AP42 Section: **12.2 Coke Production**

Title: **Comments and correspondence to 5th edition supplement**

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November 25, 1998

Mr. Ron Myers
Emission Factor and Inventory Group (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

Re: AP-42 Comment Review and Section(s) Revision
EPA Purchase Order No. 7D-1554-NALZ
MRI Project No. 4864

Dear Mr. Myers:

This letter confirms transmittal of draft AP-42 Section No. 12.2--Coke Production, and the associated revised draft background report. The electronic files (Wordperfect 6.1) for these two documents are being transmitted to you by email. Also enclosed is a brief note identifying some changes made by MRI (in consultation with RTI) during our final review/revision of the draft document; please review these changes. If you have any questions, please call me at 851-8181, extension 5224.

Sincerely,

for Brian Shrager
Project Leader

Enclosures

cc: J. Turner (RTI)
Project File

November 25, 1998

To: Ron Myers

From: Roy Neulicht

RE: Changes to AP-42 Section 12.2, Coke Production

This is a brief summary of some of the major changes I made during my review of the draft document. I consulted with Jim Turner and Brian on these. See attached mark -up pages.

1. Figures12.2-2 and 12.2-3. There were some blank SCC's that were competed based upon SCC's used in the AP-42 tables. Note also that the SCC for combustion stacks appeared as -06 and-17 in the text. According to Jim Turner -17 is correct and these figures were changed accordingly.

2. Pages 12.2-12; I added an insert to clarify calculation of emissions for lids and offtakes relative to equation for doors, since the calculations for these sources do not include an "empty" factor. It is my understanding that you are going to make additional revisions to these calculations; I have enclosed a copy of the text from before my insert was added. If you need to review some previous versions, please let us know; we have "a file" of the various mark-ups.

3. Table 12.2-2. I changed footnote "d" from "BSO:PM ratio of 1.2 for charging and 1.1 for leaks" to "PM:BSO ratio of 0.8 for charging and 0.9 for leaks." I made this change to be consistent with the ratios as they were listed in Table 12.2.-5; I thought it was confusing to show two different ratios....figured we did not need to be testing user's math skills. I believe I also made this change some where in the text, also.

4. Table 12.2-3. Added footnote "b" identifying control level as "pre-NESHAP."

5. Table 12.2-6. Changed SCC for bypassed coke oven gas to -99; it was shown as -17 (combustion gas); this change also was made on Figure 12.2-2, which had been blank.

6. Table 12.2-8; corrected equation in footnote "l".

7. Tables 12.2-11, 12, 13, 14. Reformatted for "clarity".

8. Table 12.2-18. Revised footnote "b" to clarify that emissions are controlled by fabric filter system.

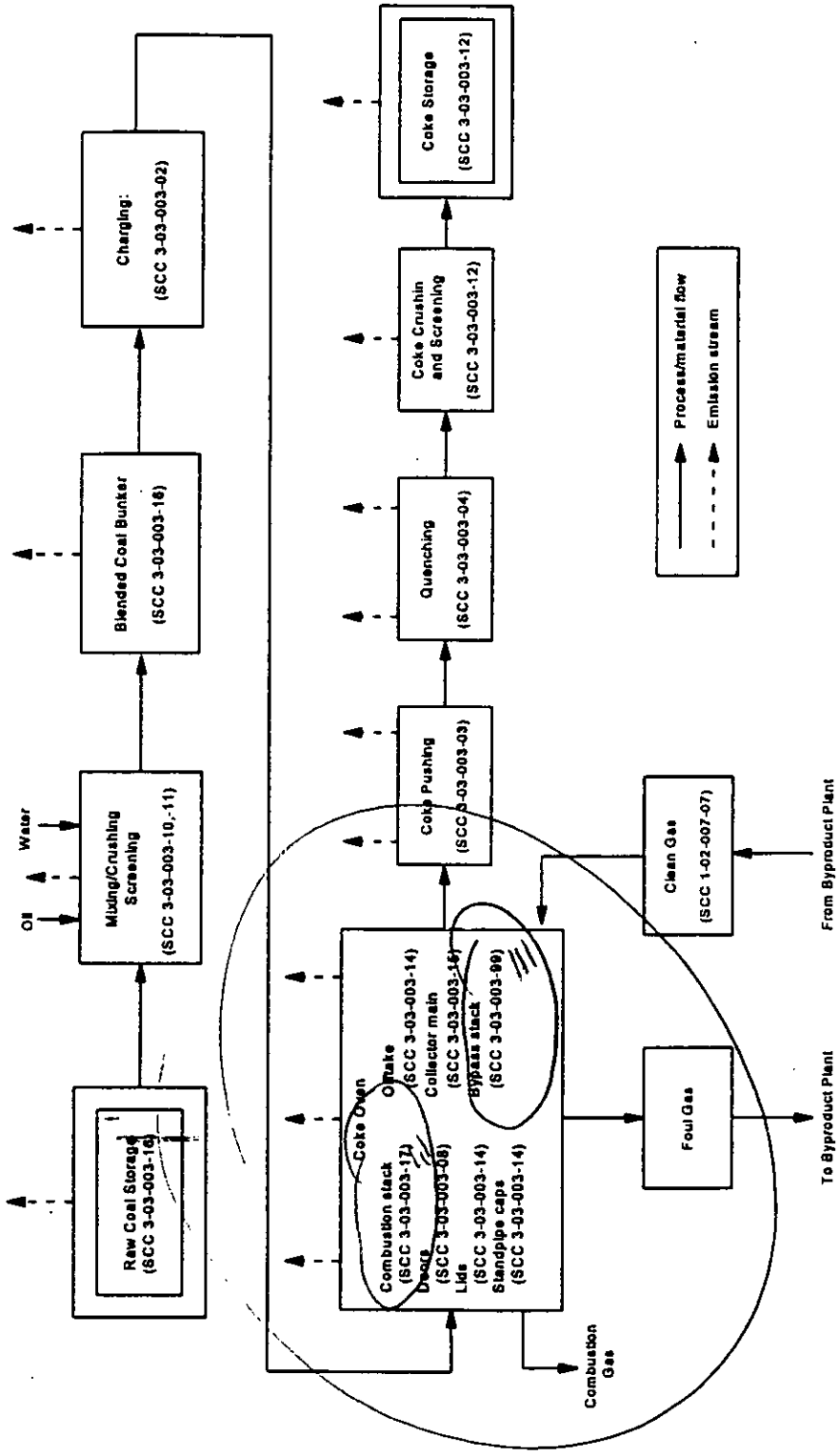

Figure 12.2-2. Flow diagram for byproduct coke production.
(Source Classification Code in parentheses.)

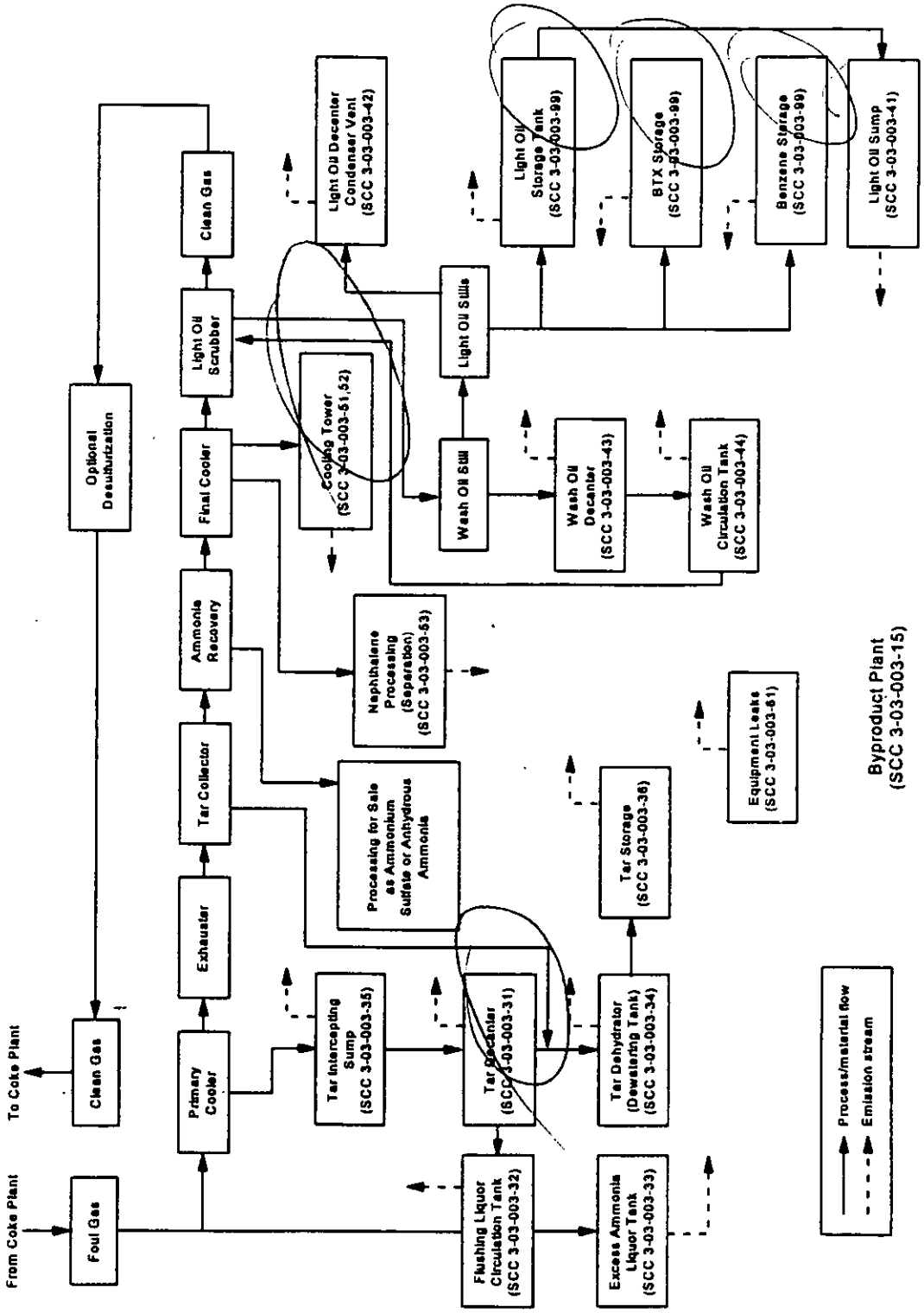

Figure 12.2-3. Flow diagram for coke byproduct recovery plant. (Source Classification Code in parentheses.)

For the purposes of presenting emission factors for coke oven charging, door leaks, lid leaks, and offtake leaks, emission control levels are categorized as uncontrolled, pre-national emission standard for hazardous air pollutants (NESHAP) controls, and post-NESHAP controls. Uncontrolled pertain to the control level that characterized coke ovens up to the 1980s; pre-NESHAP controls pertains to the level of control prior to the effective date of the NESHAP for coke ovens (40 CFR part 63, subpart L); and post-NESHAP controls refer to the level of control required by the NESHAP. Table 12.2-1 summarizes these control levels.

The emission factors available for coking operations for criteria pollutants, HAPs, and VOCs are given in Table 12.2-2, Table 12.2-3, Table 12.2-4, Table 12.2-5, Table 12.2-6, Table 12.2-7, Table 12.2-8, Table 12.2-9, Table 12.2-10, Table 12.2-11, Table 12.2-12, Table 12.2-13, and Table 12.2.-14. Table 12.2-15 presents particle size information for coking operations; these particle-size data were obtained primarily in the 1970s and may not represent current practice.

With the exception of the factors for uncontrolled charging and uncontrolled door leaks, the emission factors for leaks and charging given in Table 12.2.2 are based on an average or typical battery. These emission factors may be useful if site-specific information (other than capacity) is not available for the battery. The preferred approach for a specific battery is to use the actual number of emission points on the battery and historical data for control of visible emissions, such as the annual average percent of the doors that leak. This emission estimating approach for batteries with low levels of visible leaks (5 percent leaking doors or offtakes and 1 percent leaking lids) is outlined below for BSO emissions; emissions of other pollutants can be estimated by the ratio of the pollutant to BSO as presented in Table 12.2-5.

Door, lid, and offtake leaks

$$E_D = [PLD/100 \times N_D \times 0.027] + [(1-(PLD/100)) \times N_D \times 0.0044]$$

where

E_D = BSO emission rate, kg/hr;

PLD = average percent leaking doors;

N_D = total number of doors on battery; and

0.027 = typical door leak rate for visibly leaking doors, kg/hr.

0.0044 = door leak rate for doors without visible leaks, kg/hr

Modified (see old version ATTACHED)

Similarly, estimations can be made for lid leaks as follows:

$$E_L = PLL \times N_L \times 0.0033$$

where

E_L = BSO emission rate, kg/hr;
PLL = average percent leaking lids;
N_L = total number of lids on battery; and
0.0033 = typical lid leak rate, kg/hr.

Offtake leaks can be estimated using the same equation as for lid leaks and an emission rate of 0.0033 kg/hr per offtake leak.

Charging

$$E_C = N_T/T \times 0.0042 \times (VE \div 10)$$

where

E_C = BSO emission rate, kg/hr;
N_T = total number of ovens on battery;
T = coking cycle time, hr;
0.0042 = typical emission rate per charge, kg/charge; and
VE = average seconds of visible emissions per charge.

Nonrecovery Coke Production — For the nonrecovery process, emissions from pushing and quenching are ~~expected~~ to be similar in composition and quantity to those from by-product cokemaking. There are no emissions from leaking doors because the ovens are maintained under a negative pressure. There are no charging port lids or coke oven gas offtakes on the nonrecovery batteries. Some emissions occur when the coal is charged into the oven by a drag conveyor, and these emissions are usually minimized by maintaining a high draft on the oven and charging as quickly as possible. One of the nonrecovery batteries has been equipped with a capture hood positioned over the open door through which the coal is charged. During charging, emissions are captured by the hood and sent to a fabric filter (baghouse) for cleaning.

For the purposes of presenting emission factors for coke oven charging, door leaks, lid leaks, and offtake leaks, emission control levels are categorized as uncontrolled, pre-national emission standard for hazardous air pollutants (NESHAP) controls, and post-NESHAP controls. Uncontrolled pertain to the control level that characterized coke ovens up to the 1980s; pre-NESHAP controls pertains to the level of control prior to the effective date of the NESHAP for coke ovens (40 CFR part 63, subpart L); and post-NESHAP controls refer to the level of control required by the NESHAP. Table 12.2-1 summarizes these control levels.

The emission factors available for coking operations for criteria pollutants, HAPs, and VOCs are given in Table 12.2-2, Table 12.2-3, Table 12.2-4, Table 12.2-5, Table 12.2-6, Table 12.2-7, Table 12.2-8, Table 12.2-9, Table 12.2-10, Table 12.2-11, Table 12.2-12, Table 12.2-13, and Table 12.2-14, and Table 12.2-15 presents particle size information for coking operations. These particle-size data were obtained primarily in the 1970s and may not represent current practice.

With the exception of the factors for uncontrolled charging and uncontrolled door leaks, the emission factors for leaks and charging given in Table 12.2.2 are based on an average or typical battery. These emission factors may be useful if site-specific information (other than capacity) is not available for the battery. The preferred approach for a specific battery is to use the actual number of emission points on the battery and historical data for control of visible emissions, such as the annual average percent of the doors that leak. This emission estimating approach for batteries with low levels of visible leaks (5 percent leaking doors or offtakes and 1 percent leaking lids) is outlined below for BSO emissions; emissions of other pollutants can be estimated by the ratio of the pollutant to BSO as presented in Table 12.2-5.

Door leaks

$$E_D = [PLD/100 \times N_D \times 0.027] + [(1-(PLD/100)) \times N_D)) \times 0.0044]$$

where

E_D = BSO emission rate, kg/hr;

PLD = average percent leaking doors;

N_D = total number of doors on battery; and

0.027 = typical door leak rate, kg/hr.

Similar estimations can be made for lid or offtake leaks using a leak rate of 0.0033 kg/hr per lid or offtake leak.

Charging

$$E_C = N_T/T \times 0.0042 \times (VE \div 10)$$

where

E_C = BSO emission rate, kg/hr;
N_T = total number of ovens on battery;
T = coking cycle time, hr;
0.0042 = typical emission rate per charge, kg/charge; and
VE = average seconds of visible emissions per charge.

Nonrecovery Coke Production — For the nonrecovery process, emissions from pushing and quenching are expected to be similar in composition and quantity to those from by-product cokemaking. There are no emissions from leaking doors because the ovens are maintained under a negative pressure. There are no charging port lids or coke oven gas offtakes on the nonrecovery batteries. Some emissions occur when the coal is charged into the oven by a drag conveyor, and these emissions are usually minimized by maintaining a high draft on the oven and charging as quickly as possible. One of the nonrecovery batteries has been equipped with a capture hood positioned over the open door through which the coal is charged. During charging, emissions are captured by the hood and sent to a fabric filter (baghouse) for cleaning.

Emissions also occur from the combustion stack of nonrecovery batteries. These emissions include PM, SO_2, NO_x, and other compounds typical of combustion gas. Significant levels of volatile organics and BSO have not been found, probably due to the high combustion temperatures, adequate oxygen, and a residence time of several seconds in the combustion system. Tables 12.2-16 and Table 12.2-17 present the emission factors for nonrecovery coking combustion stacks. Table 12.2-18 presents emission factors for nonrecovery charging.

Byproduct Recovery — Emissions from the byproduct recovery plant are primarily organic vapors such as benzene and other light aromatics, POM, cyanides, phenols, and light oils. These emissions occur

Draft Table 12.2-2 (Metric And English Units).
TYPICAL EMISSION FACTORS FOR COKE PRODUCTION: OVEN LEAKS AND CHARGING[a]

EMISSION FACTOR RATING: E

Source[b]	Filterable PM[c]		BSO[d]	
	kg/Mg	lb/ton	kg/Mg	lb/ton
Charging (SCC 3-03-003-02)				
Uncontrolled[e]	0.35	0.70	0.44	0.88
Scrubber[f]	0.0070	0.014	ND	ND
Pre-NESHAP controls[f]	0.0020	0.0040	0.0027	0.0053
Post-NESHAP controls[f]	0.00021	0.00040	0.00025	0.00050
Door leaks[g] (SCC 3-03-003-08)				
Uncontrolled[h]	0.25	0.50	0.28	0.55
Pre-NESHAP controls[f]	0.010	0.020	0.022	0.044
Pre-NESHAP controls[j]	0.033	0.066	--	--
Post-NESHAP controls[f]	0.012	0.023	0.012	0.023
Lid leaks[f,g] (SCC 3-03-003-14)				
Uncontrolled	0.012	0.023	0.013	0.026
Pre-NESHAP controls	0.0032	0.0065	0.0032	0.0065
Post-NESHAP controls	0.000043	0.000086	0.000045	0.000089
Offtake leaks[f,g] (SCC 3-03-003-14)				
Uncontrolled	0.023	0.045	0.025	0.050
Pre-NESHAP controls	0.0030	0.0060	0.0030	0.0060
Post-NESHAP controls	0.00014	0.00029	0.00015	0.00029

[a] Emission factor units are kg/Mg and lb/ton of coal charged unless otherwise specified. SCC = Source Classification Code. ND = no data.
[b] Refer to Table 12.2-1 for summary of uncontrolled, pre-NESHAP, and post-NESHAP control levels.
[c] Filterable PM is that PM collected on or before the filter of an EPA Method 5 (or equivalent) sampling train.
[d] BSO = benzene soluble organics. The BSO and filterable PM estimates are based on a ratio of PM:BSO of 0.8 for charging and 0.9 for leaks.
[e] References 7-8,11.
[f] Derived as described in Reference 5. Based on the model battery described in Reference 5 charging 492,000 Mg/yr of coal.
[g] For low levels of visible emissions, site-specific estimates of current emissions should be based on the average number of leaks or seconds of visible emissions from charging. Estimate BSO as follows:
Average number of doors visibly leaking x 0.027 + average number of doors without visible leaks x 0.0044 = door leak emission rate, kg/hr;
Average number of lids leaking x 0.0033 = lid leak emission rate, kg/hr;
Average number of offtakes leaking x 0.0033 = offtake leak emission rate, kg/hr: and
Average number of charges/hr x (seconds of emissions ÷ 10) x 4.2 x 10^{-3} = charging emission rate, kg/hr.
[h] References 3-4,6,11.
[j] Reference 166; emission factor units converted from lb/ton of coke pushed using a factor of 0.69.

Draft Table 12.2-3. (Metric Units)
EMISSION FACTORS FOR COKE PRODUCTION: DOOR LEAKS--SO_2, NO_x, TOC, CO[a]

EMISSION FACTOR RATING: E

Operation	SO_2	NO_x	TOC (as propane)	CO
Door leaks (SCC 3-03-003-08) Controlled[b]	0.020	0.0007	0.0028	0.011

[a] Reference 166. Emission factor units are kg/Mg of coal charged, converted from lb/ton of coke pushed using a factor of 0.345. SCC = Source Classification Code.

[b] Pre-NESHAP control.

Draft Table 12.2-4 (English Units)
EMISSION FACTORS FOR COKE PRODUCTION: DOOR LEAKS--SO_2, NO_x, TOC, CO[a]

EMISSION FACTOR RATING: E

Operation	SO_2	NO_x	TOC (as propane)	CO
Door leaks (SCC 3-03-003-08) Controlled[b]	0.039	0.0013	0.0055	0.021

[a] Reference 166. Emission factor units are lb/ton of coal charged, converted from lb/ton of coke pushed using a factor of 0.69. SCC = Source Classification Code.

[b] Pre-NESHAP control.

Added Footnote

Draft Table 12.2-5. RATIOS OF OTHER POLLUTANTS TO BSO

Pollutant	Ratio To BSO[a]	Derived From Reference No.
Filterable PM (leaks)[b]	0.9	6
Filterable PM (charging)[b]	0.8	7,8
Condensible PM (leaks)[c]	0.9	6
Condensible PM (charging)[c]	0.9	8
VOC[d]	2.2	9
TOC[e]	5.2	9
Acetylene	0.009	9
Ammonia	0.15	9
Benzene	0.5	9
Butadiene	0.009	10[f]
Butane	0.02	9
Butene	0.07	9
Carbon dioxide	0.5	9
Carbon disulfide	0.001	10
Carbon monoxide	1.1	9
Carbonyl sulfide	0.001	10
Ethane	0.3	9
Ethylene	0.4	9
Heavy hydrocarbons	0.8	9
Hydrogen cyanide	0.05	9
Hydrogen sulfide	0.15	9
Metals		
arsenic	2×10^{-7}	10
mercury	2×10^{-7}	10
selenium	2×10^{-7}	10
Methane	2.7	9
Methylethyl benzene	0.003	10
Naphthalene	0.2	9
Pentene	0.01	9
Propane	0.03	9
Propylene	0.08	9
Propyne	0.003	10
Solvents	0.02	9
Tar acids	0.02	9
Tar bases	0.01	9
Tar oil	0.02	9
Thiophenes	0.003	10

DRAFT

Draft Table 12.2-6 (English Units).
EMISSION FACTORS FOR COKE PRODUCTION: BYPASSED COKE OVEN GAS[a]
(SCC 3-03-003-99)

EMISSION FACTOR RATING: E

Pollutant	Uncontrolled	Flared
Benzene soluble organics (BSO)	44	ND
Filterable PM[b]	40	ND
Condensible PM[c]	40	ND
Carbon monoxide	48	4.8
Carbon dioxide	21	780
Hydrogen sulfide	6.6	0.10
Ammonia	6.5	0.065[d]
Hydrogen cyanide	2.1	0.021[d]
Heavy hydrocarbons	35	1.7
Sulfur dioxide	0	13
Methane	120	1.2[d]
Ethane	12	0.12[d]
Propane	1.1	0.010[d]
Butane	0.70	0.0070[d]
Ethylene	17	0.17[d]
Propylene	3.5	0.035[d]
Butene	2.9	0.029[d]
Pentene	0.60	0.0060[d]
Benzene	22	0.22[d]
Toluene	1.9	0.019[d]
Xylene	0.20	0.0020[d]
Acetylene	0.40	0.0040[d]
Tar acids (CxHxOH)	0.70	0.0070[d]
Tar bases (CxHxN)	0.50	0.0050[d]
Solvents	0.70	0.0070[d]
Naphthalene	7.0	0.07[d]
Tar oil	1.0	0.010[d]

[a] Reference 9. SCC = Source Classification Code. ND = no data. Factor units are lb/ton of coal charged and are used to estimate emissions of bypassed coke oven gas that is vented directly to atmosphere or flared as required by the NESHAP. To estimate total emissions per episode, multiply emission factor by average coal usage rate (ton/hr) and duration of venting episode in hours. To obtain emission factor units of kg/Mg of coal charged, multiply table values by 0.5.

[b] Filterable PM is that PM collected on or before the filter of an EPA Method 5 (or equivalent) sampling train.

[c] Condensible PM is that PM collected in the impingers portion of a PM sampling train.

[d] Emissions after flaring are considered as "trace". The factors are based on an assumed 99 percent destruction.

Draft Table 12.2-8 (cont.).

[h] References 121,143,149-150,153,155,161,165,170; emissions captured by hood.
[j] References 135, 148; foundry coke, emissions captured by hood.
[k] References 15-17; emission factor units are kg/Mg and lb/ton of coke pushed.
[l] For quench water having a TDS value between those for clean and dirty water, an interpolation procedure is suggested. For example, for a quench water TDS value of 1,000 mg/L, for a properly maintained tower of normal height, the following PM emission factor would be found:
[(1,000 - 500)/(1,500 - 500)] x [(0.54 - 0.31) + 0.31] = 0.425 lb/ton of coal. Corrected equation
[m] Reference 28.
[n] Reference 28; dirty water: 5,000 mg/L or more total dissolved solids.
[p] Reference 13; clean water: 500 mg/L or less; dirty water: about 1,500 mg/L or more total dissolved solids.
[q] A wide range of emissions is possible, depending on the condition of the oven, from black smoke in cracked ovens to clear stacks in well maintained ovens.
[r] References 34,45,56-65,70-71,76-78,80-82,84-89,91,98,106-109,114,123,156-157,159,166,169-170, 176.
[s] Reference 34.
[t] References 34,45.
[u] References 34,84-89.

Draft Table 12.2-11 (Metric Units).
EMISSION FACTORS FOR COKE PRODUCTION: COMBUSTION STACKS--PM, CO_2, TOC, BENZENE, METHANE, ETHANE, BENZO(a)PYRENE[a]
(SCC 3-03-003-17)

Pollutant	No. of Sources	Emission Factor Rating	Emission Factor Range	Emission Factor, kg/Mg	References
PM-10	1	E	--	0.029	166
Condensible inorganic PM	6	D	0.044-0.37	0.13	84,87,89,98,157
Condensible organic PM	3	D	0.0019-0.085	0.030	87,98
CO_2	35	B	55-550	165	(a)
TOC as propane	6	D	0.0026-0.31	0.070	156,157,166, 170,176
Benzene[b]	1	E	--	0.015	89
Methane	1	E	--	0.039	176
Ethane	1	E	--	0.0020	176
Benzo(a)pyrene	1	E	--	1.9×10^{-5}	176

[a] References 56-65,70-71,76-78,80-82,98,106-109,123,156-157,159,166,169-170,176.
[b] Controlled with fabric filter.

Emission factor units are kg/Mg of coal charged.

Delete Columns

Draft Table 12.2-13.(Metric Units).
EMISSION FACTORS FOR COKE PRODUCTION: CONTROLLED PUSHING--CONDENSIBLE INORGANIC PM, CO, CO_2, NO_x, TOC[a]
(SCC 3-03-003-03)

Control	Condensible Inorganic PM	CO	CO_2	NO_x	TOC (as propane)
Emission factor rating	E	--	C	--	--
Hooded quench car with venturi scrubber	0.007[b]	--	7[c]	--	--
Emission factor rating[c]	E	E	D	E	E
Hood with fabric filter Metallurgical coke Foundry coke[f]	 -- 0.019	 0.023[d] --	 2.2[e] 15	 0.009[d] --	 0.0012[d] --

[a] Emission factor units are kg/Mg of coal charged.
[b] Reference 48.
[c] References 93-97,124-126,128,130,144,147.
[d] Reference 170.
[e] References 155,161,165,170.
[f] Reference 148.

Draft Table 12.2-14 (English Units).
EMISSION FACTORS FOR COKE PRODUCTION: CONTROLLED PUSHING--CONDENSIBLE INORGANIC PM, CO, CO_2, NO_x, TOC[a]
(SCC 3-03-003-03)

Control	Condensible Inorganic PM	CO	CO_2	NO_x	TOC (as propane)
Emission factor rating	E	--	C	--	--
Hooded quench car with venturi scrubber	0.013[b]	--	14[c]	--	--
Emission factor rating[c]	E	E	D	E	E
Hood with fabric filter Metallurgical coke Foundry coke[f]	 -- 0.037	 0.046[d] --	 4.3[e] 29	 0.018[d] --	 0.0023[d] --

[a] Emission factor units are lb/ton of coal charged.
[b] Reference 48.
[c] References 93-97,124-126,128,130,144,147.
[d] Reference 170.
[e] References 155,161,165,170.
[f] Reference 148.

Draft Table 12.2-18 (Metric And English Units).
EMISSION FACTORS FOR COKE PRODUCTION: NONRECOVERY CHARGING[a]
(SCC 3-03-003-02)

EMISSION FACTOR RATING: D

Pollutant	Uncontrolled Emissions		Controlled Emissions[b]	
	kg/Mg	lb/ton	kg/Mg	lb/ton
Filterable PM[c]	0.013	0.027	0.0041	0.0081
TSO[d]	0.0013	0.0026	0.0011	0.0022
Benzene	1.8×10^{-5}	3.6×10^{-5}	1.8×10^{-5}	3.6×10^{-5}
Toluene	8.4×10^{-6}	1.7×10^{-5}	8.4×10^{-6}	1.7×10^{-5}
Xylene	3.4×10^{-6}	6.7×10^{-6}	3.4×10^{-6}	6.7×10^{-6}
Carbon disulfide	1.1×10^{-6}	2.1×10^{-6}	1.1×10^{-6}	2.1×10^{-6}
Chloromethane	1.0×10^{-6}	2.0×10^{-6}	1.0×10^{-6}	2.0×10^{-6}
Ethyl benzene	3.6×10^{-7}	7.3×10^{-7}	3.6×10^{-7}	7.3×10^{-7}
Naphthalene	1.2×10^{-5}	2.3×10^{-5}	1.2×10^{-5}	2.3×10^{-5}
Total PAHs[e]	1.4×10^{-5}	2.7×10^{-5}	1.1×10^{-5}	2.1×10^{-5}
Manganese	7.5×10^{-7}	1.5×10^{-6}	2.3×10^{-7}	4.6×10^{-7}
Arsenic	4.0×10^{-7}	7.9×10^{-7}	1.2×10^{-7}	2.4×10^{-7}
Nickel	2.5×10^{-7}	5.0×10^{-7}	7.5×10^{-8}	1.5×10^{-7}
Lead	1.7×10^{-7}	3.4×10^{-7}	5.0×10^{-8}	1.0×10^{-7}
Chromium	1.7×10^{-7}	3.4×10^{-7}	5.0×10^{-8}	1.0×10^{-7}
Cobalt	1.2×10^{-7}	2.4×10^{-7}	3.6×10^{-8}	7.1×10^{-8}
Beryllium	1.5×10^{-8}	2.9×10^{-8}	4.4×10^{-9}	8.7×10^{-9}
Mercury	1.3×10^{-9}	2.6×10^{-9}	4.0×10^{-10}	7.9×10^{-10}

[a] References 5,21. Emission factor units are kg/Mg and lb/ton of coal charged. SCC = Source Classification Code.
[b] Fabric filter control system; based on estimated 70 percent capture efficiency and analysis of baghouse catch as described in Reference 5.
[c] Filterable PM is that PM collected on or before the filter of an EPA Method 5 (or equivalent) sampling train.
[d] Toluene soluble organics.
[e] Polyaromatic hydrocarbons.

Revised Footnote to clarify controlled = Fabric Filter System

Comments from Ron Myers on Coke ovens Comment/response log.

Emission Factor and Inventory Group
Emissions Monitoring and Analysis Division (MD-14)
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711
FAX Number: (919) 541-0684

FAX TRANSMISSION

Date: _____

To: Bryan Schragen (MRI)

NAME	PHONE NUMBER
Jim Turner (RTI)	951-3232
COMPANY/OFFICE	FAX NUMBER 990-8600

From:

NAME	PHONE NUMBER
Ron Myers	541-5407

COMMENTS:

See attached

Number of Pages (including cover sheet): 16

If you did not receive all the pages, please contact the following person:

Name: _____ **Phone Number:** _____

RESPONSES TO PUBLIC COMMENTS ON AP-42 COKE MANUFACTURE CHAPTER

Comments received on the AP-42 draft chapter for coke manufacture (Chapter 12.2) are summarized below. Responses to the comments are also given. The comments and responses are divided by subject. Commenters are identified by the following acronyms or names.

American Coke and Coal Chemicals Institute	ACCCI
American Iron and Steel Institute	AISI
Jefferson County (AL) Health Department	JCHD
Bethlehem Steel Corporation	Bethlehem
Jewell Smokeless Coal Corporation	Jewell
Allegheny County (PA) Health Department	ACHD

A. LEAKS AND CHARGING EMISSIONS

Comment A-1: (ACCCI/AISI) The commenter believes that emission factors for coke ovens at uncontrolled, pre-NESHAP, and post-NESHAP LEVELS should not be listed. Control levels and emission estimates based on an average or typical plant should be deleted and/or revised.

Response A-1: The EPA agrees that the emission estimates given for uncontrolled and pre-NESHAP do not represent the current control levels that have been achieved by the industry, which have resulted in significant reductions in emissions over the past several years. The uncontrolled and pre-NESHAP levels are presented only because they may be useful for purposes other than estimating current emission levels, such as estimating emissions from batteries in other countries that may have poor emission control or for estimating emissions for some period in the past (e.g., estimating the trends in emission reduction). The EPA also agrees that reductions were occurring in the 1980s in the pre-NESHAP period, and many batteries probably had better emission control than that indicated by the "pre-NESHAP" emission estimates given in the draft document. However, the Background Information Document for the NESHAP provides an estimate of the "baseline" based on State regulations that were in place prior to the NESHAP. Consequently, the "pre-NESHAP" emission estimates are based on the regulations that were in place rather than the varying levels of emission control that different batteries were achieving at the time. Additionally, support for any emission factor is no better than an order of magnitude because there are no measured emissions data at the level of control of the NESHAP.

Comment A-2: The commenter recommends that leak and charging emissions be estimated from actual battery design and performance data rather than from a typical battery.

luting), new door designs, and adjustments to the door or seal to reduce leakage.

As stated in the BID, the model was based on self sealing doors that rely on the condensation of tar to seal gaps gradually after the oven is charged. However, many batteries are using supplemental sealants to reduce doors leaks in order to meet the low levels of percent leaking doors (PLD) currently required by the NESHAP. Consequently, the theoretical basis for the exponential model does not apply to these batteries. Another complication is that the NESHAP does not distinguish between large leaks and small leaks -- any size leak from a door is counted as a door leak. When a supplemental sealant is used, the easiest leaks to seal quickly with the sealant are small leaks. Larger quantities and reapplication are required for large leaks. For these reasons, the exponential model is not applicable when supplemental sealants or hand luting are used to assist in reducing door leaks. In addition, a door leak may occur after charging that is a very heavy leak that perhaps would not self seal for several hours. However, the operator may adjust the door or seal to reduce the gap size and the leakage rate. In this case, the model could underestimate emissions by not accounting for the very high leak rate prior to door adjustment.

The BID clearly states that the exponential model (with an exponent of 2.5) becomes inappropriate for levels below 10 PLD (see page 3-48). The exponent is predicted to change at about 10 PLD (the model becomes more linear), and the model is not appropriate for low levels of PLD.

The model was used in the late 1970s and early 1980s to estimate the emission reductions that would be achieved if doors leaks were reduced from 12 to 15 percent to 5 to 10 percent. (For example, State limits in Pennsylvania were 10 percent excluding 2 door leaks, which is about 12 PLD, and limits in Alabama were 15 PLD). After promulgation of the much lower limits in the coke oven NESHAP, batteries currently are achieving very low levels of PLD (many are averaging below 5 PLD). The exponential model is not applicable at these current levels, and the BID clearly states that the model becomes linear (i.e., emissions rates as a function of PLD) for low levels of PLD. [The model is not applicable for low percent leaking doors (a low PLD means that the sealing time following charging is short) because it is based on the constant small positive pressure that is reached and maintained in the oven 0.5 to 1 hour after charging. For short sealing times or low percent leaking doors, the oven pressures may still be quite high, which would result in

probably more reasonable than using the model, especially when considering the variations in plume size that are seen. If the exponential model is applied to the current situation of very low levels of PLD, the estimates from the model would presume that all of the door leaks are only small wisps.

The exponential model uses a theoretical extrapolation from high levels of door leaks to low levels, and this great extrapolation introduces significant uncertainty. The only data available at the time the model was developed showed door leak rates on the order of 0.2 to 0.7 kg BSO/hr per leaking door (when the percent leaking doors was in the range of 29 to 70 percent). The model extrapolates these measured values down to theoretical levels that give emission rates that are 10 to 100 times lower than the measured emission rates (assuming door leaks are much smaller at current levels of control).

Another complication is that not all door leaks are visible. The model would predict no emissions when PLD is measured as zero. However, EPA data indicate that doors are leaking even when they are not visible from the yard. (Method 303 inspections are made from the yard and not from a close inspection of the doors.) EPA studies showed that when doors are observed more closely (e.g., from the bench rather than the yard), more leaks are seen. The coke oven NESHAP also acknowledges this observation and allows a correction factor of 6 PLD when doors are inspected from the bench (under cokeside sheds). For example, if the inspection measured 6 PLD from the bench, the actual reported PLD (yard equivalent) would be 0 PLD. The model would estimate no emissions, but the inspector saw 6 percent of the doors leaking!

Comment A-3b: (ACCCI/AISI) The commenter recommends that the emission estimating approach presented in the BID be used for AP-42 because it was developed through a process that involved numerous meetings, public technical advisory committee meetings, and public hearings.

Response A-3b: Prior to 1990, industry representatives, the trade association, and contractors hired by the industry to review EPA's work criticized the exponential model and the emission estimates. They argued that it was unvalidated and overestimated the emission reduction that would be achieved by any new national standards. An example is the report "A Critical Review of EPA's Background Information Document for NESHAP on Coke Oven Charging, Door Leaks, and Topside Leaks for Wet-Coal Charged Batteries" prepared by TRC Environmental Consultants, Inc. for the American Iron and Steel Institute and submitted to

Response A-4: The EPA agrees to revise the emission estimates for lid and offtake leaks and to use the procedure presented in the BID. The emission estimate are based on the average emission rate of small and large leaks.

Comment A-5: (ACCCI/AISI) The commenter believes that the emission factor for charging is 20 percent too high. The exponential model from the BID should be used, and the facility should be allowed to take credit for reduced mass emissions when the seconds of charging emissions are reduced.

Response A-5: The value of 5 g/charge in the AP-42 estimate was taken from Table 3-6 of the BID as the midrange from two exponential models (the range was 2 to 8 g/charge). The commenter recommends a value of 4.2 g/charge based on the midrange value given in Table 7-1 for an arithmetic average of 10 s/charge (corresponding to an emission limit of 16 s expressed as a log average). Considering that the uncertainty is at least a factor of 10 (i.e., actual emissions may be a factor of 10 higher or lower), the change does not make much difference. The EPA agrees to use a value of 4.2 g/charge and to acknowledge the great amount of uncertainty in the estimate. This quantity will be associated with an arithmetic average of 10 s/charge. Site-specific variations in performance can be accommodated by an adjustment in the quantity of BSO per charge that is proportional to the seconds of visible emissions per charge.

The exponential model for charging emissions has all of the problems described for the door leak exponential model and more. It is completely speculative and the uncertainty is acknowledged in the BID as being great (orders of magnitude). Consequently, the simplified approach presented in AP-42 was recommended because it is easy to use and there is no loss in accuracy.

Comment A-6: (JCHD) The commenter believes that the emission factors for coke oven leaks and charging based on Method 303 inspections of byproduct coke plants are too low. He bases his assertion on the argument that daily inspections are performed over a short duration, are almost never time varied, and may thus be biased below true plant performance.

Response A-6: The commenter offered no data to support his belief that Method 303 inspection results are not representative. In the absence of better data, these daily inspections provide the best information on the number of leaks at a given battery and offer a means to perform site-specific emission estimates. Additionally, facilities with the daily inspections that are significantly biased low with respect to true plant performance are in jeopardy of being found in non-compliance with the NESHAP.

The procedures for estimating door, lid, and offtake leaks and for charging have been modified to give BSO directly, from which other compounds in Table 12.2.3 can be estimated. Double counting should not be inferred from the table.

Comment A-12: (JCHD) Does AP-42 consider the use by some plants of large quantities (thousands of gallons) of diesel oil mixed with the coal before charging.

Response A-12: No data are available to provide emission factor adjustments for diesel oil addition. Emissions may change in proportion to battery performance changes associated with the diesel oil addition.

Comment A-13: (JCHD) The commenter requests clarification of filterable matter and condensible values in deriving criteria pollutants from BSO values.

Response A-13: Table 4-10 of the background document and 12.2.3 of the emission factors document provide ratios of BSO to several compounds. However, criteria pollutants are not included in the list. No procedure is given with which to estimate criteria pollutants from the listed BSO ratios. Definitions of filterable particulate matter and condensible particulate matter are given in the tables and are discussed in the introduction to AP-42.

Comment A-14: (Bethlehem) The commenter suggests that another reason for declining industry is the more economical purchase of foreign coke.

Response A-14: This additional reason for decline is added to section 12.2.1 of the emission factors document.

Comment A-15: (Bethlehem) The commenter suggests adding text to section 12.2-6 regarding longer coking times used under some circumstances. He also suggests added text for clarifications in several places.

Response A-15: Section 12.2-6 is changed to include reasons for extended coking times such as decreased production. The clarifying text is also added.

Comment A-16: (Jewell) Several text additions and table corrections are suggested, primarily for non-recovery coking.

Response A-16: The suggested additions and corrections are included in the revised documents.

Comment A-21: (ACHD) Stack tests in Allegheny County suggest uncontrolled coke oven gas emissions are less than 0.1 lb/ton rather than the value of 0.47 lb/ton listed in Table 12.2-7 of the emission factors document.

Response A-21: The experience in Allegheny County is noted. However, in the absence of supporting data, the value of 0.47 lb/ton is retained.

Comment A-22: (ACHD) The commenter suggests simplifying the leak equations to, for example, 0.05 x (no. of leaking doors) x (charging rate) for door leaks.

Response A-22: Based on other comments and consideration of the original equations, revisions to the leak equations are made that estimate BSO emissions from leaks in terms of the number of oven doors, the percentage of doors that leak, and a typical door leak rate. This equation form allows estimation of any compound for which a BSO ratio is available. The equation also allows adjustment for known site-specific leak rates.

B. COKE PUSHING, QUENCHING, AND BATTERY UNDERFIRING

Comment B-1a: (ACCCI/AISI) The commenter believes that older emission factors for pushing should not be used. Present pushing emissions are significantly less than at the time of the tests used for the listed emission factors.

Response B-1a: Pushing emission factors have been revised to include results of additional test data.

Comment B-1b: (ACCCI/AISI) The commenter suggests cautioning the reader that BSO speciation ratios given in Table 12.2-3 are only for oven charging and door/topside leaks, not for pushing.

Response B-1b: Cautions have been added in the emission factor chapter and in its supporting document.

Comment B-2: (ACCCI/AISI) The commenter suggests a revision to the definitions of clean and dirty quenching water for the category of tall towers and/or poor maintenance: clean water should be less than 1,050 mg/L total dissolved solids (TDS) and dirty water should be greater than 9,850 mg/L TDS. The commenter also suggests that linear interpolation between emission factors be used for intermediate values of TDS.

Response B-2: The definitions for clean and dirty water have been reviewed and changed as appropriate. An interpolation

Part of the process of revising the AP-42 Section is the evaluation of all factors [redacted] in the FIRE database. Factors with supporting data or a reasonable technical basis will replace existing factors in FIRE. [redacted] The remaining factors in FIRE will be evaluated for reasonableness.

Response B-7: It is EPA's belief that the FIRE values may not be correct and may lack supporting data. Without the supporting data, the original values are retained. Those factors which are not unreasonable will be retained with a "U" rating. The remainder will be deleted.

C. SOAKING

Comment C-1: (ACCCI/AISI, JCHD, Bethlehem, ACHD) One commenter suggests that Leney's method in estimating soaking emissions is flawed because of improper assumptions and the method should be replaced by an estimation procedure developed by LTV company. Leney's method assumes, among other things, that standpipe emissions during soaking do not ignite or are not ignited. Bethlehem suggests removing the CO emission factor. ACHD suggests using 244 lb CO/oven and 0.044 lb SO_2/ton.

Response C-1: EPA prefers to use Leney's method with revisions for combustion of escaping oven gases. During periods of soaking it is assumed that 80 percent control is obtained due to combustion of the gases from open standpipes. Instead of Leney's 1.2 pounds of particulate matter below 10 μm (PM10) per push from 16 tons of coal coked, emissions are estimated at 0.24 lb/16 tons. On a unit basis, the emission factor is 0.015 lb PM10/ton of coal charged. [Ron, is this change what you meant in your comment?] Revised emission factors based on this value for total PM, SO_2, NO_x, VOC, and CO are presented in the draft chapter and background document.

Yes, as long as the remainder is reasonable.

D. DECARBONIZATION

Comment D-1: (ACCCI/AISI) The commenter contends that the draft emission factor for decarbonization is three to four orders of magnitude too high. Data presented by the commenter suggest that the draft emission factor should be reduced to 0.009 lb CO/ton of coal charged from 29 lb CO/ton of coal charged.

Response D-1: While a considerable amount of data were presented by the commenter, EPA was unable to verify them through inspection of the test reports associated with the tests from which the data were derived. The commenter also made assumptions about the quantity of decarbonizing offgas that was converted to CO_2 from CO. Until EPA is able to review test reports and to verify or support the commenter's assumptions, the emission factor remains at 29 lb CO/ton of coal charged.

E. BYPRODUCT PLANTS

Comment E-1: (ACCCI/AISI) The commenter believes that the draft benzene and VOC emission factors are too high, not

Response G-1: The only emission factors available are for coal crushing controlled by cyclone or rotoclone, primary and secondary coal pulverizers with building enclosures, coke screening, and coke handling controlled with a cyclone. Table 4-12 in the background document and Table 12.2.6 in the emission factors document present these emission factors. The data for coal crushing controlled by a rotoclone, pulverization, and coke screening are additions to the draft documents.

H. BYPRODUCT PLANT

Comment H-1: (Bethlehem) The commenter suggests that the byproduct plant description is outdated and should be revised to reflect current practice. He also believes the emission factors should be revised based on new measurements for plants complying with subparts L and FF (40 CFR 61).

Response H-1: Because the descriptions of byproduct plants in the background and emission factor documents are used for historical purposes and for non-U.S. plants as well as current U.S. plants, the basic descriptions are retained. However comments are added to the text and illustrations to show trends in post-NESHAP plants. In the absence of supportable data, no changes are made to the emission factors.

I. GENERAL COMMENTS

Comment I-1: (ACHD) The commenter suggest numerous clarifying or corrective additions and changes to text and tables in the emission factors document.

Response I-1: Most of the suggested changes are made to the emission factors document (and , as applicable, to the background document). Suggested changes not made are generally discussed in responses to comments given above.

Comment I-2: (ACHD) The commenter requests additional emission factors for soaking, decarbonizing, pushing emission control baghouses, traveling hot cars, pushing emission control baghouse and fugitives, and uncontrolled pushes.

Response I-2 Changes to emission factors for soaking and decarbonizing are discussed in the responses to comments C-1 and D-1 above. Additional emission factors are available for hooded quench cars and pushing emissions controlled by baghouses. No usable data are available for the remaining operations.

Response A-2: (ACCCI/AISI) The EPA agrees that the use of site-specific data on battery design, operation, and performance should result in improved emission estimates, and this approach will be incorporated into AP-42. However, the traditional way of presenting emission factors in AP-42 (i.e., mass normalized by throughput, such as lb/ton) will also be retained because some users of AP-42 may not have basic design and performance data for a given battery.

The revision relies on site-specific data in terms of emission control performance, such as the monthly or annual average number of doors that leak on a given battery. For example, if a battery has data from inspections that show the annual average number of doors that leak, then that number of leaks can be multiplied by an average or representative leak rate for a leaking door to estimate emissions. A similar approach is incorporated for lid and offtake leaks based on the average number that are leaking. For charging, an alternate approach is presented similar to that used in the background information document (BID) that supports the NESHAP for coke ovens: *Coke Oven Emissions from Wet-Coal Charged Byproduct Coke Oven Batteries - Background Information for Proposed Standards*, EPA-450/3-85-028a, U.S. Environmental Protection Agency, Research Triangle Park, NC. April 1987. The method is based on the number of charges per year, the average seconds of emissions per charge, and the grams of BSO emitted per charge (expressed as a function of the seconds of visible emissions).

Comment A-3a: (ACCCI/AISI, JCHD, Bethlehem, ACHD) The commenters believe that the emission estimating procedure for door leaks is not supported by data or valid models and should use the exponential model that was developed in the late 1970s and was presented in the background information document (BID) for the Coke Oven NESHAP. Experience from Burns Harbor and Lackawanna plant retrofits should have been considered (Bethlehem). More clarification would be helpful regarding the relationships among BSO and filterable, condensible, and total PM (ACHD).

Response A-3a: There are several reasons why the exponential model is not appropriate for estimating emissions from doors leaks considering current techniques for controlling these emissions and the levels of control that are being achieved. Details are given below.

- The theoretical model is based solely on the self-sealing mechanism and does not consider the current widespread use of supplementary sealants (such as sodium silicate or hand

much higher leak rates (for a given gap size) than those leaks that are seen after the oven pressure has dropped.]

- Even when or if the exponential model is applicable, it is used in a way that underestimates emissions because the estimates are based on an arithmetic average for percent leaking doors.

To illustrate this with an example, assume that the model is applicable and that emissions can be estimated from the exponential relationship:

$$E = a\ (PLD)^{2.5}$$

where E = emission rate, a = constant, and PLD = percent leaking doors. Assume that 3 door leak inspections measured values of 5 PLD, 10 PLD, and 15 PLD for an average of 10 PLD. When the emission estimates are based on a battery's average performance, the emissions would be:

$$E = a\ (10)^{2.5} = \mathbf{316\ a.}$$

However, if the exponential model is appropriate, the average emission rate **should** be calculated from the average emissions of the 3 levels of PLD:

$E = [a\ (5)^{2.5} + a\ (10)^{2.5} + a\ (15)^{2.5}]/\ 3 = [56\ a + 316\ a + 871\ a]/3 =$ **414 a.**

In all cases, emissions estimated from a single arithmetic average **will be lower** than the average estimate determined from the various levels of PLD using the exponential model. Most plants will have available some long term measure of PLD expressed as an arithmetic average and would find it cumbersome to estimate annual emissions from 365 different values of PLD (collected from the daily inspections).

- Considering the uncertainty in any estimates of emissions from door leaks, the exponential model provides a false sense of accuracy. The use of an average or typical leak rate for a leaking door is just as accurate and is simpler to use.

The exponential model is not validated, primarily because of the difficulties of measuring door leak emissions and the lack of good data. It has the potential to underestimate emissions significantly for low levels of PLD. Using a typical leak rate (or a range of leak rates to represent the uncertainty) is

EPA on November 24, 1982. The report is critical of all of EPA's models and approaches for estimating emissions, including charging and topside leaks as well as door leaks. There has been no industry endorsement of the BID approach during public hearings or during the regulatory negotiations. The emission estimating procedure was never discussed as an issue during the negotiations.

Comment A-3c: (ACCCI/AISI) The commenter believes that the data in the ENSR report (Phase I) should not be used to estimate emissions from doors leaks because it was only a method validation study. The ENSR Phase II study shows that the emissions from small leaks are more than a factor of two lower than the emission factor presented in the draft AP-42 document.

Response A-3c: There are perhaps some problems with the study, but the results confirm what other tests have shown: there is a great deal of variability and uncertainty in quantifying the mass emission rate from these fugitive leaks, and the range of these rates can cover an order of magnitude. Almost all of the available reports and studies have significant problems with them because of the difficulty of capturing and accurately measuring highly variable emission rates. The problem is compounded by the tendency of the organic particulate matter (which is tarry material) to condense on capture devices and sampling equipment. The EPA is grateful for the commenter providing additional data from the second phase of the ENSR/AISI study. These data are considered in developing an improved emission estimate for door leaks. The only other data available are for heavy door leaks, which show emission rates that are over 10 times higher than those measured by ENSR for small leaks.

After reviewing the additional data and considering the theoretical model predictions, the EPA agrees that the estimated door leak rate could be revised from 0.05 to 0.02 kg/hr. This estimated leak rate is a technical judgement of a reasonable midrange value; consequently, the AP-42 document acknowledges the uncertainty and states that actual emissions may be much higher or lower. For example, the leak rate of 0.02 kg/hr presumes the leaks at current levels of emission control are small, and if heavy door leaks occur (such as those in Class 3 or 4 in the ENSR study), emissions would be much higher.

Comment A-4: (ACCCI/AISI) The commenter states that the estimates for lid and offtake leaks are high. The estimates from the BID should be used.

Comment A-7: (JCHD) The commenter suggests that a means for using individual plant performance be found for estimating door and topside leaks and charging emissions based on Method 303 (which measures seconds of visible emissions).

Response A-7: The emission factors and estimation methods given in Table 4-9 of the background document and Table 12.2.2 of the emission factors document have been revised. Average annual number of leaks or seconds of visible emissions from charging can be used for site-specific estimates of emissions as explained in the tables.

Comment A-8: (JCHD) Certain emission points have not been addressed, for example, NO_x for doors, but older versions of AP-42 have such information. How should the reader estimate emissions for these cases?

Response A-8: New data have been submitted for several emission points. These data are now included in the emission factor tables.

Comment A-9: (JCHD) The commenter finds that the uncontrolled door leak emission factor for filterable PM in Table 4-9 of the background document and Table 12.2.2 of the emission factor document should be 0.25 kg/Mg of coal charged. He also asks for references to the this value and values for lids and offtakes.

Response A-9: The value has been changed. Sources for the emission factor values are given in the revised tables.

Comment A-10: (JCHD) The commenter asks if SO_x [in clean coke oven gas] can be estimated from knowledge of H_2S concentration in the clean coke oven gas and the ratio of H_2S to BSO given in Tables 4-10 and 12.2.3. Should other sulfur compounds be speciated from BSO values?

Response A-10: No data are available to substantiate using such a procedure. Given the reducing atmosphere present in the coke oven, the amount of oxidation of sulfur compounds leaving the oven is problematic.

Comment A-11: (JCHD) The commenter asks for more background and instruction for using speciation values in Table 12.2.3 so that double counting or omissions can be avoided.

Response A-11: The background document now contains more information about BSO and the relation to emission quantities.

Comment A-17: (ACHD) The commenter asks for more guidance as to when condensible PM is a particulate, a separate pollutant, or a VOC.

Response A-17: Guidance is given in the footnotes to Table 4-10 of the background document and Table 12.2-3 in the emission factors document; discussion is also given in the introduction to the emission factors document. Because filterable PM is the portion (the front half) of the Method 5 train that is typically used for regulatory purposes, it is reported in Tables 4-9 of the background document and Table 12.2.2 of the emission factors document. Using the BSO emission factors in the tables, and the ratios of BSO to filterable PM and to condensible PM in Tables 4-10 and 12.2-3, condensible emissions can be estimated when needed. Similarly, VOC or other other pollutants can be estimated when needed. These estimates apply only to charging, door leaks and topside leaks.

Comment A-18: (ACHD) Can AP-42 specify which pollutants are likely to be adsorbed on PM, emitted as VOC, or neither?

Response A-18: Data are not available that answer the question. There is too much uncertainty to speculate about which pollutants take what route when being emitted.

Comment A-19: (ACHD) In the absence of particle size distribution data for leaks, does EPA agree with the Coke Oven NESHAP BID that PM10 is 94 percent of total suspended particulate (TSP)?

Response A-19: Given the method of generation, most emission points are expected to be essentially 100 percent PM10. However, pushing, quenching, and charging particulate emissions are expected to be some unknown value less than 100 percent PM10.

Comment A-20: (ACHD) Can an estimate be given of the quantity of coke oven gas (COG) vented in association with Table 12.2-4 and can emission factors be given in terms of lb/mmcf?

Response A-20: The reference given for emission factors for bypassed coke oven gas does not give the associated quantity of gas. However, Reference 11 (and Table 4-6) of the background document uses a value of 12,000 scf of coke oven gas from one ton of coal. This value is added as a footnote to Table 12.2-3 of the emission factors document. Readers can use this value to convert emission factors to a lb/mmcf basis if they do not have a site-specific value to use.

procedure is also included for facilities that measure the TDS content of their quench water.

Comment B-3 (ACCCI/AISI) The commenter believes that combustion stack emission factors do not reflect current practice and should be replaced with factors derived from more recent data.

Response B-3: Test data have been supplied that allow revisions to the emission factors. These revisions are reflected in the emission factor tables.

Comment B-4: (JCHD, ACHD) The commenters contend that emission factors for combustion stacks are based on northern plants that use desulfurization, therefore have much lower emissions than southern plants that typically do not have desulfurization (JCHD). The lack of desulfurization leading to higher emission factors is supported by ACHD.

Response B-4: The emission factors given in the draft documents have been revised upward based on receiving new data. Northern and southern plants are included in the range of test data.

Can we differentiate at least PM_{10} and SO_2 emissions for desulfurized and uncontrolled COG combustion?

Comment B-5: (Bethlehem) The commenter notes that incorrect emission factor values have been supplied for combustion stacks (Tables 4-19 and 4-20 of the background document and Tables 12.2-8 and 12.2-9 of the emission factors document). Corrected values are suggested.

Response B-5: The original values have been corrected.

Comment B-6: (Bethlehem) The VOC emission factors for pushing in Table 12.2-8 are based on old test data not representative of current practice. The emission factors should be lower.

Response B-6: No new supportable data were found for VOC emission factors. However, test data for total organic carbon (TOC) measured as propane were submitted and have been added to the table. The TOC value was 0.0023 lb/ton of coal charged compared to the older VOC value of 0.20 lb/ton of coal charged.

Comment B-7: (ACHD) The commenter believes that the emission factors for coke production, pushing, and combustion stacks for SO_x and NO_x and should be replaced with values from the FIRE database.

supported by recent data, and do not account for plant variability. He suggests using models such as EPA'a TANKS for individual plant estimates.

Response E-1: Other than for typical storage tanks in the byproduct plant, the TANKS model is not appropriate. The model does not account for such things as dissolved gases or heated input streams. Further, because of the many factors in the model developed from engineering judgement and technology transfer from data at significantly disparate conditions from those at which most U.S. batteries are performing, the uncertainties of the estimates are considered to be greater than those presented in AP-42. For estimating emissions for regulatory purposes, facilities can always use their own data as long as they are acceptable to the Administrator.

F. BYPRODUCT PLANT EQUIPMENT LEAKS

Comment F-1a: (ACCCI/AISI) The commenter believes that the draft emission factors for equipment leaks for VOCs are outdated and too high. He asserts that leak programs have significantly reduced current emissions. He suggests using the third most refined version of the 1995 EPA leak protocol document, the EPA Correlation Approach, in place of the draft emission factors.

Response F-1a: For facilities that have an effective leak detection and repair (LDAR) program, and that have screening values required by the protocol document, EPA believes the correlation approach for refineries is appropriate. Text and table footnotes are added to the background and emission factors documents to introduce use of the correlation approach. However, for facilities not having an LDAR program and screening values, the emission factors in the draft documents are retained.

Comment F-1b: (ACCCI/AISI) The commenter requests amplification of the manner in which VOC emission factors should be used in regard to inspection programs and suggests that more emphasis be given to using average emission factors for a specific facility only in the absence of leak detection data for that facility.

Response F-1b: The requested amplification and emphasis have been added to the draft chapter and to its supporting document.

G. MATERIALS HANDLING

Comment G-1: (JCHD, ACHD) Are emission factors available for materials handling total suspended particulate (TSP)?

COKE OVEN EMISSION REPORT REVIEW SUMMARY

255 source test reports from various emission points of byproduct coke production were reviewed and 92 were found to contain sufficient data to calculate emission factors. Those 92 reports represent a total of 104 sources tested for various pollutants. The following criteria were used in the evaluation of each test report:

- the use of appropriate test methodologies
- presentation of original/field data
- completeness of the data package (ie inclusion of lab reports, sample calculations)
- presentation of process description and process operation variables needed to calculate emission factors
- the number of sources presented in each report

The emission points that are noted in the reports include but were not limited to:

- pushing emissions
- quenching emissions
- combustion stack emissions

An approximate breakdown of the data into pollutant specific groups yields the following:

98% of the reports were particulate testing including some data for condensables and sulfates
2% of the reports included CO_2, CO, and NO_X data
1% of the reports were POM/PAH testing

The reports were not reviewed for data quality or checked for errors, they were checked to make sure they contained the key pieces of information needed to calculate emission factors.

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Date: June 29, 1998

Subject: Completion of Selected Sections of AP-42,
EPA Purchase Order No. 7D-1554-NALX
MRI Project 4864

From: Brian Shrager BLS

To: Ron Myers
EPA/EFIG/EMAD (MD-14)
U. S. Environmental Protection Agency
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Enclosed is the final draft comment and response log (prepared by RTI) for the coke production AP-42 section. Following your review, RTI will prepare the final AP-42 background report and AP-42 section. Please call me at 851-8181, ext. 5224, if you have any questions.

RESPONSES TO PUBLIC COMMENTS ON AP-42 COKE MANUFACTURE CHAPTER

Comments received on the AP-42 draft chapter for coke manufacture (Chapter 12.2) are summarized below. Responses to the comments are also given. The comments and responses are divided by subject. Commenters are identified by the following acronyms or names.

American Coke and Coal Chemicals Institute	ACCCI
American Iron and Steel Institute	AISI
Jefferson County (AL) Health Department	JCHD
Bethlehem Steel Corporation	Bethlehem
Jewell Smokeless Coal Corporation	Jewell
Allegheny County (PA) Health Department	ACHD

A. LEAKS AND CHARGING EMISSIONS

Comment A-1: (ACCCI/AISI) The commenter believes that emission factors for coke ovens at uncontrolled, pre-NESHAP, and post-NESHAP LEVELS should not be listed. Control levels and emission estimates based on an average or typical plant should be deleted and/or revised.

Response A-1: The EPA agrees that the emission estimates given for uncontrolled and pre-NESHAP do not represent the current control levels that have been achieved by the industry, which have resulted in significant reductions in emissions over the past several years. The uncontrolled and pre-NESHAP levels are presented only because they may be useful for purposes other than estimating current emission levels, such as estimating emissions from batteries in other countries that may have poor emission control or for estimating emissions for some period in the past (e.g., estimating the trends in emission reduction). The EPA also agrees that reductions were occurring in the 1980s in the pre-NESHAP period, and many batteries probably had better emission control than that indicated by the "pre-NESHAP" emission estimates given in the draft document. However, the Background Information Document for the NESHAP provides an estimate of the "baseline" based on State regulations that were in place prior to the NESHAP. Consequently, the "pre-NESHAP" emission estimates are based on the regulations that were in place rather than the varying levels of emission control that different batteries were achieving at the time. Additionally, support for any emission factor is no better than an order of magnitude because there are no measured emissions data at the level of control of the NESHAP.

Comment A-2: The commenter recommends that leak and charging emissions be estimated from actual battery design and performance data rather than from a typical battery.

Response A-2: (ACCCI/AISI) The EPA agrees that the use of site-specific data on battery design, operation, and performance should result in improved emission estimates, and this approach will be incorporated into AP-42. However, the traditional way of presenting emission factors in AP-42 (i.e., mass normalized by throughput, such as lb/ton) will also be retained because some users of AP-42 may not have basic design and performance data for a given battery.

The revision relies on site-specific data in terms of emission control performance, such as the monthly or annual average number of doors that leak on a given battery. For example, if a battery has data from inspections that show the annual average number of doors that leak, then that number of leaks can be multiplied by an average or representative leak rate for a leaking door to estimate emissions. A similar approach is incorporated for lid and offtake leaks based on the average number that are leaking. For charging, an alternate approach is presented similar to that used in the background information document (BID) that supports the NESHAP for coke ovens: *Coke Oven Emissions from Wet-Coal Charged Byproduct Coke Oven Batteries - Background Information for Proposed Standards*, EPA-450/3-85-028a, U.S. Environmental Protection Agency, Research Triangle Park, NC. April 1987. The method is based on the number of charges per year, the average seconds of emissions per charge, and the grams of BSO emitted per charge (expressed as a function of the seconds of visible emissions).

Comment A-3a: (ACCCI/AISI, JCHD, Bethlehem, ACHD) The commenters believe that the emission estimating procedure for door leaks is not supported by data or valid models and should use the exponential model that was developed in the late 1970s and was presented in the background information document (BID) for the Coke Oven NESHAP. Experience from Burns Harbor and Lackawanna plant retrofits should have been considered (Bethlehem). More clarification would be helpful regarding the relationships among BSO and filterable, condensible, and total PM (ACHD).

Response A-3a: There are several reasons why the exponential model is not appropriate for estimating emissions from doors leaks considering current techniques for controlling these emissions and the levels of control that are being achieved. Details are given below.

- The theoretical model is based solely on the self-sealing mechanism and does not consider the current widespread use of supplementary sealants (such as sodium silicate or hand

luting), new door designs, and adjustments to the door or seal to reduce leakage.

As stated in the BID, the model was based on self sealing doors that rely on the condensation of tar to seal gaps gradually after the oven is charged. However, many batteries are using supplemental sealants to reduce doors leaks in order to meet the low levels of percent leaking doors (PLD) currently required by the NESHAP. Consequently, the theoretical basis for the exponential model does not apply to these batteries. Another complication is that the NESHAP does not distinguish between large leaks and small leaks -- any size leak from a door is counted as a door leak. When a supplemental sealant is used, the easiest leaks to seal quickly with the sealant are small leaks. Larger quantities and reapplication are required for large leaks. For these reasons, the exponential model is not applicable when supplemental sealants or hand luting are used to assist in reducing door leaks. In addition, a door leak may occur after charging that is a very heavy leak that perhaps would not self seal for several hours. However, the operator may adjust the door or seal to reduce the gap size and the leakage rate. In this case, the model could underestimate emissions by not accounting for the very high leak rate prior to door adjustment.

- The BID clearly states that the exponential model (with an exponent of 2.5) becomes inappropriate for levels below 10 PLD (see page 3-48). The exponent is predicted to change at about 10 PLD (the model becomes more linear), and the model is not appropriate for low levels of PLD.

The model was used in the late 1970s and early 1980s to estimate the emission reductions that would be achieved if doors leaks were reduced from 12 to 15 percent to 5 to 10 percent. (For example, State limits in Pennsylvania were 10 percent excluding 2 door leaks, which is about 12 PLD, and limits in Alabama were 15 PLD). After promulgation of the much lower limits in the coke oven NESHAP, batteries currently are achieving very low levels of PLD (many are averaging below 5 PLD). The exponential model is not applicable at these current levels, and the BID clearly states that the model becomes linear (i.e., emissions rates as a function of PLD) for low levels of PLD. [The model is not applicable for low percent leaking doors (a low PLD means that the sealing time following charging is short) because it is based on the constant small positive pressure that is reached and maintained in the oven 0.5 to 1 hour after charging. For short sealing times or low percent leaking doors, the oven pressures may still be quite high, which would result in

much higher leak rates (for a given gap size) than those leaks that are seen after the oven pressure has dropped.]

- Even when or if the exponential model is applicable, it is used in a way that underestimates emissions because the estimates are based on an arithmetic average for percent leaking doors.

To illustrate this with an example, assume that the model is applicable and that emissions can be estimated from the exponential relationship:

$$E = a\ (PLD)^{2.5}$$

where E = emission rate, a = constant, and PLD = percent leaking doors. Assume that 3 door leak inspections measured values of 5 PLD, 10 PLD, and 15 PLD for an average of 10 PLD. When the emission estimates are based on a battery's average performance, the emissions would be:

$$E = a\ (10)^{2.5} = \mathbf{316\ a.}$$

However, if the exponential model is appropriate, the average emission rate **should** be calculated from the average emissions of the 3 levels of PLD:

$E = [a\ (5)^{2.5} + a\ (10)^{2.5} + a\ (15)^{2.5}]/\ 3 = [56\ a + 316\ a + 871\ a]/3 =$ **414 a.**

In all cases, emissions estimated from a single arithmetic average **will be lower** than the average estimate determined from the various levels of PLD using the exponential model. Most plants will have available some long term measure of PLD expressed as an arithmetic average and would find it cumbersome to estimate annual emissions from 365 different values of PLD (collected from the daily inspections).

- Considering the uncertainty in any estimates of emissions from door leaks, the exponential model provides a false sense of accuracy. The use of an average or typical leak rate for a leaking door is just as accurate and is simpler to use.

The exponential model is not validated, primarily because of the difficulties of measuring door leak emissions and the lack of good data. It has the potential to underestimate emissions significantly for low levels of PLD. Using a typical leak rate (or a range of leak rates to represent the uncertainty) is

probably more reasonable than using the model, especially when considering the variations in plume size that are seen. If the exponential model is applied to the current situation of very low levels of PLD, the estimates from the model would presume that all of the door leaks are only small wisps..

The exponential model uses a theoretical extrapolation from high levels of door leaks to low levels, and this great extrapolation introduces significant uncertainty. The only data available at the time the model was developed showed door leak rates on the order of 0.2 to 0.7 kg BSO/hr per leaking door (when the percent leaking doors was in the range of 29 to 70 percent). The model extrapolates these measured values down to theoretical levels that give emission rates that are 10 to 100 times lower than the measured emission rates (assuming door leaks are much smaller at current levels of control).

Another complication is that not all door leaks are visible. The model would predict no emissions when PLD is measured as zero. However, EPA data indicate that doors are leaking even when they are not visible from the yard. (Method 303 inspections are made from the yard and not from a close inspection of the doors.) EPA studies showed that when doors are observed more closely (e.g., from the bench rather than the yard), more leaks are seen. The coke oven NESHAP also acknowledges this observation and allows a correction factor of 6 PLD when doors are inspected from the bench (under cokeside sheds). For example, if the inspection measured 6 PLD from the bench, the actual reported PLD (yard equivalent) would be 0 PLD. The model would estimate no emissions, but the inspector saw 6 percent of the doors leaking!

Comment A-3b: (ACCCI/AISI) The commenter recommends that the emission estimating approach presented in the BID be used for AP-42 because it was developed through a process that involved numerous meetings, public technical advisory committee meetings, and public hearings.

Response A-3b: Prior to 1990, industry representatives, the trade association, and contractors hired by the industry to review EPA's work criticized the exponential model and the emission estimates. They argued that it was unvalidated and overestimated the emission reduction that would be achieved by any new national standards. An example is the report "A Critical Review of EPA's Background Information Document for NESHAP on Coke Oven Charging, Door Leaks, and Topside Leaks for Wet-Coal Charged Batteries" prepared by TRC Environmental Consultants, Inc. for the American Iron and Steel Institute and submitted to

EPA on November 24, 1982. The report is critical of all of EPA's models and approaches for estimating emissions, including charging and topside leaks as well as door leaks. There has been no industry endorsement of the BID approach during public hearings or during the regulatory negotiations. The emission estimating procedure was never discussed as an issue during the negotiations.

Comment A-3c: (ACCCI/AISI) The commenter believes that the data in the ENSR report (Phase I) should not be used to estimate emissions from doors leaks because it was only a method validation study. The ENSR Phase II study shows that the emissions from small leaks are more than a factor of two lower than the emission factor presented in the draft AP-42 document.

Response A-3c: There are perhaps some problems with the study, but the results confirm what other tests have shown: there is a great deal of variability and uncertainty in quantifying the mass emission rate from these fugitive leaks, and the range of these rates can cover an order of magnitude. Almost all of the available reports and studies have significant problems with them because of the difficulty of capturing and accurately measuring highly variable emission rates. The problem is compounded by the tendency of the organic particulate matter (which is tarry material) to condense on capture devices and sampling equipment. The EPA is grateful for the commenter providing additional data from the second phase of the ENSR/AISI study. These data are considered in developing an improved emission estimate for door leaks. The only other data available are for heavy door leaks, which show emission rates that are over 10 times higher than those measured by ENSR for small leaks.

After reviewing the additional data and considering the theoretical model predictions, the EPA agrees that the estimated door leak rate could be revised from 0.05 to 0.02 kg/hr. This estimated leak rate is a technical judgement of a reasonable midrange value; consequently, the AP-42 document acknowledges the uncertainty and states that actual emissions may be much higher or lower. For example, the leak rate of 0.02 kg/hr presumes the leaks at current levels of emission control are small, and if heavy door leaks occur (such as those in Class 3 or 4 in the ENSR study), emissions would be much higher.

Comment A-4: (ACCCI/AISI) The commenter states that the estimates for lid and offtake leaks are high. The estimates from the BID should be used.

Response A-4: The EPA agrees to revise the emission estimates for lid and offtake leaks and to use the procedure presented in the BID. The emission estimate are based on the average emission rate of small and large leaks.

Comment A-5: (ACCCI/AISI) The commenter believes that the emission factor for charging is 20 percent too high. The exponential model from the BID should be used, and the facility should be allowed to take credit for reduced mass emissions when the seconds of charging emissions are reduced.

Response A-5: The value of 5 g/charge in the AP-42 estimate was taken from Table 3-6 of the BID as the midrange from two exponential models (the range was 2 to 8 g/charge). The commenter recommends a value of 4.2 g/charge based on the midrange value given in Table 7-1 for an arithmetic average of 10 s/charge (corresponding to an emission limit of 16 s expressed as a log average). Considering that the uncertainty is at least a factor of 10 (i.e., actual emissions may be a factor of 10 higher or lower), the change does not make much difference. The EPA agrees to use a value of 4.2 g/charge and to acknowledge the great amount of uncertainty in the estimate. This quantity will be associated with an arithmetic average of 10 s/charge. Site-specific variations in performance can be accommodated by an adjustment in the quantity of BSO per charge that is proportional to the seconds of visible emissions per charge.

The exponential model for charging emissions has all of the problems described for the door leak exponential model and more. It is completely speculative and the uncertainty is acknowledged in the BID as being great (orders of magnitude). Consequently, the simplified approach presented in AP-42 was recommended because it is easy to use and there is no loss in accuracy.

Comment A-6: (JCHD) The commenter believes that the emission factors for coke oven leaks and charging based on Method 303 inspections of byproduct coke plants are too low. He bases his assertion on the argument that daily inspections are performed over a short duration, are almost never time varied, and may thus be biased below true plant performance.

Response A-6: The commenter offered no data to support his belief that Method 303 inspection results are not representative. In the absence of better data, these daily inspections provide the best information on the number of leaks at a given battery and offer a means to perform site-specific emission estimates.

Comment A-7: (JCHD) The commenter suggests that a means for using individual plant performance be found for estimating door and topside leaks and charging emissions based on Method 303 (which measures seconds of visible emissions).

Response A-7: The emission factors and estimation methods given in Table 4-9 of the background document and Table 12.2.2 of the emission factors document have been revised. Average annual number of leaks or seconds of visible emissions from charging can be used for site-specific estimates of emissions as explained in the tables.

Comment A-8: (JCHD) Certain emission points have not been addressed, for example, NO_x for doors, but older versions of AP-42 have such information. How should the reader estimate emissions for these cases?

Response A-8: New data have been submitted for several emission points. These data are now included in the emission factor tables.

Comment A-9: (JCHD) The commenter finds that the uncontrolled door leak emission factor for filterable PM in Table 4-9 of the background document and Table 12.2.2 of the emission factor document should be 0.25 kg/Mg of coal charged. He also asks for references to the this value and values for lids and offtakes.

Response A-9: The value has been changed. Sources for the emission factor values are given in the revised tables.

Comment A-10: (JCHD) The commenter asks if SO_x [in clean coke oven gas] can be estimated from knowledge of H_2S concentration in the clean coke oven gas and the ratio of H_2S to BSO given in Tables 4-10 and 12.2.3. Should other sulfur compounds be speciated from BSO values?

Response A-10: No data are available to substantiate using such a procedure. Given the reducing atmosphere present in the coke oven, the amount of oxidation of sulfur compounds leaving the oven is problematic.

Comment A-11: (JCHD) The commenter asks for more background and instruction for using speciation values in Table 12.2.3 so that double counting or omissions can be avoided.

Response A-11: The background document now contains more information about BSO and the relation to emission quantities.

The procedures for estimating door, lid, and offtake leaks and for charging have been modified to give BSO directly, from which other compounds in Table 12.2.3 can be estimated. Double counting should not be inferred from the table.

Comment A-12: (JCHD) Does AP-42 consider the use by some plants of large quantities (thousands of gallons) of diesel oil mixed with the coal before charging.

Response A-12: No data are available to provide emission factor adjustments for diesel oil addition. Emissions may change in proportion to battery performance changes associated with the diesel oil addition.

Comment A-13: (JCHD) The commenter requests clarification of filterable matter and condensible values in deriving criteria pollutants from BSO values.

Response A-13: Table 4-10 of the background document and 12.2.3 of the emission factors document provide ratios of BSO to several compounds. However, criteria pollutants are not included in the list. No procedure is given with which to estimate criteria pollutants from the listed BSO ratios. Definitions of filterable particulate matter and condensible particulate matter are given in the tables and are discussed in the introduction to AP-42.

Comment A-14: (Bethlehem) The commenter suggests that another reason for declining industry is the more economical purchase of foreign coke.

Response A-14: This additional reason for decline is added to section 12.2.1 of the emission factors document.

Comment A-15: (Bethlehem) The commenter suggests adding text to section 12.2-6 regarding longer coking times used under some circumstances. He also suggests added text for clarifications in several places.

Response A-15: Section 12.2-6 is changed to include reasons for extended coking times such as decreased production. The clarifying text is also added.

Comment A-16: (Jewell) Several text additions and table corrections are suggested, primarily for non-recovery coking.

Response A-16: The suggested additions and corrections are included in the revised documents.

Comment A-17: (ACHD) The commenter asks for more guidance as to when condensible PM is a particulate, a separate pollutant, or a VOC.

Response A-17: Guidance is given in the footnotes to Table 4-10 of the background document and Table 12.2-3 in the emission factors document; discussion is also given in the introduction to the emission factors document. Because filterable PM is the portion (the front half) of the Method 5 train that is typically used for regulatory purposes, it is reported in Tables 4-9 of the background document and Table 12.2.2 of the emission factors document. Using the BSO emission factors in the tables, and the ratios of BSO to filterable PM and to condensible PM in Tables 4-10 and 12.2-3, condensible emissions can be estimated when needed. Similarly, VOC or other other pollutants can be estimated when needed. These estimates apply only to charging, door leaks and topside leaks.

Comment A-18: (ACHD) Can AP-42 specify which pollutants are likely to be adsorbed on PM, emitted as VOC, or neither?

Response A-18: Data are not available that answer the question. There is too much uncertainty to speculate about which pollutants take what route when being emitted.

Comment A-19: (ACHD) In the absence of particle size distribution data for leaks, does EPA agree with the Coke Oven NESHAP BID that PM10 is 94 percent of total suspended particulate (TSP)?

Response A-19: Given the method of generation, most emission points are expected to be essentially 100 percent PM10. However, pushing, quenching, and charging particulate emissions are expected to be some unknown value less than 100 percent PM10.

Comment A-20: (ACHD) Can an estimate be given of the quantity of coke oven gas (COG) vented in association with Table 12.2-4 and can emission factors be given in terms of lb/mmcf?

Response A-20: The reference given for emission factors for bypassed coke oven gas does not give the associated quantity of gas. However, Reference 11 (and Table 4-6) of the background document uses a value of 12,000 scf of coke oven gas from one ton of coal. This value is added as a footnote to Table 12.2-3 of the emission factors document. Readers can use this value to convert emission factors to a lb/mmcf basis if they do not have a site-specific value to use.

Comment A-21: (ACHD) Stack tests in Allegheny County suggest uncontrolled coke oven gas emissions are less than 0.1 lb/ton rather than the value of 0.47 lb/ton listed in Table 12.2-7 of the emission factors document.

Response A-21: The experience in Allegheny County is noted. However, in the absence of supporting data, the value of 0.47 lb/ton is retained.

Comment A-22: (ACHD) The commenter suggests simplifying the leak equations to, for example, 0.05 x (no. of leaking doors) x (charging rate) for door leaks.

Response A-22: Based on other comments and consideration of the original equations, revisions to the leak equations are made that estimate BSO emissions from leaks in terms of the number of oven doors, the percentage of doors that leak, and a typical door leak rate. This equation form allows estimation of any compound for which a BSO ratio is available. The equation also allows adjustment for known site-specific leak rates.

B. COKE PUSHING, QUENCHING, AND BATTERY UNDERFIRING

Comment B-1a: (ACCCI/AISI) The commenter believes that older emission factors for pushing should not be used. Present pushing emissions are significantly less than at the time of the tests used for the listed emission factors.

Response B-1a: Pushing emission factors have been revised to include results of additional test data.

Comment B-1b: (ACCCI/AISI) The commenter suggests cautioning the reader that BSO speciation ratios given in Table 12.2-3 are only for oven charging and door/topside leaks, not for pushing.

Response B-1b: Cautions have been added in the emission factor chapter and in its supporting document.

Comment B-2: (ACCCI/AISI) The commenter suggests a revision to the definitions of clean and dirty quenching water for the category of tall towers and/or poor maintenance: clean water should be less than 1,050 mg/L total dissolved solids (TDS) and dirty water should be greater than 9,850 mg/L TDS. The commenter also suggests that linear interpolation between emission factors be used for intermediate values of TDS.

Response B-2: The definitions for clean and dirty water have been reviewed and changed as appropriate. An interpolation

procedure is also included for facilities that measure the TDS content of their quench water.

Comment B-3 (ACCCI/AISI) The commenter believes that combustion stack emission factors do not reflect current practice and should be replaced with factors derived from more recent data.

Response B-3: Test data have been supplied that allow revisions to the emission factors. These revisions are reflected in the emission factor tables.

Comment B-4: (JCHD, ACHD) The commenters contend that emission factors for combustion stacks are based on northern plants that use desulfurization, therefore have much lower emissions than southern plants that typically do not have desulfurization (JCHD). The lack of desulfurization leading to higher emission factors is supported by ACHD.

Response B-4: The emission factors given in the draft documents have been revised upward based on receiving new data. Northern and southern plants are included in the range of test data.

Comment B-5: (Bethlehem) The commenter notes that incorrect emission factor values have bee supplied for combustion stacks (Tables 4-19 and 4-20 of the background document and Tables 12.2-8 and 12.2-9 of the emission factors document). Corrected values are suggested.

Response B-5: The original values have been corrected.

Comment B-6: (Bethlehem) The VOC emission factors for pushing in Table 12.2-8 are based on old test data not representative of current practice. The emission factors should be lower.

Response B-6: No new supportable data were found for VOC emission factors. However, test data for total organic carbon (TOC) measured as propane were submitted and have been added to the table. The TOC value was 0.0023 lb/ton of coal charged compared to the older VOC value of 0.20 lb/ton of coal charged.

Comment B-7: (ACHD) The commenter believes that the emission factors for coke production, pushing, and combustion stacks for SO_x and NO_x and should be replaced with values from the FIRE database.

Response B-7: It is EPA's belief that the FIRE values may not be correct and may lack supporting data. Without the supporting data, the original values are retained.

C. SOAKING

Comment C-1: (ACCCI/AISI, JCHD, Bethlehem, ACHD) One commenter suggests that Leney's method in estimating soaking emissions is flawed because of improper assumptions and the method should be replaced by an estimation procedure developed by LTV company. Leney's method assumes, among other things, that standpipe emissions during soaking do not ignite or are not ignited. Bethlehem suggests removing the CO emission factor. ACHD suggests using 244 lb CO/oven and 0.044 lb SO_2/ton.

Response C-1: EPA prefers to use Leney's method with revisions for combustion of escaping oven gases. During periods of soaking it is assumed that 80 percent control is obtained due to combustion of the gases from open standpipes. Instead of Leney's 1.2 pounds of particulate matter below 10 μm (PM10) per push from 16 tons of coal coked, emissions are estimated at 0.24 lb/16 tons. On a unit basis, the emission factor is 0.015 lb PM10/ton of coal charged. [Ron, is this change what you meant in your comment?] Revised emission factors based on this value for total PM, SO_2, No_x, VOC, and CO are presented in the draft chapter and background document.

D. DECARBONIZATION

Comment D-1: (ACCCI/AISI) The commenter contends that the draft emission factor for decarbonization is three to four orders of magnitude too high. Data presented by the commenter suggest that the draft emission factor should be reduced to 0.009 lb CO/ton of coal charged from 29 lb CO/ton of coal charged.

Response D-1: While a considerable amount of data were presented by the commenter, EPA was unable to verify them through inspection of the test reports associated with the tests from which the data were derived. The commenter also made assumptions about the quantity of decarbonizing offgas that was converted to CO_2 fro CO. Until EPA is able to review test reports and to verify or support the commenter's assumptions, the emission factor remains at 29 lb CO/ton of coal charged.

E. BYPRODUCT PLANTS

Comment E-1: (ACCCI/AISI) The commenter believes that the draft benzene and VOC emission factors are too high, not

supported by recent data, and do not account for plant variability. He suggests using models such as EPA'a TANKS for individual plant estimates.

Response E-1: Other than for typical storage tanks in the byproduct plant, the TANKS model is not appropriate. The model does not account for such things as dissolved gases or heated input streams. Further, because of the many factors in the model developed from engineering judgement and technology transfer from data at significantly disparate conditions from those at which most U.S. batteries are performing, the uncertainties of the estimates are considered to be greater than those presented in AP-42. For estimating emissions for regulatory purposes, facilities can always use their own data as long as they are acceptable to the Administrator.

F. BYPRODUCT PLANT EQUIPMENT LEAKS

Comment F-1a: (ACCCI/AISI) The commenter believes that the draft emission factors for equipment leaks for VOCs are outdated and too high. He asserts that leak programs have significantly reduced current emissions. He suggests using the third most refined version of the 1995 EPA leak protocol document, the EPA Correlation Approach, in place of the draft emission factors.

Response F-1a: For facilities that have an effective leak detection and repair (LDAR) program, and that have screening values required by the protocol document, EPA believes the correlation approach for refineries is appropriate. Text and table footnotes are added to the background and emission factors documents to introduce use of the correlation approach. However, for facilities not having an LDAR program and screening values, the emission factors in the draft documents are retained.

Comment F-1b: (ACCCI/AISI) The commenter requests amplification of the manner in which VOC emission factors should be used in regard to inspection programs and suggests that more emphasis be given to using average emission factors for a specific facility only in the absence of leak detection data for that facility.

Response F-1b: The requested amplification and emphasis have been added to the draft chapter and to its supporting document.

G. MATERIALS HANDLING

Comment G-1: (JCHD, ACHD) Are emission factors available for materials handling total suspended particulate (TSP)?

Response G-1: The only emission factors available are for coal crushing controlled by cyclone or rotoclone, primary and secondary coal pulverizers with building enclosures, coke screening, and coke handling controlled with a cyclone. Table 4-12 in the background document and Table 12.2.6 in the emission factors document present these emission factors. The data for coal crushing controlled by a rotoclone, pulverization, and coke screening are additions to the draft documents.

H. BYPRODUCT PLANT

Comment H-1: (Bethlehem) The commenter suggests that the byproduct plant description is outdated and should be revised to reflect current practice. He also believes the emission factors should be revised based on new measurements for plants complying with subparts L and FF (40 CFR 61).

Response H-1: Because the descriptions of byproduct plants in the background and emission factor documents are used for historical purposes and for non-U.S. plants as well as current U.S. plants, the basic descriptions are retained. However comments are added to the text and illustrations to show trends in post-NESHAP plants. In the absence of supportable data, no changes are made to the emission factors.

I. GENERAL COMMENTS

Comment I-1: (ACHD) The commenter suggest numerous clarifying or corrective additions and changes to text and tables in the emission factors document.

Response I-1: Most of the suggested changes are made to the emission factors document (and , as applicable, to the background document). Suggested changes not made are generally discussed in responses to comments given above.

Comment I-2: (ACHD) The commenter requests additional emission factors for soaking, decarbonizing, pushing emission control baghouses, traveling hot cars, pushing emission control baghouse and fugitives, and uncontrolled pushes.

Response I-2 Changes to emission factors for soaking and decarbonizing are discussed in the responses to comments C-1 and D-1 above. Additional emission factors are available for hooded quench cars and pushing emissions controlled by baghouses. No usable data are available for the remaining operations.

RESEARCH TRIANGLE INSTITUTE

Center for Environmental Analysis

MEMORANDUM

August 15, 1997

TO: Brian Shrager - MRI

FROM: Jim Turner - RTI J. H. T.

SUBJECT: Review of Comments on Draft Coke-making/Byproduct Chapter for AP-42
MRI Subcontract No. 270-3600, WA No. 4-02

Attached is a table that lists commenters, a brief summary of their comments, suggested responses (in some cases alternate responses) and an estimate of the time required to respond. We were able to suggest responses for most of the comments, but a few will require more investigation before we can suggest responses for them or estimate required resources. The resource estimate is uncertain, but could be from about 90 hours to more than 250 hours depending on which of the suggested responses are followed. We are uncertain about time requirements because the work is often more than a simple comparison of one set of numbers against another. The comparisons require delving into methodologies used in obtaining the numbers and investigating rationales behind using one methodology over another.

A major topic is industry's suggested use of the Coke BID methodology for estimating leaks rather than using the method presented in the draft AP-42 chapter. We believe good reasons exist not to adopt industry's suggestion and can write the reasons. A second major topic is industry's suggestion to provide methodology for estimating emissions on an individual plant basis. Although AP-42 may have general statements about using plant-specific data, it appears that industry wants specific AP-42 mention in the coke chapter about using plant-specific data for emission estimates. As well as providing estimates that industry proposes as being correct, it also gives a way for them to keep their emission charges down when talking with local permitting agencies that base charges on AP-42. Does EPA wish to acknowledge this situation and reinforce the general statements about using real data when available instead of AP-42 emission factors?

We will begin to change the text for the easily-handled items in the AP-42 section and background document while waiting for direction on the remaining items. If contacts are to be made with industry and government agencies in hopes of getting supporting information for responding to their wuggestions, it is unlikely that this task can be finished by the end of September. If you have comments or questions, please call me at 990-8617, fax to 990-8600, or e-mail to jht@rti.org.

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REVIEW OF COKE AP-42 COMMENTS

Commenter	Comment	Suggested response	Required resources
ACCCI Enclosure 1 door leaks, etc. comment 1 (a)	Remove uncontrolled emission factors.	Reject comment and explain uses for historical factors and for non-U.S. batteries.	0.5 hrs
Comment 1 (b)	Remove pre-NESHAP factors or revise them to reflect current better control and foundry coke battery instead of furnace coke battery.	Keep factors for reasons above. Probably can't revise as requested because of lack of supported data	0.5
Comment 1 (c)	No need for average or typical factors for post-NESHAP control levels; should estimate based on individual plant parameters.	(a) Needed for modeling purposes and for cases when details not available. (b) Can incorporate site-specific approach as an alternative.	(a) 0.3 hrs (b) 20 hrs
"	If average plant used, should have factors for more detailed categories	(a) Look for data among new test reports or from ACCCI; replace current factors (likely to be fruitless). (b)Do not replace factors. Several reasons can be given	(a) ? (b) 2 hrs

Commenter	Comment	Suggested response	Required resources
Comment 2	Leak and charging emissions; estimate from plant details and performance data.	(a) Retain general approach; details not always available. (b) Generate site-specific approach.	(a) 0.3 hrs (b) 16 hrs
"	If average battery estimates retained, provide more caveats.	OK.	4 hrs
Comment 3	Door leak emission estimates not supported by data or valid model.	We can prepare a response	4 hrs
"	Use Coke BID approach to estimate emissions.	Exponential model not appropriate for current emission levels. We explain why.	4 hrs
"	Do not use data for emission factors in Table 4-3 of background report (Method Validation Report data are not representative)	Requires detailed response	8 hrs
Comment 5 (Comment 4 not listed)	Lid and offtake estimates are high and should not be used	May be true. Check and revise document	8 hrs
Comment 6	5 g BSO/charge is high	Need to check, may be valid, but the 5 g may OK considering uncertainty in the number	6 hrs

Commenter	Comment	Suggested response	Required resources
"	BID estimates and approach should be used	Probably not applicable, but need to respond	included in above
ACCCI Enclosure 2	Copy of AISI Phase II Method Validation Report - not a comment		
ACCCI Enclosure 3 Coke pushing, quenching, and battery underfiring Comment 1	Disagrees with use of older EFs for pushing. Recommends use of (unsupported) data given in their comment. Applies to PM, VOC, SO_2, CO, and NO_x	(a) Ask for supporting data. If acceptable, replace the existing EFs. Would need to decide if existing and new data should be intermingled or existing data discarded (b) Claim no supporting data and reject comment	(a) 12 hrs (b) 0.3 hrs
"	Revise Table 12.2-3 to contain caution that BSO speciation ratios are only for oven charging and door/topside leaks, not for pushing	OK	0.3 hrs

Commenter	Comment	Suggested response	Required resources
Comment 2	Generally agrees with quenching PM EFs, but suggests correction to definition of clean and dirty water for tall towers/poor maintenance. Also suggests linear interpolation for quench water TDS values between t stated clean and dirty water values in draft	(a) Examine definition change; probably OK. Use interpolation as suggested (b) Reject changes (no good rationale for doing this without examination)	(a) 2 (b) 0.3
Comment 3	Underfiring EFs supplied by ACCCI are recommended as replacements for the draft EFs. The new data are not supported.	(a) Ask for supporting data. If acceptable, replace the existing EFs. Would need to decide if existing and new data should be intermingled or existing data discarded (b) Claim no supporting data and reject comment	(a) 12 hrs (b) 0.3 hrs

Commenter	Comment	Suggested response	Required resources
ACCCI Enclosure 4 Soaking (Butch Allen, Jefferson County Health Dept also sent the estimation procedure supplied by ACCCI)	ACCCI believes the EFs developed by Leney are improper (based on improper assumptions) and should be replaced by an estimation methodology developed by LTV. No supporting test reports are supplied as backup for the equations used in the method. Explanation of the method is incomplete (text is missing starting on p. 7). Method based on German data.	(a) Ask for supporting data and the missing text from the comment. If data and method are acceptable, replace the existing EFs. Will require time for analysis. (b) Reject the comment for lack of supporting test reports and reliance on foreign coke plant data	(a) 16 hrs if analysis not complex (b) 1 hr
ACCCI Enclosure 5 Decarbonization - CO	ACCCI contends that the draft CO EF for soaking is three to four orders of magnitude too high and presents test data to support changing the EF. A significant amount of support for the data is given, but no test reports are included. The draft EF is based on theory.	(a) Ask for supporting data. If acceptable, replace the existing Ef. (b) Reject the comment based on lack of test reports (not recommended)	(a) 10 hrs (b) 0.3 hrs

Commenter	Comment	Suggested response	Required resources
ACCCI Enclosure 6 Byproduct plant Comment 1	Benzene and VOC EFs are high, not supported by recent data, and do not account for plant variability. Suggest using models such as TANKS for individual plant estimates	Reject using TANKS model (dissolved gases, etc.) For uses other than straight storage tanks. State that individual plants can always use their own data (acceptable to the Administrator) for regulatory purposes; EFs are for general usage where specific data are not available (Put this statement at beginning of section and in background document)	1 hr
Comment 2	Equipment leak EFs for VOC are outdated and too high. Leak programs have significantly reduced current emissions. Should use the third most refined version (of EPA 1995 leak protocol document), the EPA Correlation Approach to estimate emissions in place of the draft EFs	(a) Investigate replacing draft method with Correlation Approach; replace if warranted. (b) Reject the comment on the basis of inappropriate support (probably a weak argument).	(a) 16 hrs (b) 0.5 hrs

Commenter	Comment	Suggested response	Required resources
"	Support for VOC EFs for equipment subject to periodic inspection (and equipment not so subject) is not clear. Should emphasize that draft average EFs be used only in the absence of plant-specific data	(a) Add support for EFs and add emphasis (b) Add support, but not emphasis © Reject comment based on lack of test reports to support the EPA protocol document (if true)	(a) 4 hrs (b) < 4 hrs © 2
Butch Allen, Jefferson Co. Dept of Health Comment 1	For byproduct plants, EFs based on Method 303 (visible emissions) appear to be low	Explain that the EFs are based on the data we have, but check his statement.	1 hr
Comment 2	Certain emission points have not been addressed in the draft, but older versions of AP-42 have EFs that might be use (e.g., NO_x for doors). Suggests estimating TSP by the draft method ratioed to the old pre-NESHAP EF to determine a percent reduction for gases	Policy decision for Ron (a) insert discussion for using older EFs (b) Reject based on lack of new data and inapplicability of older EFs (may be hard to be consistent with use of older EFs elsewhere in the chapter	(a) 2 hrs (b) 1 hr
Comment 3	Need documentation of origin of EFs for door, lids, and offtakes. If taken from Table 12.2.2 for uncontrolled category, door value should be 0.25, not 0.05	Check that origin is stated; fix if missing. Check questioned value.	0.5 hrs

Commenter	Comment	Suggested response	Required resources
Comment 4	Can sulfur compounds other than H_2S be estimated from its ratio in Table 12.2-3 and the BSO number Table 12.2? Can compounds such as SO_x, CO, and COS be speciated from the BSO values?	No data that we know of to support doing this	0.3 hrs
Comment 5	Can EPA provide more background and instruction for using speciation values in Table 12.2-3 so that double counting or omissions can be avoided?	Yes	4 hrs
Comment 6	Contends that SO_2 EFs are based on mostly northern plants that have desulfirization, therefor much lower emissions than southern plants that don't have desulfuriztion.	Write a general statement of warning; look for data, but probably no data to support a different EF	4 hrs
Comment 7	Asks if EFs exist for materials handling besides crushed stone processing (i.e., coal and coke handling)	No factors available (unless from older versions of AP-42).	0.5 hrs

Commenter	Comment	Suggested response	Required resources
Comment 8	Plants want to use their own performance numbers (from Method 303) to estimate emissions, but the EF equations don't allow use of in-plant performance. How can plants use an adjusted equation to estimate emissions due to seconds of visible charge?	(a) Accept or (b) reject based on handling of ACCCI Enclosure 1, comment 1c	(a) 4 hrs (b) 0.3 hrs
Comment 9 (numbered as a second comment 8)	Does AP-42 consider the use by some plants of large quantities of diesel oil mixed with the coal before charging?	No	0.3
Comment 9	Requests clarification of filterable matter and condensible values in deriving criteria pollutants from BSO values	OK	0.5
Comment 10	Address soaking	Covered under ACCCI comment from Enclosure 4	

Commenter	Comment	Suggested response	Required resources
Comment 11	Draft BSO numbers are substantially higher than found in *Coke Oven Emissions from Wet-Coal Charged...*(EPA-450/3-85-028a), yet the document is referenced for establishing the EFs. Please discuss/	OK	0.5
Bethlehem/ Easterly Comment 1	Table 12.2-9 has incorrect values for combustion stacks because of a conversion error in Easterly's 1944 paper. He encloses corrected values.	Change the tables	0.5
Comment 2	Pushing VOC EFs are high and are based on a single, old (1981) piece of data. Should use data he suppled. Says we have supporting test reports	(a) Look for test reports. Change EF if we find reports and they support Easterly. Contact Easterly if we cannot find the test reports (they may have gone through several hands) (b) Reject on the basis of insufficient time to review reports (not recommended)	(a) 12 hrs (b) 0.5 hrs

Commenter	Comment	Suggested response	Required resources
Comment 3	Supports ACCCI comments on using Coke Oven Emission BID method for leaking doors, lids, and offtakes. Experience of Burns Harbor and Lackawanna plant retrofits should have been considered	See ACCCI comment Enclosure	
Comment 4	Byproduct plant description is outdated and EFs are high. Should get new EFs based on new measurements (for plants complying with Subparts L and FF); the current 1980 numbers are no longer valid	Comment on uses for historical factors and for non-U.S. batteries. We can add comments to some of the description indicating changes that have taken place since the NESHAP.	2 hrs
Comment 5	Add text to Section 12.2.1 re reasons for declining industry (often more economical to buy foreign coke)	OK	0.3
Comment 6	Add text to Section 12.2-6 re longer coking times under some circumstances	OK	0.3
Comment 7	Add text in several places for clarification	OK	1 hr

Commenter	Comment	Suggested response	Required resources
Comment 8	If draft Table 12.2.2 for leaks (lids, offtakes, and charging) is retained, should distinguish between short and tall batteries and have lower EF. [Twice the coal charged but not much more leaking surface]. Should have an EF about half the value of short batteries	Should probably be considered and a discussion written. May or may not be able to give EFs or EF advice	4 to 8 hrs
Comment 9	Remove the soaking CO EF.	Addressed under ACCCI comments for Enclosure 4	
Comment 10	Believes it is "absolutely essential" to resolve issues about using the NESHAP BID methodology for estimating HAP leak emissions rather than the draft EFs before releasing the new chapter. Should meet with industry if necessary. Will prevent continued disagreements among States and EPA re emissions from individual facilities	Addressed under ACCCI comments for Enclosure 1	
Jewel/Waddell	Suggests several text additions and corrections to tables	OK	2 hrs

Commenter	Comment	Suggested response	Required resources
Allegheny Co. Health Dept/Leney Comment 1 (general)	Suggests many small text changes. Other comments addressed below	OK for the ones we can readily accommodate	4 hrs
Comment 2	Would like to see additional EFs for soaking, decarbonizing, Pushing emission control baghouse, traveling hot car, PEC fugitives, and uncontrolled pushes.	Some of these addressed above, for others we have no data and can so state	0.5 hrs
Comment 3	Add diagram blocks for coke loadout or include with coke storage. Check SCC no. For clean gas from byproduct plant	(a) Explain that blocks are included only for processes having EFs (Check that it's true.) (b) Add blocks	(a) 0.3 hrs (b) 0.5 hrs
Comment 4	Add blocks for product shipment, clean gas to other users, ammonium compounds, tar, naphthalene, light oil, benzene, BTX. Add SCC nos. for tar decanter, direct water final cooler, and tar bottom final cooler as noted by EPA approval given to Allegheny co.	As above. Add SCC nos. as noted after checking.	(a) 0.5 hrs (b) 2 hrs

Commenter	Comment	Suggested response	Required resources
Comment 5	Clarify relationship of filterable PM and condensible PM to BSO. Report filterable and condensible PM numbers plus total PM in Table 12.2.2 and give guidance as to when condensible PM is a particulate, a separate pollutant, or a VOC.	Need to investigate	?
Comment 6	Clarify that condensible PM and BSO are not included in PM emission calculations. Specify which pollutants are likely to be adsorbed on PM, emitted as VOC, or neither.	Need to investigate	?
"	Why are NOx and SOx excluded from Table12.2-3, Ratios of Other Pollutants to BSO?	No data available	0.3 hrs
"	Coke Oven NESHAP PM10 is given as 94% of TSP. Does EPA agree?	Need to investigate - very little data	?
Comment 7	Add some indication of volume of gas being vented in Table 12.2-4 (bypassed COG)	May be able to do this	4 hrs

Commenter	Comment	Suggested response	Required resources
"	Instead of adding an English units table for bypassed COG, just use a prominent note that a multiplier of 2 gives English unit values from metric values	Decision for Ron?	0.3 hrs
Comment 8a	Allegheny Co. uses 0.28 Lb/t for crushing [vs Table 12.2-6 value of 0.11] based on 1990 EPA memo	Review memo. Combine with existing EF if memo provides sufficient support, else disregard	4 hrs
Comment 8b	Suggests adding EFs for coke crushing, screening, and loadout are at least as high as for coal crushing	(a) Ask for support and add to EFs if suitable (b) Reject for lack of support	(a) 8 hrs (b) 0.3 hrs
Comment 8c	List soaking and decarbonization with other battery operations instead of with miscellaneous operations	Decision for Ron?	0.5 hrs
Comment 8d	Gives 244 lb CO/oven from decarbonizing	Reject unless support is available. Call Leney	0.5 hrs (more if support available)
Comment 8e	Should reduce soaking SO_2 EF based on AFS being at least 10 times too high. Use 0.044 lb/ton	Reject unless support is available. Call Leney	0.5, more if support available

Commenter	Comment	Suggested response	Required resources
Comment 9c	Suggests lowering uncontrolled COG EF to less than 0.1 lb/t.	Reject unless support is available. Call Leney	0.5, more if support available
"	Also give above EFs in terms of lb/mmcf	(a) Could be done, but would require assumptions (b) Reject because of required assumptions	(a) 4 hrs (b) 0.3
Comment 10a	EFs for coke production, pushing, and combustion stacks, SOx, NOx are too high. Replace with values in FIRE	Need to investigate	?
Comment 10b	EF for SO_2 from combustion stacks is too low for undesulfirized COG. Use EF from 10/86 version of AP-42 and/or USX Clairton value. Use other EFs from Allegheny Co. For ammonia (0.9 lb/t coal charged)	Need to investigate	?
Comment 11	Omit App A since its data are given in Table 12.2-10	OK	0.3 hrs
Comment 12	Suggests simplifying leak equations, e.g., Door leaks (metric) = 0.05 (no. of leaking doors)(charging rate)	(a) Evaluate and comply (b) Evaluate and reject	(a) 2 hrs (b) 1 hr

Commenter	Comment	Suggested response	Required resources
Comment 12	Check values in Tables 12.2-13 and -14	OK	2 hrs