flues c. Survey goosenecks and standpipes and prioritize for repair d. Replace leaking aspirating steam valves e. Modify and install sliding brick *f.* Battery setting coarse adjustment g. Adjust tie rods *h.* Order additional dry gunning equipment *i.* Increase patching and flue clean-out resources	Complete	Complete
3. **Battery setting final adjustment**	10/31/07	Complete
4. **Replace end flue casting inspection blocks as identified by survey.**	11/30/07	Complete
5. **Begin implementation of an enhanced preventive maintenance refractory repair program* to include:** a. Dry gunning all oven ends b. Dry gunning all standpipe interiors c. Dry gunning all charging holes d. Perform ceramic welding and replace standpipes where dry gunning is not sufficient. This preventive maintenance will be performed on each oven semi-annually. The first round of preventive maintenance will be complete on all ovens by 12/31/07.	12/31/07	Complete
6. **Complete the second round of the enhanced preventive maintenance refractory repair program.**	6/30/08	
7. **Complete the third round of the enhanced preventive maintenance refractory repair program.**	12/31/08	
8. **Achieve Compliance with Article XXI 20% and 60% opacity standards.**	12/31/08 **	

* The program will be updated as required to maintain compliance.

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

U. S. Steel Clairton Works
Schedule M Supplement
Underfire Combustion Stack Opacity for Battery 15
January 2, 2008

Issue:

A review of current monitoring data indicates that this battery does not achieve continuous compliance with applicable opacity requirements for combustion stack visible emissions.

Citation:

ACHD Article XXI, §2105.21(f)(3) and §2105.21(f)(4)

Compliance Plan Description:

Combustion stack visible emissions occur when process gases leak into the battery heating flues. The compliance plan utilizes pollution prevention elements to achieve continuous compliance. The compliance plan elements are briefly described as follows:

- Conduct a comprehensive study and develop and implement a plan to achieve compliance with the 20% opacity and 60% opacity standards for 15 Battery.

U.S. Steel Clairton Works
Pushing / Travel and Stacks Schedule of Compliance
For Battery 19
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date	
1. Conduct comprehensive 3rd party battery inspection.	Complete	Complete
2. Replace 12 walls on 19 Battery.	Complete	Complete
3. Develop and implement advanced patching program.	Ongoing	Ongoing
4. Replace 25 walls on 19 Battery.	October 31, 2012	
5. Compliance on 19 Battery	December 31, 2012**	

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

Schedule M Supplement

Issue:

A review of current monitoring data indicates that this battery does not achieve continuous compliance with applicable opacity requirements for pushing and travel fugitive visible emissions.

Citation:

ACHD Article XXI, §2105.21(e) (4), §2105.21(e)(5), and §2105.21(f)(3) and §2105.21(f)(4)

Compliance Plan Description:

Oven wall damage and deterioration can result in raw coke oven gas leakage to the battery heating flues. The oven inspection program referred to in the compliance plan will identify deteriorated or damaged refractory that may contribute to pushing and travel emissions. It has been identified that all of the remaining walls on the Battery.

U.S. Steel Clairton Works
Pushing / Travel and Stacks Schedule of Compliance
For Battery 20
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date	
1. Conduct comprehensive 3rd party battery inspection.	Complete	Complete
2. Complete installation of WOBBE stabilizer.	April 30, 2008	
3. Develop and implement advanced patching program.	Ongoing	Ongoing
4. Develop and implement revitalization program of battery heating system.	Ongoing	Ongoing
5. Replace 88 walls on 20 Battery.	October 31, 2014	
6. Compliance on 20 Battery.	December 31, 2014**	

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

Schedule M Supplement

Issue:

A review of current monitoring data indicates that this battery does not achieve continuous compliance with applicable opacity requirements for pushing and travel fugitive visible emissions.

Citation:

ACHD Article XXI, §2105.21(e)(4), §2105.21(e)(5), and §2105.21(f)(3) and §2105.21(f)(4)

Compliance Plan Description:

Oven wall damage and deterioration can result in raw coke oven gas leakage to the battery heating flues. The oven inspection program referred to in the compliance plan will identify deteriorated or damaged refractory that may contribute to pushing and travel emissions. It has been identified that all of the walls on 20 Battery must be replaced.

U.S. Steel Clairton Works
PEC Baghouse and Underfire Stack Schedule of Compliance for B Battery
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date
1. Data Collection Complete installation and implementation of automated data collection system on B Battery	Complete
2. Wall Inspection Perform an oven-by-oven wall inspection	Complete
3. Wall Replacement Replace 24 heating walls.	Complete
4. Wall Replacement Replace the remaining 52 heating walls.	June 30, 2010
5. Compliance Conduct a PEC emissions test to demonstrate compliance on B Battery	December 31, 2010 **

** An interim milestone date, which is missed, is not a permit violation provided the final compliance date(s) are met

Schedule M Supplement

Issue:

A review of current monitoring data indicates that this battery does not achieve continuous compliance with applicable opacity requirements for combustion stack visible emissions and particulate emissions from the PEC Baghouse.

Citation:

ACHD Article XXI, §2105.21(f)(3), §2105.21(f)(4), and 2105.21.e.3

Compliance Plan Description:

Combustion stack visible emissions occur when process gasses leak into the battery heating flues. PEC Baghouse particulate emissions result from non-uniform heat distribution. The compliance plan utilizes pollution prevention elements to achieve continuous compliance. The compliance plan elements are briefly described as follows:

- ☐ Oven Inspections and Repairs - Oven wall damage and deterioration can result in non-uniform heat distribution. The oven inspection program referred to in the compliance plan has identified deteriorated or damaged refractory that may lead to combustion stack and PEC Baghouse stack emissions. All 76 heating walls will be replaced.

U.S. Steel Clairton Works
3 Screening Station
Schedule of Compliance
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date
1. Begin construction of new baghouse.	6 months after receipt of acceptable installation permit and revision of Article XXI limit
2. Complete construction of new baghouse.	12 months after receipt of acceptable installation permit and revision of Article XXI limit

Schedule M Supplement
3 Screening Station

Issue:

Limitations are set in Permit Number 0052-I003 and in ACHD Article XXI, Paragraph 2104.02(f). The two limitations do not correspond to each other. A recent compliance demonstration test showed that compliance to the Article XXI limit can not be attained.

Citation:

ACHD Article XXI Paragraph 2104.02(f)
ACHD Permit Number 0052-I003

Compliance Plan Description:

The compliance plan contains a schedule to investigate potential compliance options including addressing a change to the numerical limit or the associated units through the PM-10 SIP modeling. USS believes that limitations described in ACHD Article XXI are in error and will work with ACHD to correct the error.

U.S. Steel Clairton Works
Pushing Schedule of Compliance - B Battery
Schedule of Compliance
Schedule M
January 2, 2008

Compliance Plan Element	Milestone Date
1. Conduct initial compliance evaluation	Complete
2. Complete repairs to the B Battery shed	Complete
3. Compliance on B Battery	Complete

* USS has completed this compliance and therefore withdraws the Schedule of Compliance. USS Clairton Works is currently in compliance with ACHD Article XXI, §2105.21(e)(4) and §2105.21(e)(5) for B Battery.

Schedule M Supplement
Pushing for Batteries - B Battery

Issue:

A review of current monitoring data indicates that B Battery does not achieve continuous compliance with applicable opacity requirements for pushing fugitive visible emissions.

Citation:

ACHD Article XXI, §2105.21(e)(4) and §2105.21(e)(5)

Compliance Plan Description:

The main element of the compliance plan is repair to the B Battery shed to improve the capture efficiency during the pushing operation. Several areas of the shed are in need of repair due to wear and tear. As part of the repair process, new techniques to improve the reliability and efficiency of the shed will be used and new materials to prolong the life of the shed will be tested. The new materials will be tested after all repairs are completed on a smaller section of the shed and if successful, will be expanded to other sections. Major repairs are necessary for any large piece of equipment in order to continue reliable, efficient day to day operations and maintain compliance with environmental regulations.

2700-PM-AQ0004 Rev. 5/2001

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY

AIR POLLUTION CONTROL ACT COMPLIANCE REVIEW FORM

Fully and accurately provide the following information, as specified. Attach additional sheets as necessary.

Type of Compliance Review Form Submittal (check all that apply)

☐ Original Filing
☒ Amended Filing

Date of Last Compliance Review Form Filing:
10/27/4

Type of Submittal

☒ New Plan Approval
☐ Extension of Plan Approval
☐ Other: ____________________
☐ New Operating Permit
☐ Change of Ownership
☐ Renewal of Operating Permit
☐ Periodic Submission (@ 6 mo.s)

SECTION A: GENERAL APPLICATION INFORMATION

Name of Applicant/Permittee/("applicant")
(non-corporations-attach documentation of legal name)
U. S. Steel Corporation, Mon Valley Works (including Edgar Thomson and Irvin Plants and Clairton Plant)

Address PO Box 878
Dravosburg, PA 15034

Telephone (412) 233-1015 **Taxpayer ID#** ____________

Permit, Plan Approval or Application ID#

Identify the form of management under which the applicant conducts its business (check appropriate box)

☐ Individual
☐ Municipality
☐ Proprietorship
☒ Public Corporation
☐ Private Corporation
☐ Syndicate
☐ Municipal Authority
☐ Fictitious Name
☐ Partnership
☐ Limited Partnership
☐ Government Agency
☐ Joint Venture
☐ Association
☐ Other Type of Business, specify below:

Describe below the type(s) of business activities performed.

United States Steel Corporation manufactures and sells a wide variety of steel sheet, plate, tubular, and tin products; coke and taconite pellets; and coal chemicals.

SECTION B. GENERAL INFORMATION REGARDING "APPLICANT"

If applicant is a corporation or a division or other unit of a corporation, provide the names, principal places of business, state of incorporation, and taxpayer ID numbers of all domestic and foreign parent corporations (including the ultimate parent corporation), and all domestic and foreign subsidiary corporations of the ultimate parent corporation with operations in Pennsylvania. Please include all corporate divisions or units, (whether incorporated or unincorporated) and privately held corporations. (A diagram of corporate relationships may be provided to illustrate corporate relationships.) Attach additional sheets as necessary.

Unit Name	Principal Places of Business	State of Incorporation	Taxpayer ID	Relationship to Applicant
United States Steel	USA	Delaware	25-1897152	Parent
	Europe		Pa Direct Pay # 00401	
	Canada			

SECTION C. SPECIFIC INFORMATION REGARDING APPLICANT AND ITS "RELATED PARTIES"

Pennsylvania Facilities. List the name and location (mailing address, municipality, county), telephone number, and relationship to applicant (parent, subsidiary or general partner) of applicant and all Related Parties' places of business, and facilities in Pennsylvania. Attach additional sheets as necessary.

Unit Name	Street Address	County and Municipality	Telephone No.	Relationship to Applicant
Clairton Plant	400 State Street	Allegheny/Clairton	(412) 233-1015	Self
Edgar Thomson Plant	13th Street and Braddock Avenue	Allegheny/Braddock	(412) 273-4730	Self
Irvin Plant	PO Box 878	Allegheny/Dravosburg	(412) 675-7381	Self
Fairless Plant	Pennsylvania Avenue	Bucks/Fairless Hills	(215) 736-4000	Sister Plant

Provide the names and business addresses of all general partners of the applicant and parent and subsidiary corporations, if any.

Name	Business Address
N/A	

List the names and business address of persons with overall management responsibility for the process being permitted (i.e. plant manager).

Name	Business Address
Anton Lukac	P.O. Box 878, Dravosburg, PA 15034

Plan Approvals or Operating Permits. List all plan approvals or operating permits issued by the Department or an approved local air pollution control agency under the APCA to the applicant or related parties that are currently in effect or have been in effect at any time 5 years prior to the date on which this form is notarized. This list shall include the plan approval and operating permit numbers, locations, issuance and expiration dates. Attach additional sheets as necessary.

Air Contamination Source	Plan Approval/ Operating Permit#	Location	Issuance Date	Expiration Date
See Attached List	See Attached List	Clairton Works	See Attached List	See Attached List
See Attached List	See Attached List	Edgar Thomson Plant	See Attached List	See Attached List
See Attached List	See Attached List	Irvin Plant	See Attached List	See Attached List
Fairless Plant	#09-00006	Fairless Plant	08/21/2007	08/21/2012

Compliance Background. (Note: Copies of specific documents, if applicable, must be made available to the Department upon its request.) List all documented conduct of violations or enforcement actions identified by the Department pursuant to the APCA, regulations, terms and conditions of an operating permit or plan approval or order by applicant or any related party, using the following format grouped by source and location in reverse chronological order. Attach additional sheets as necessary. See the definition of "documented conduct" for further clarification. Unless specifically directed by the Department, deviations which have been previously reported to the Department in writing, relating to monitoring and reporting, need not be reported.

Date	Location	Plan Approval/ Operating Permit#	Nature of Documented Conduct	Type of Departmen t Action	Status: Litigation Existing/Continuing or Corrected/Date	Dollar Amount Penalty
02/28/05	Clairton	Article XXI	Battery Emissions	SOV	Final	$11,150
05/10/05	Clairton	Article XXI	Battery Emissions	SOV	Final	$4125
01/06/06	Clairton	Article XXI	Battery Emissions	SOV	Final	$16,200
03/24/06	Clairton	Article XXI	Battery Emissions	SOV	Final	$11,950
05/08/06	Clairton	Article XXI	Battery Emissions	SOV	Final	$3,800
08/16/06	Clairton	Article XXI	Battery Emissions	SOV	Final	$29,300
02/20/07	Clairton	Article XXI	Battery Emissions	SOV	Final	$4,050
05/25/07	Clairton	Article XXI	Battery Emissions	SOV	Final	$1,725
06/01/07	Clairton	Article XXI	Battery & PEC Emissions	NOV	Final	$395,900
08/30/07	Clairton	Article XXI	Battery Emissions	SOV	Final	$2,700
11/29/07	Clairton	Article XXI	Battery Emissions	SOV	Final	$3,050
06/10/05	Edgar Thomson	Article XXI	BOP	SOV	Final	$3425

List all incidents of deviations of the APCA, regulations, terms and conditions of an operating permit or plan approval or order by applicant or any related party, using the following format grouped by source and location in reverse chronological order. This list must include items both currently known and unknown to the Department. Attach additional sheets as necessary. See the definition of "deviations" for further clarification.

Date	Location	Plan Approval/ Operating Permit#	Nature of Deviation	Incident Status: Litigation Existing/Continuing Or Corrected/Date
10/04 - 12/07	Edgar Thompson	Article XXI	BOP roof VE	see compliance plan
10/04 - 12/07	Edgar Thompson	Article XXI	LMF	see compliance plan
10/04 – 12/07	Edgar Thompson	Article XXI	BOP Stack	See compliance plan
10/04 – 12-07	Edgar Thompson	Article XXI	Mixer	See compliance plan
10/04 - 12/07	Clairton	Article XXI	Pushing & travel VE	see compliance plan
10/04 - 12/07	Clairton	Article XXI	Stacks VE	see compliance plan
10/04 - 12/07	Clairton	Article XXI & Permit #0052-I003	#3 Screening Station	see compliance plan
10/04 - 12/07	Clairton	Article XXI	B PEC Baghouse	see compliance plan
02/07 – 12/07	Irvin	Article XXI & Permit # 0050	See attached	See attached

<u>CONTINUING OBLIGATION</u>. Applicant is under a continuing obligation to update this form using the Compliance Review Supplemental Form if any additional deviations occur between the date of submission and Department action on the application.

AIR POLLUTION CONTROL ACT COMPLIANCE REVIEW FORM

I George F. Babcoke , being duly sworn according to the law depose and state, under penalty of law as provided in 18 Pa. C.S. §4944 and Section 9(b)(2) of the Air Pollution Control Act, 35 P.S. §4009(b)(2), that I am the representative of the Applicant/Permittee, identified above, authorized to make this affidavit. I further state that the information provided with this form, after reasonable inquiry, is true and complete to the best of my belief and that there are reasonable procedures in place to insure that documented conduct and deviations are identified and made part of the compliance review information contained in the Compliance Review Form. *

Signature

George F. Babcoke

Name (Print or Type)

Vice President, Plant Operations

Title

Sworn to and subscribed before me this _____ day of _____, _____.

Notary Public

Affix Corporate Seal and
Attach Copy of Articles of Incorporation
(For Corporations, see Instructions, Instruction 4, regarding corporate seal and signatures.)

* The information contained in this Compliance Review Form submittal covers the period of July 16, 2003 through September 30, 2004 and excludes exceedances of emission standards resulting from breakdowns reported per Article XXI, Section 2108.01(c), and except for clarifications for quench water, cooling tower water, big plug doors, and coal pulverizer enclosures at Clairton Works,

Schedule M: Schedule of Compliance

United States Steel Corporation
Edgar Thomson Plant
BOP
(Roof Monitor, Scrubber Stack & Mixer Baghouse)
January 2, 2008

Description	Milestone Date*	
1. Submit summary of the engineering evaluation to determine the cause of the BOP roof emissions to ACHD.	January 31, 2006	Complete
2. Submit installation permit application to ACHD for the upgrade to the BOP roof monitor fugitive emission control system.	February 10, 2006	Complete
3. Installation permit appealed	September 11, 2006	Complete
4. Appealed issue resolved. Appeal withdrawn.	January 15, 2007	Complete
5. Final permit issued.	January 4, 2007	Complete
6. U. S. Steel capital appropriation finalized.	~~Two months after installation permit issued by ACHD~~ February 20, 2007	Complete
7. Submit revised compliance plan to ACHD based on final appropriation which will include dates for beginning of on-site construction, completion of construction, shakedown period and compliance.	~~Three months after installation permit is issued by ACHD~~ April 4, 2007	Complete
8. Begin on-site construction of upgrade to the emission capture system.	April 30, 2007	Complete
9. Retain consultant to conduct engineering study of the mixer baghouse and the gas cleaning system.	January 31, 2008	
10. Develop and implement enhanced operating and maintenance program for the mixer baghouse.	February 29, 2008	
11. Develop and implement enhanced operating and maintenance program for the gas cleaning system.	March 31, 2008	
12. Complete engineering study of the mixer baghouse and revise plan, if required.	May 31, 2008	
13. Completion of construction of upgrade to the emission capture system.	June 30, 2008	

14. Complete engineering study of the gas cleaning system and revise plan, if required.	August 31, 2008	
15. End of shakedown period of upgrade to the emission capture system.	November 30 2008	
16. Complete upgrade to the emission capture system and demonstrate compliance at the BOP.	December 31, 2008	

*An interim milestone date, which is missed, is not a violation provided that the final compliance date(s) are met.

Schedule M: Schedule of Compliance

United States Steel Corporation
Edgar Thomson Plant
BOP
(Roof Monitor, Scrubber Stack & Mixer Baghouse)
January 2, 2008

Issue:

A review of current monitoring data indicates that continuous compliance cannot be maintained with the ACHD opacity limit at the BOP Shop roof monitor.

Citation:

ACHD Article XXI, §2104.01(a)

Compliance Plan Description:

BOP Shop roof visible emissions occur when process fumes escape the shop building.

The compliance plan contains a requirement for the submittal of an installation permit application to ACHD for an upgrade to the existing fugitive emission control system for the BOP Shop roof monitor. Within two months of ACHD issuing the installation permit, U. S. Steel will appropriate the funds required for the project. Within three months of ACHD issuing the installation permit, U. S. Steel will submit a revised compliance with detailed information for project construction. Compliance will be achieved by December 31, 2008.

Schedule M: Schedule of Compliance

United States Steel Corporation
Edgar Thomson Plant
Caster Louvers (LMF Emissions)
January 2, 2008

Description	Milestone Date*	
1. Retain engineering consultant(s) to evaluate the cause(s) of LMF emissions and identify options for compliance.	Complete	
2. Submit summary of the engineering evaluation to evaluate options for the LMF to ACHD.	January 31, 2008	
3. Develop and implement an enhanced operating and maintenance program for the LMF baghouse.	March 31, 2008	
3. Complete engineering for the upgrade to the LMF baghouse.	June 30, 2008	
4. Submit installation permit application to ACHD for the upgrade to the LMF baghouse.	August 31, 2008	
5. U. S. Steel capital appropriation finalized.	One month after installation permit issued by ACHD	
6. Submit revised compliance plan to ACHD based on final appropriation which will include dates for beginning of construction, completion of construction, shakedown period and completion of project.	Two months after installation permit issued by ACHD	
7. Completion of project.	December 31, 2009**	

*An interim milestone date, which is missed, is not a violation provided that the final compliance date(s) are met. This final date is also contingent on receiving a timely installation permit.
** Date contingent upon issuance of installation permit and will be in step 6.

Schedule M: Schedule of Compliance

United States Steel Corporation
Edgar Thomson Plant
Caster Louvers (LMF Emissions)
January 2, 2008

Issue:

A review of current monitoring data indicates that intermittent non-compliance exist with the ACHD opacity limit at the Caster Louvers located on the south wall of the Caster facility.

Citation:

ACHD Article XXI, §2104.01(a) Permit No. 90-I-003-P

Compliance Plan Description:

Caster Louver emissions occur when emissions from the LMF operations draft up to the Cast floor and escape the building.

The compliance plan contains a requirement for performing an engineering evaluation to determine the causes of the emission and options for reduction, submitting a summary or the causes, and submittal of an updated compliance plan to correct the intermittent non-compliance.