Missouri
Department of
Natural Resources

2005 Hourly Lead Emission Inventory for the Doe Run Company's Herculaneum, Missouri Smelter

Prepared For:

The Doe Run Company

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1.0 Introduction

1.1 Project Description

The Doe Run Company operates a primary lead smelter in Herculaneum, Missouri, located approximately 25 miles south of St. Louis, Missouri, adjacent to the Mississippi River. The city of Herculaneum was designated as non-attainment for lead in 1991. The Missouri Department of Natural Resources submitted a revised SIP in 1994, which failed to meet the quarterly lead National Ambient Air Quality Standard (NAAQS). An additional SIP revision was submitted in 2001, which established an attainment date of August 14, 2002. Following the August 2002 attainment date, lead monitoring in Herculaneum indicated that the lead NAAQS was met for ten consecutive quarters. However, measured lead concentrations at the Broad Street monitor site exceeded the lead standard for the first three quarters of 2005. Violations have also occurred in the 1st and 3rd quarters during 2006. Based on these violations of the lead NAAQS, the Missouri lead SIP must be revised so the Herculaneum area will be in attainment of the lead standard.

An integral part of developing the revision to the lead SIP is the development of the hourly lead emission inventory that will be used as input into the atmospheric dispersion model. The purpose of this report is to discuss in detail the methodology that has been used in the development of the emission inventory. In accordance with the recommendations of the Missouri Department of Natural Resources (MDNR) and Region 7 EPA, the year of 2005 was used as the study period for the analysis.

The remainder of the report has broken out into seven sections, one for each department at the facility:

Section 2 – Unloading Department

Section 3 – Sinter Plant

Section 4 – Blast Furnace (Includes the Main Stack)

Section 5 – Drossing Plant

Section 6 – Refinery

Section 7 – Strip Rolling Mill

Section 8 – Fugitive Emissions (Storage Piles and Haul Roads)

The emission points at the smelter and changes since the 2000 SIP study have been summarized in Table 1-1. The annual lead emissions for each department have been summarized in Figure 1-1.

1.2 Facility Description

As previously mentioned, the smelter is located in Herculaneum, Missouri. A map showing the general location of the facility has been provided as Figure 1-2 and the general facility layout has been depicted in Figure 1-3.

Lead concentrate, which contains approximately 75% lead by weight, is delivered to the facility by truck. The trucks currently come down main street and enter on the south end of the plant north of the strip rolling mill. The trucks dump the concentrate into a hopper and the material is then conveyed to a storage pile. The concentrate is then picked up using a front end loader and dumped into a railcar. The railcar transports the concentrate to the rotary dumper where it is unloaded and transferred to the mixing bins. The concentrate, secondary feed constituents, and return sinter are then crushed and mixed before being sent to the sinter machine. The material coming off of the sinter machine is screened. The overs (sinter) are crushed using a smooth roll crusher (in the sinter plant) and are then ready to be fed to the blast furnace. The fines (material that needs additional contact time on the sinter machine) are cooled and crushed before returning to the sinter machine for additional processing. The fines drop from the screen to a conveyor that feeds the sinter cooler. The cooled sinter then drops onto the CV-30 belt that fills the 130 ton return fines bin. The CV-37A belt

transports the fines from the bin to the smooth roll crusher which feeds the CV-37B belt. Material on the CV-37B belt puts the material back to the sinter machine feed line.

The sintered material, which contains approximately 50% lead, is mixed with coke and fed to the blast furnace. Molten lead exits the bottom of the blast furnace and is transferred to the drossing plant in pots using overhead cranes. Slag is also tapped off of the blast furnace. The slag is granulated and then is either used as a feedstock to the sinter machine or is hauled to storage.

In the drossing department, the molten lead is cooled and impurities are skimmed from the surface. The lead is approximately 97% pure when it exits the drossing plant for the refinery. In the refinery, the remaining trace amounts of impurities are removed producing a refined lead that is greater than 99.999% pure. The lead is then sent to either the casting machine or the strip rolling mill to put it into its final form.

Table 1-1. Source Summary

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
10001A1	Dump-Concentrate-Hopper	Unloading Department	When the 2000 SIP study was developed concentrate was delivered by rail. Concentrate is now delivered to the facility by truck and unloaded at the hopper.	370
10001A2	Dump-Concentrate-Storage	Unloading Department	When the 2000 SIP study was developed concentrate was delivered by rail. Concentrate is now delivered to the facility by truck and unloaded at the hopper.	370
10001B1	Load-Conc.-Railcar (Front End Loader)	Unloading Department	No Change	382
10001B2	Dump-Conc. And Sec.-Unloader (80% Conc, 20% Sec)	Unloading Department	Concentrate is now loaded with secondaries on the south end and mix is dumped at the unloader.	459
10001C	Dump-Fume-Unloader	Unloading Department	Fume is now dumped with concentrate at the unloader. Source Removed. Emissions accounted for in 10001B2.	---
20001A,B	Load-Sinter-Railcar/Dump-Sinter-Unloader	Sinter Plant	No Change	0.219
20002,3	Load-Sinter-Truck/Dump-Sinter-Storage	Sinter Plant	No Change	0.18

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
20004	Load-Fume-Railcar	Sinter Plant	When the 2000 SIP study was developed dry fume was loaded to railcar and then transferred to the unloader and dumped. Fume is now loaded to railcar wet (>8% moisture, 30% typical) and stored on the south end. It is then loaded with concentrate and dumped at the unloader	3
20004B	Railcar Fume Unloading (At Storage)	Sinter Plant	When the 2000 SIP study was developed dry fume was loaded to railcar and then transferred to the unloader and dumped. Fume is now loaded to railcar wet (>8% moisture, 30% typical) and stored on the south end. It is then loaded with concentrate and dumped at the unloader	3

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
20004C	Railcar Fume (South, Front End Loader)	Sinter Plant	When the 2000 SIP study was developed dry fume was loaded to railcar and then transferred to the unloader and dumped. Fume is now loaded to railcar wet (>8% moisture, 30% typical) and stored on the south end. It is then loaded with concentrate and dumped at the unloader	2
20005A-F	Sinter Plant Mix Room Fugitives-Concentrate and Fume Handling	Sinter Plant	The 2000 SIP study included sinter handling in the mix room. Sinter is not handled in the mix room and was removed.	461
20006	Sinter Plant Building Fugitives	Sinter Plant	As part of the model reconciliation work and comparison to the CMB data and meassured lead values, the sinter plant fugitives were scaled up by a factor of 4 from the emissions used in the 2000 SIP study.	1408
20007	Baghouse No. 3 Fugitives	Sinter Plant	No Change	14
30001	Main Stack	Blast Furnace	Revised emission factor from 12/9/2004 Stack Test	50007

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
30002	Blast Furnace Fugitves	Blast Furnace	As part of the 2000 SIP control strategy the blast furnace building openings were enclosed (30002) and the charge belt roof vent was enclosed (30003-5).	1744
30011-13	Baghouse No. 5 Vents	Blast Furnace	No Change	22
40004,5	Dross Kettle Heat Stacks	Dross Plant	No Change	83
40006	Dross Plant Fugitives	Dross Plant	As part of the 2000 SIP control strategy the dross aerovents were removed (40001-3). A baghouse was added to ventilate the dross plant (40007, Baghouse No. 7).	1047
40007	Baghouse No. 7	Dross Plant	This is a new baghouse added as part of the 2000 SIP control strategy.	4032
50006	Refinery Plant Fugitives	Refinery	As part of the 2000 SIP control strategy the refinery roof monitors (50001-2) and aerovents (50004-5) were removed. Two baghouses were added to ventilate the refinery (50007, Baghouse 8 and 50008, Baghouse 9).	1055

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
50007	Baghouse No. 8	Refinery	This is a new baghouse added as part of the 2000 SIP control strategy.	1964
50008	Baghouse No. 9	Refinery	This is a new baghouse added as part of the 2000 SIP control strategy.	13301
50011-18	Kettle Setting Heat Stacks	Refinery	No Change	880
60001,2	Strip Mill Heat Stacks	Strip Mill	No Change	1
60003	Strip Mill Baghouse	Strip Mill	No Change	0.04
60004	Low Alpha Baghouse	Strip Mill	No Change	5
60005-8	Strip Mill Roof Vents	Strip Mill	No Change	24
70001	Fugitive Dross Handling	Fugitives	No Change	11
70007	Fugitive Slag Handling	Fugitives	No Change	0.15
70009	Fugitive Secondaries Handling	Fugitives	No Change	1
70002	Dross Storage Fugitive Wind Erosion	Fugitives	No Change	0
70004	Conc. Storage Fugitive Wind Erosion	Fugitives	No Change	0
70006	Sinter Storage Fugitive Wind Erosion	Fugitives	No Change	0
70008A,B	Slag Storage Fugitive Wind Erosion	Fugitives	No Change	80
70010	Sec Storage Fugitive Wind Erosion	Fugitives	No Change	0

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
70100-122	Hwy 55 to Joachim Bridge Exit (Segment A-B)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	97
70150-213	Joachim Bridge Exit to Plant Entrance (Segment B-C)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	955
70250-252	Plant Entrance to NW Corner of Strip Mill Building (Segment C-D)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	63
70300	NW Corner of Strip Mill Building to Concentrate Hopper (Segment D-E)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	11
70350-358	Concetrate Hopper to SW Corner of Strip Mill Building (Segment E-F)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	14
70400-406	NW Corner of Strip Mill Building to SW Corner of Strip Mill Building (Segment D-F)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	39
70450-454	SW Corner of Strip Mill Building to North End of Slag Haul Road (Segment F-G)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	24

Source ID	Source Description	Department	Change from the 2000 SIP Study	2005 Annual Pb Emissions (lb/yr)
70500-513	North End of Slag Haul Road to Refinery Dock (Segment G-H)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	157
70550-553	South Slag Haul Road (Paved) (Segment G-K)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	21
70600-612	North End of Main Building to Refinery Dock (Unpaved) (Segment H-L)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	2801
70650-669	Sinter Plant to Sinter Storage (Segment I-J)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	17
70700-703	South Slag Haul Road (Unpaved) (Segment K-M)	Fugitives	New Source. In plant and outside plant haul road emissions completely updated.	298

Figure 1-1. 2005 Annual Emissions by Department

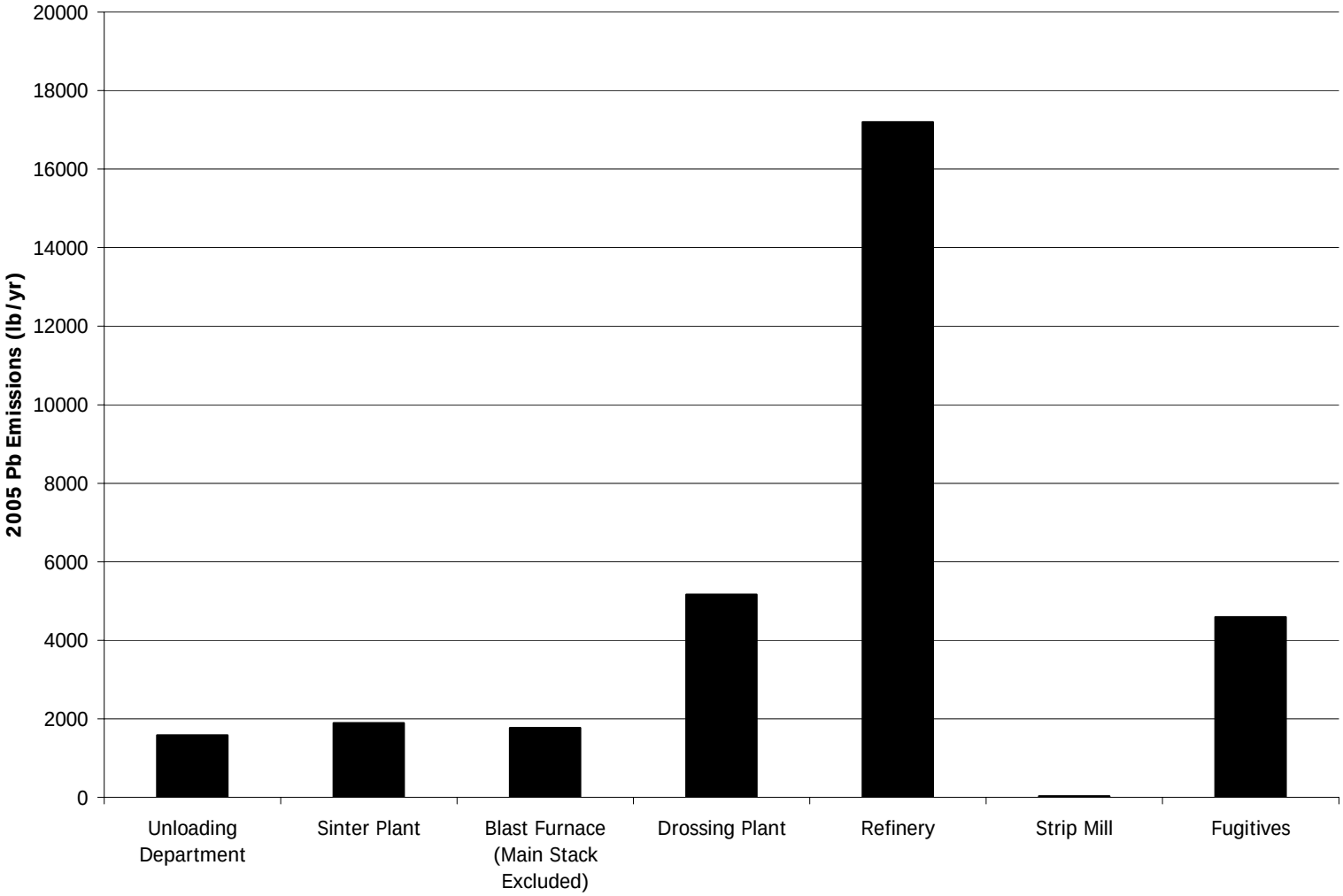


Figure 1-2. General Facility Location

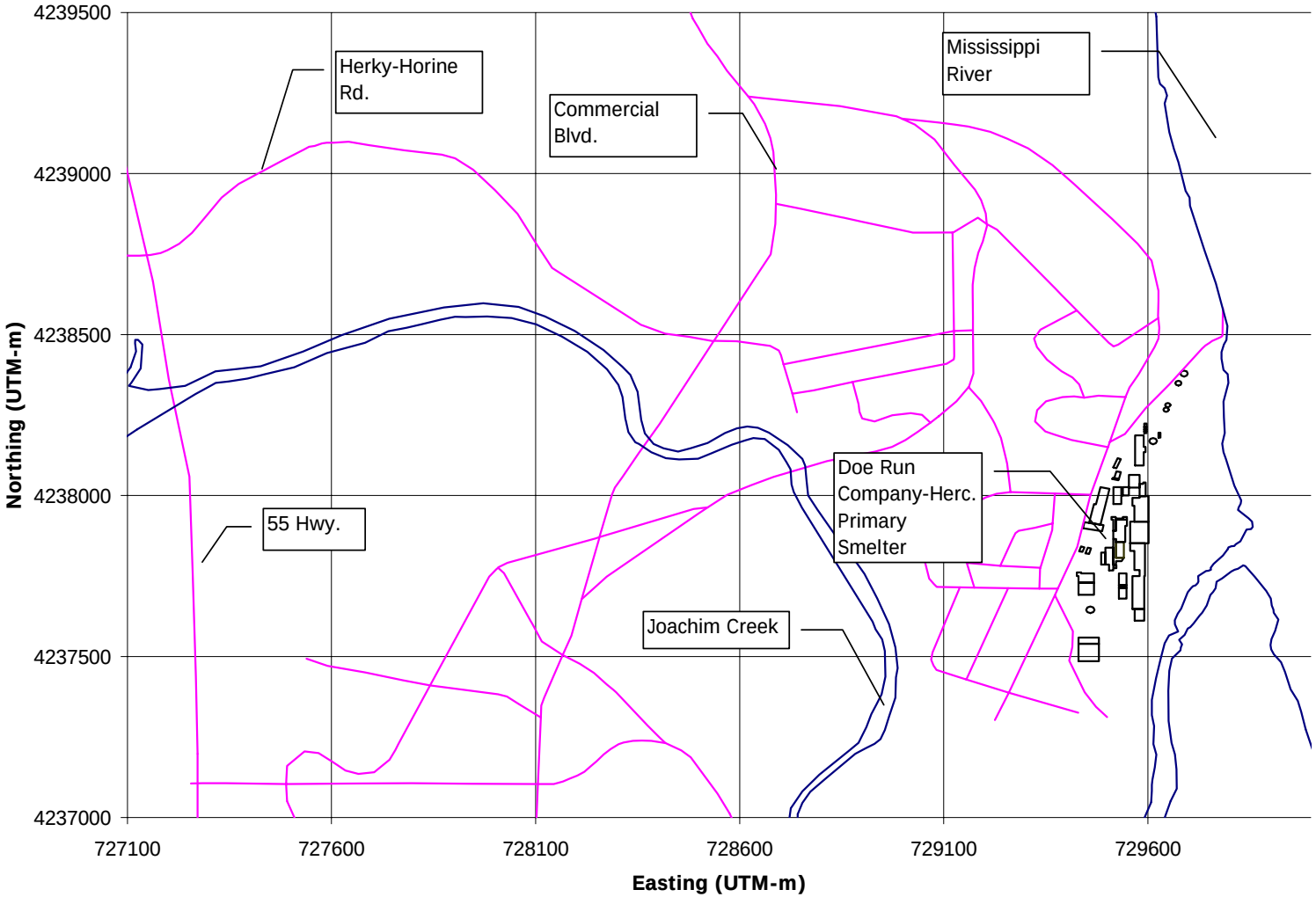
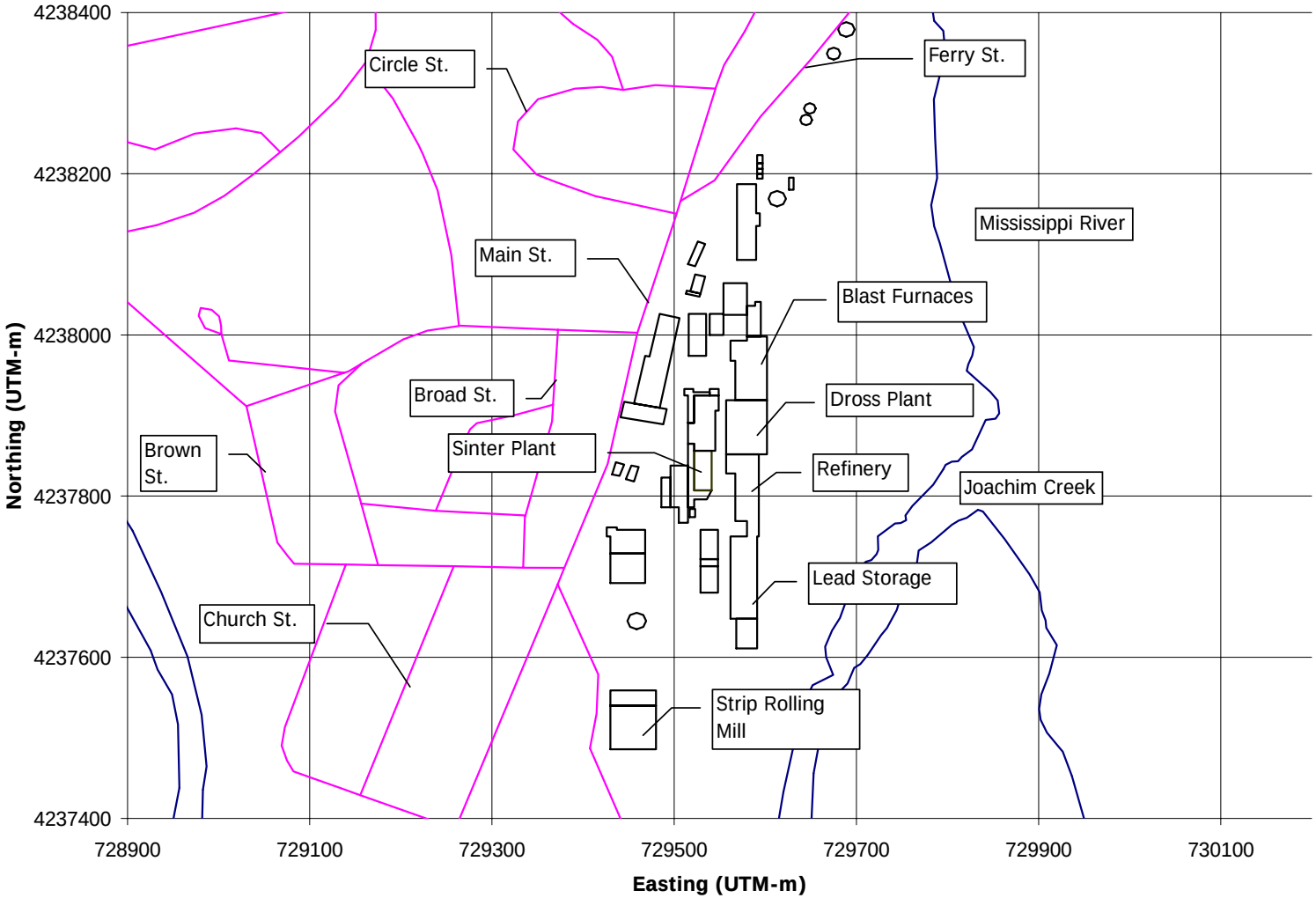


Figure 1-3. General Facility Layout



2.0 Unloading Department

10001A1
Dump-Concentrate-Hopper

Emission Factor
Pb Emission Factor = 1.63E-03 lb-Pb/Tons-Concentrate-Handled

Test at the trestle operation (73.75 g-Pb/100ton-Concentrate-Dumped)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 1, Source 10001.
When the 2000 SIP was developed concentrate was delivered by rail.

Production Data
2005 Average Daily Production Rate = 621 Tons-Concentrate-Handled/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
621 (Tons-Concentrate-Handled/day) * 1.63E-03 (lb-Pb/Tons-Concentrate-Handled) * 1 Sources =
1.0129 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
1.0129 (lb-Pb/day) * 365 (day/yr) =
370 lb-Pb/yr

Hourly Lead Emissions
Daily emissions apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7. Refer to Figure 2-1.

10001A2
Dump-Concentrate-Storage

Emission Factor
Pb Emission Factor = 1.63E-03 lb-Pb/Tons-Concentrate-Handled

Test at the trestle operation (73.75 g-Pb/100ton-Concentrate-Dumped)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 1, Source 10001.
When the 2000 SIP was developed concentrate was delivered by rail.

Production Data
2005 Average Daily Production Rate = 621 Tons-Concentrate-Handled/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
621 (Tons-Concentrate-Handled/day) * 1.63E-03 (lb-Pb/Tons-Concentrate-Handled) * 1 Sources =
1.0129 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
1.0129 (lb-Pb/day) * 365 (day/yr) =
370 lb-Pb/yr

Hourly Lead Emissions
Daily emissions apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7. Refer to Figure 2-1.

10001B1
Load-Conc.-Railcar (Front End Loader)

Emission Factor
Pb Emission Factor = 1.63E-03 lb-Pb/Tons-Concentrate-Handled

Test at the trestle operation (73.75 g-Pb/100ton-Concentrate-Dumped)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 1, Source 10001.

Production Data
2005 Average Daily Production Rate = 642 Tons-Concentrate-Handled/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
642 (Tons-Concentrate-Handled/day) * 1.63E-03 (lb-Pb/Tons-Concentrate-Handled) * 1 Sources =
1.0471 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
1.0471 (lb-Pb/day) * 365 (day/yr) =
382 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

10001B2
Dump-Conc. And Sec.-Unloader (80% Conc, 20% Sec)

Emission Factor
Pb Emission Factor = 1.63E-03 lb-Pb/Tons-Concentrate-Handled

Test at the trestle operation (73.75 g-Pb/100ton-Concentrate-Dumped)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 1, Source 10001.
Secondaries and fume are now mixed w/ the concentrate on the south end (80/20 split) before being dumped at the unloader.

Production Data
2005 Average Daily Production Rate = 771 Tons-Concentrate-Handled/day

(Conc. Feed to Sinter Plant) * 1.2
80 tons of concentrate is loaded into each railcar. The railcars are then topped off (additional 20 tons) with secondaries (ie cleanup).

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
771 (Tons-Concentrate-Handled/day) * 1.63E-03 (lb-Pb/Tons-Concentrate-Handled) * 1 Sources =
1.2565 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
1.2565 (lb-Pb/day) * 365 (day/yr) =
459 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

Figure 2-1. Hourly Traffic Scalars

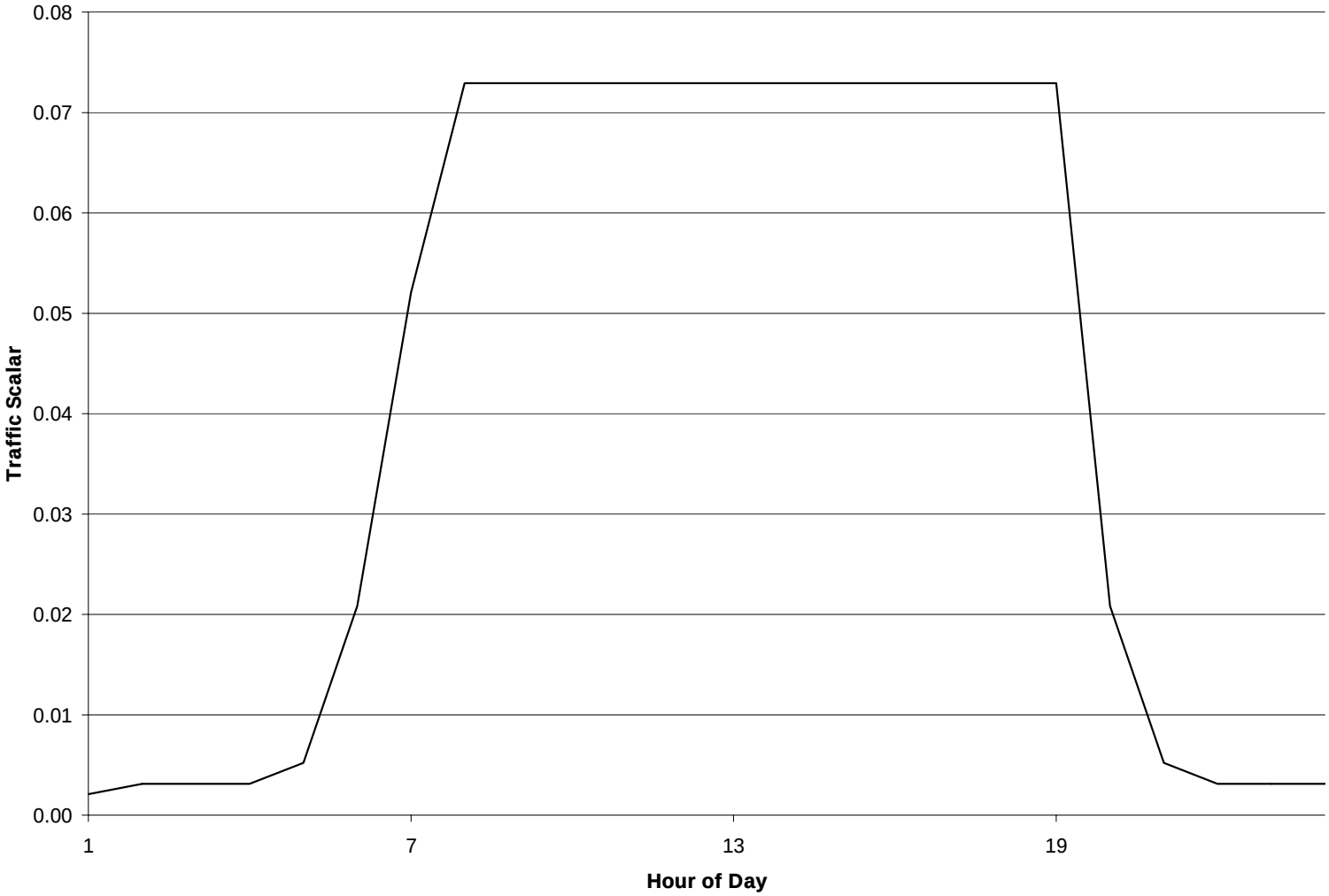


Figure 2-2. Daily Concentrate Delivery

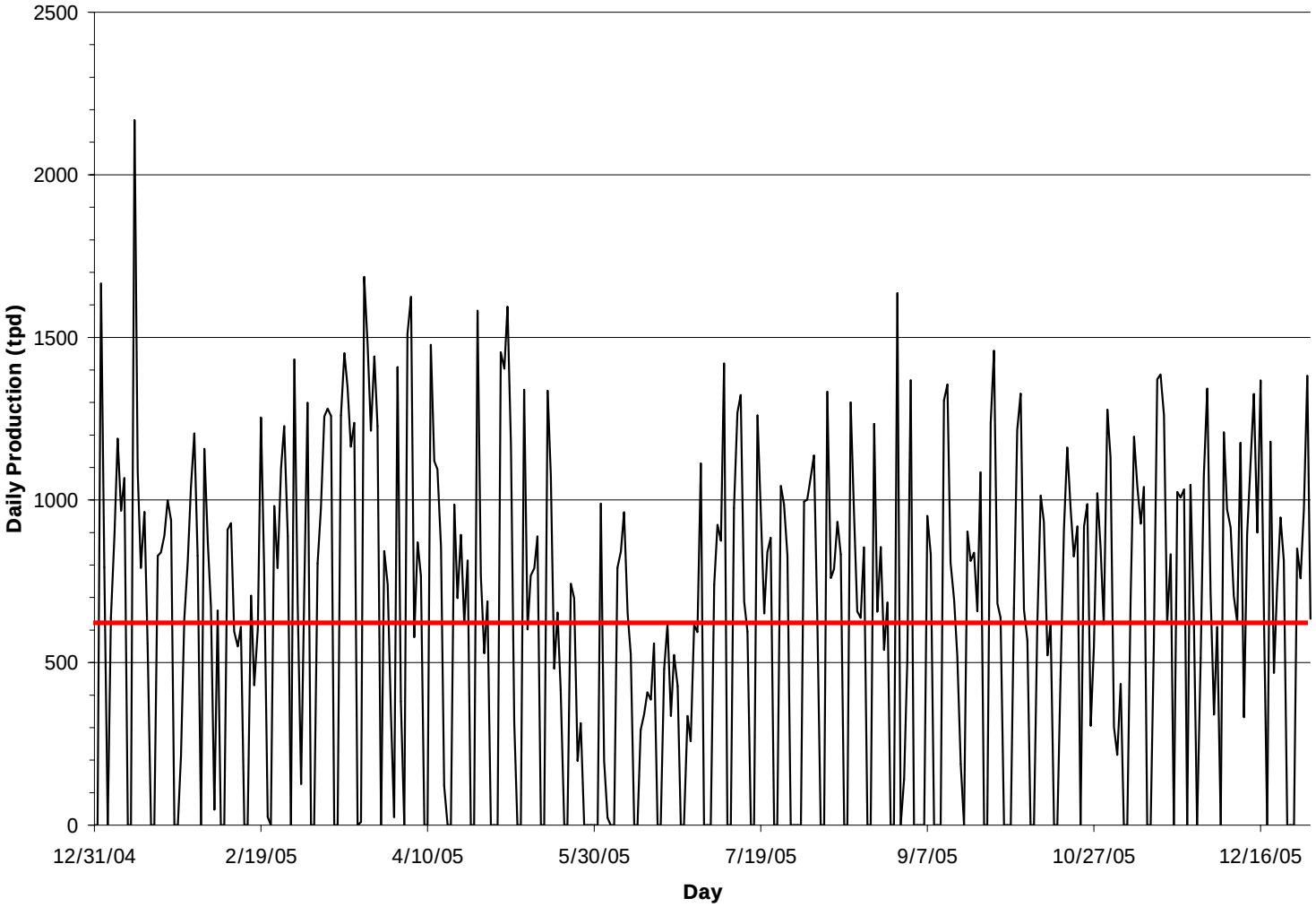
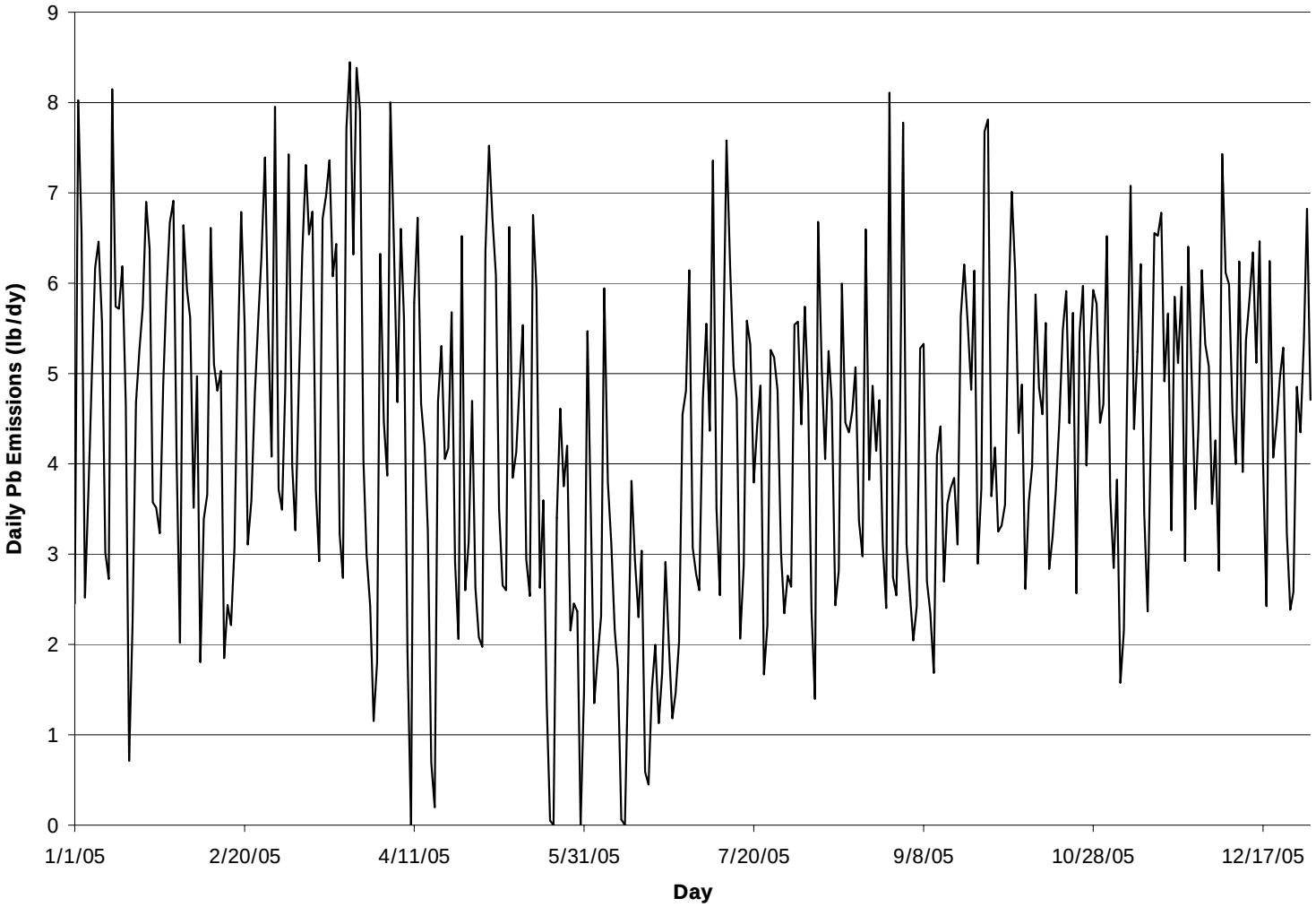


Figure 2-3. Daily Unloading Department Emissions



3.0 Sinter Plant

20001A,B
Load-Sinter-Railcar/Dump-Sinter-Unloader

Emission Factor
Pb Emission Factor = 1.15E-05 lb-Pb/Tons-Sinter-Handled

Test at the trestle operation
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20001.

Production Data
2005 Average Daily Production Rate = 26 Tons-Sinter-Handled/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
26 (Tons-Sinter-Handled/day) * 1.15E-05 (lb-Pb/Tons-Sinter-Handled) * 2 Sources =
0.0006 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0006 (lb-Pb/day) * 365 (day/yr) =
0.219 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

20002,3
Load-Sinter-Truck/Dump-Sinter-Storage

Emission Factor
Pb Emission Factor = 1.15E-05 lb-Pb/Tons-Sinter-Handled

Test at the trestle operation
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20002 and 20003.

Production Data
2005 Average Daily Production Rate = 23 Tons-Sinter-Handled/day

(Sinter Produced) * 0.02
2005 Blast Furnace-Sinter Feed-From Storage = 9613 tpy. 2005 Sinter Produced = 415212 tpy. 9613/415212 = 0.02.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
23 (Tons-Sinter-Handled/day) * 1.15E-05 (lb-Pb/Tons-Sinter-Handled) * 2 Sources =
0.0005 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0005 (lb-Pb/day) * 365 (day/yr) =
0.18 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

20004
Load-Fume-Railcar

Emission Factor
Pb Emission Factor = 7.06E-03 lb-Pb/Tons-Fume-Handled

Test at the trestle operation (3202.22 g-Pb/100ton-Fume-Dumped). This testing was done when the fume was dumped dry. The fume is now sent to storage at approximately 30% moisture. The emissions were estimated at 1/10 of the tested level.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20004.

Production Data
2005 Average Daily Production Rate = 1 Tons-Fume-Handled/day

(Sinter Produced) * 0.001
Fume Unloaded (10/1/98-4/30/99) = 350 tons. Sinter Produced (10/1/98-4/30/99) = 406023 tons. 350/460023=0.001.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1 (Tons-Fume-Handled/day) * 7.06E-03 (lb-Pb/Tons-Fume-Handled) * 1 Sources =
0.0069 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0069 (lb-Pb/day) * 365 (day/yr) =
3 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

20004B
Railcar Fume Unloading (At Storage)

Emission Factor
Pb Emission Factor = 7.06E-03 lb-Pb/Tons-Fume-Handled

Test at the trestle operation (3202.22 g-Pb/100ton-Fume-Dumped). This testing was done when the fume was dumped dry. The fume is now sent to storage at approximately 30% moisture. The emissions were estimated at 1/10 of the tested level.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20004.
When the 2000 SIP was developed fume was stored in railcars and then dumped by itself at the unloader. Fume is now taken by rail to the south end and put to storage (wet, >8% moisture). The fume is then added to the concentrate cars and dumped.

Production Data
2005 Average Daily Production Rate = 1 Tons-Fume-Handled/day

(Sinter Produced) * 0.001
Fume Unloaded (10/1/98-4/30/99) = 350 tons. Sinter Produced (10/1/98-4/30/99) = 406023 tons. 350/460023=0.001.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1 (Tons-Fume-Handled/day) * 7.06E-03 (lb-Pb/Tons-Fume-Handled) * 1 Sources =
0.0069 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0069 (lb-Pb/day) * 365 (day/yr) =
3 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

20004C
Railcar Fume (South, Front End Loader)

Emission Factor
Pb Emission Factor = 7.06E-03 lb-Pb/Tons-Fume-Handled

Test at the trestle operation (3202.22 g-Pb/100ton-Fume-Dumped). This testing was done when the fume was dumped dry. The fume is now sent to storage at approximately 30% moisture. The emissions were estimated at 1/10 of the tested level.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20004.
When the 2000 SIP was developed fume was stored in railcars and then dumped by itself at the unloader. Fume is now taken by rail to the south end and put to storage (wet, >8% moisture). The fume is then added to the concentrate cars and dumped.

Production Data
2005 Average Daily Production Rate = 1 Tons-Fume-Handled/day

(Conc. Used) * 0.0151
Fume Produced (2005) = 356 tons. Conc. Used (2005) = 235148 tons.
356/235148 = 0.00151.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1 (Tons-Fume-Handled/day) * 7.06E-03 (lb-Pb/Tons-Fume-Handled) * 1 Sources =
0.0068 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0068 (lb-Pb/day) * 365 (day/yr) =
2 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

20005A-F
Sinter Plant Mix Room Fugitives-Concentrate Handling

Emission Factor
Pb Emission Factor = 1.63E-03 lb-Pb/Tons-Concentrate-Handled

Test at the trestle operation (73.75 g-Pb/100ton-Concentrate-Dumped)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20005.

Production Data
2005 Average Daily Production Rate = 775 Tons-Concentrate-Handled/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
771 (Tons-Concentrate-Handled/day) * 1.63E-03 (lb-Pb/Tons-Concentrate-Handled) * 1 Sources =
1.2567 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
1.2567 (lb-Pb/day) * 365 (day/yr) =
458.7 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

20005A-F
Sinter Plant Mix Room Fugitives-Fume Handling

Emission Factor
Pb Emission Factor = 7.06E-03 lb-Pb/Tons-Fume-Handled

Test at the trestle operation (3202.22 g-Pb/100ton-Fume-Dumped). This testing was done when the fume was dumped dry. The fume is now sent to storage at approximately 30% moisture. The emissions were estimated at 1/10 of the tested level.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20005.

Production Data
2005 Average Daily Production Rate = 1 Tons-Fume-Handled/day

(Sinter Produced) * 0.001
Fume Unloaded (10/1/98-4/30/99) = 350 tons. Sinter Produced (10/1/98-4/30/99) = 406023 tons. 350/460023=0.001.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1 (Tons-Fume-Handled/day) * 7.06E-03 (lb-Pb/Tons-Fume-Handled) * 1 Sources = 0.0071 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0071 (lb-Pb/day) * 365 (day/yr) =
2.6 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12p.

20006
Sinter Plant Building Fugitives

Emission Factor
Pb Emission Factor = 3.40E-03 lb-Pb/Tons-Sinter-Produced

Personnel Sampling (2000 SIP value times 4 per model reconcilliation work)
(0.00085*4=0.0034 lb/ton)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20006.

Production Data
2005 Average Daily Production Rate = 1135 Tons-Sinter-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1135 (Tons-Sinter-Produced/day) * 3.40E-03 (lb-Pb/Tons-Sinter-Produced) * 1 Sources =
3.8578 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
3.8578 (lb-Pb/day) * 365 (day/yr) =
1408 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

20007
Baghouse No. 3 Fugitives

Emission Factor
Pb Emission Factor = 3.28E-05 lb-Pb/Tons-Sinter-Produced

In-house testing for the No. 5 Baghouse Vents (1981)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 2, Source 20007.

Production Data
2005 Average Daily Production Rate = 1135 Tons-Sinter-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1135 (Tons-Sinter-Produced/day) * 3.28E-05 (lb-Pb/Tons-Sinter-Produced) * 1 Sources =
0.0372 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0372 (lb-Pb/day) * 365 (day/yr) =
14 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

Figure 3-1. Daily Sinter Production

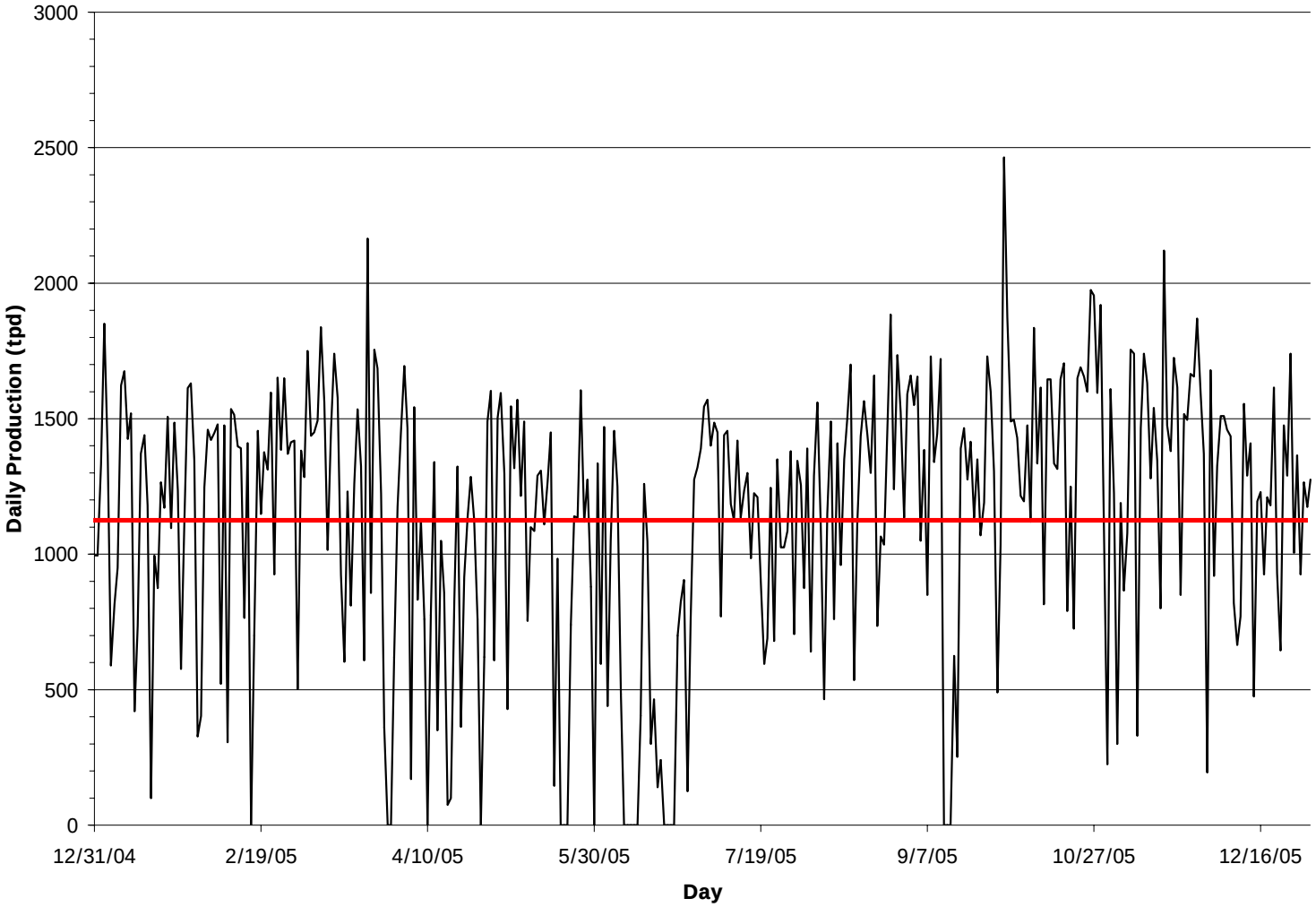
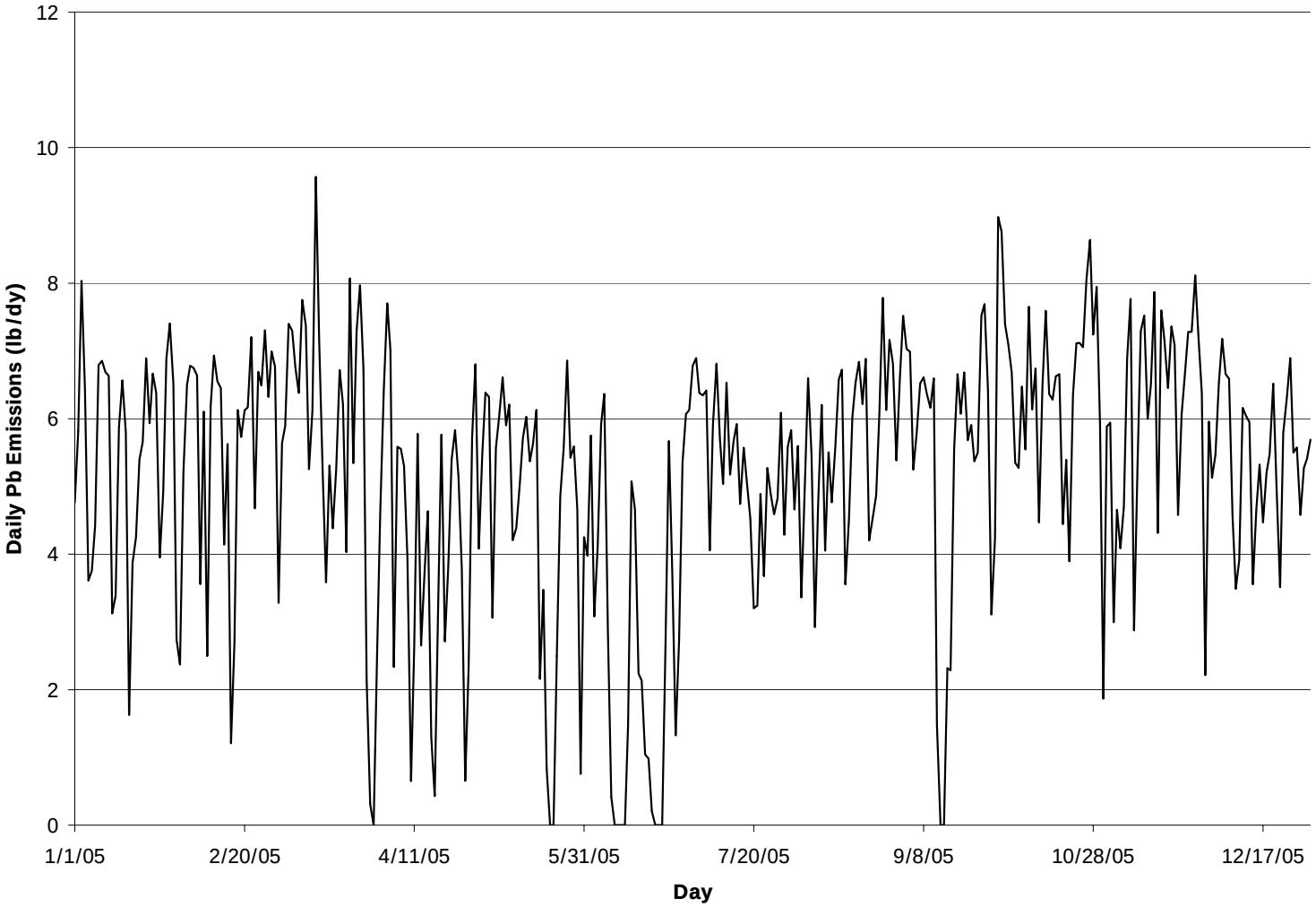


Figure 3-2. Daily Sinter Plant Emissions



4.0 Blast Furnace

30001
Main Stack

Emission Factor
Pb Emission Factor = 5.70E-02 lb-Pb/(Tons-Sinter-Produced)+(Tons-Lead Bearing Material-Charged to the Blast Furnace)

12/9/2004 Stack Test
7.1/124.58 = 5.7e-2 lb/ton

Production Data
2005 Average Daily Production Rate = 2404 (Tons-Sinter-Produced)+(Tons-Lead Bearing Material-Charged to the Blast Furnace)/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
2404 ((Tons-Sinter-Produced)+(Tons-Lead Bearing Material-Charged to the Blast Furnace)/day) * 5.70E-02 (lb-Pb/(Tons-Sinter-Produced)+(Tons-Lead Bearing Material-Charged to the Blast Furnace)) * 1 Sources =
137.0065 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
137.0065 (lb-Pb/day) * 365 (day/yr) =
50007 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

30002
Blast Furnace Fugitves

Emission Factor
Pb Emission Factor = 4.10E-03 lb-Pb/Tons-Sinter-Charged to the Blast Furnace

30002-5 2000 SIP pre-control emission factor (8.2E-02 lb/ton) with a 95% capture efficiency
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 3, Source 30002.
As part of the 2000 SIP control strategy the blast furnace building openings were enclosed (30002) and the charge belt roof vent was enclosed (30003-5).

Production Data
2005 Average Daily Production Rate = 1166 Tons-Sinter-Charged to the Blast Furnace/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
1166 (Tons-Sinter-Charged to the Blast Furnace/day) * 4.10E-03 (lb-Pb/Tons-Sinter-Charged to the Blast Furnace) * 1 Sources =
4.7788 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
4.7788 (lb-Pb/day) * 365 (day/yr) =
1744 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

30011-13
Baghouse No. 5 Vents

Emission Factor
Pb Emission Factor = 1.70E-05 lb-Pb/Tons-Sinter-Charged to the Blast Furnace

In-house testing for the No. 5 Baghouse Vents (1981). 5.1e-5/3=1.7e-5.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 3, Source 30011-13.

Production Data
2005 Average Daily Production Rate = 1166 Tons-Sinter-Charged to the Blast Furnace/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

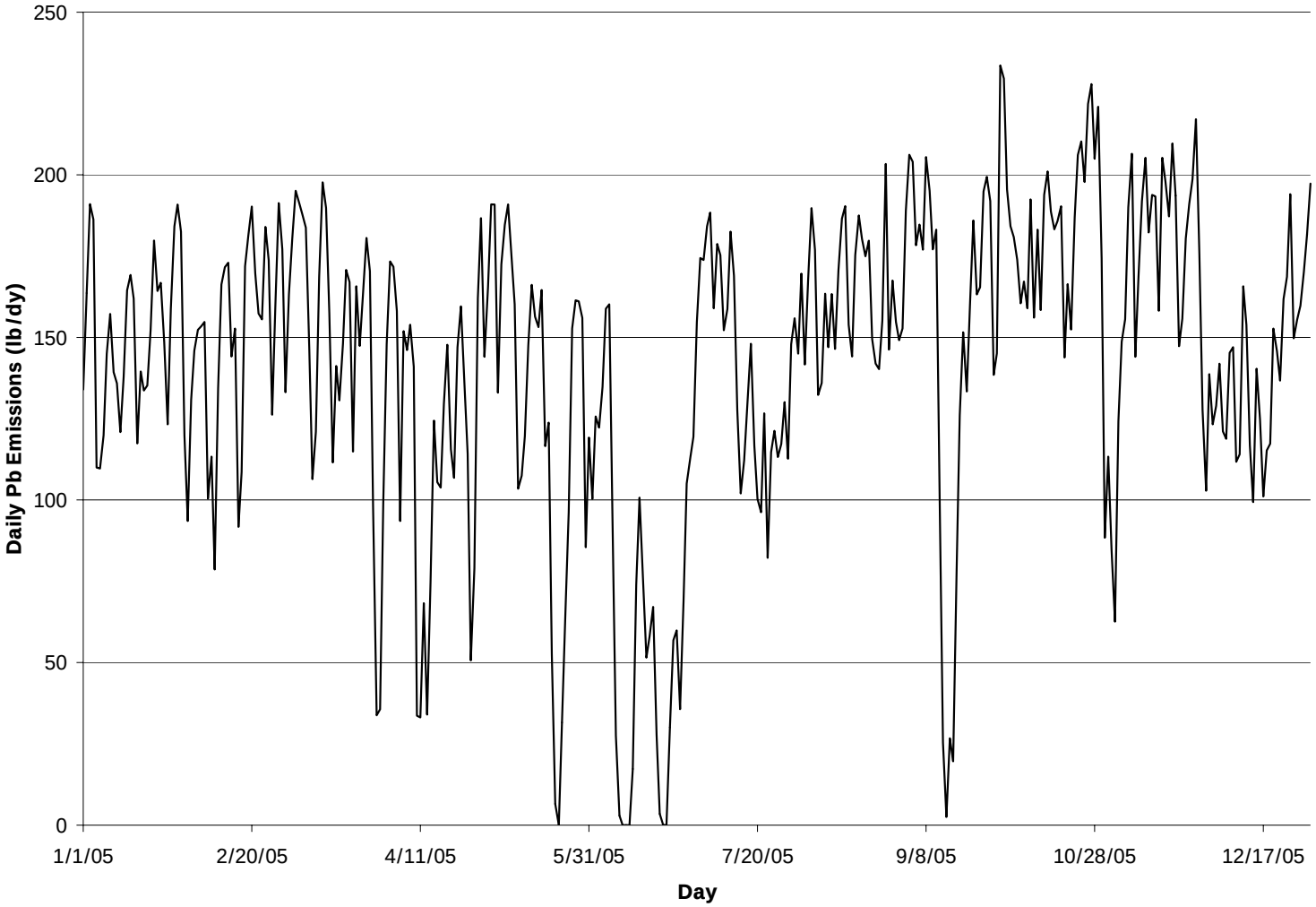
2005 Average Daily Pb Emissions =
1166 (Tons-Sinter-Charged to the Blast Furnace/day) * 1.70E-05 (lb-Pb/Tons-Sinter-Charged to the Blast Furnace) * 3 Sources =
0.0594 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0594 (lb-Pb/day) * 365 (day/yr) =
22 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

Figure 4-1. Daily Blast Furnace Emissions



5.0 Drossing Plant

40004,5
Dross Kettle Heat Stacks

Emission Factor
Pb Emission Factor = 5.19E-04 lb-Pb/Tons-Rough Lead-Produced

Stack test of No. 4 kettle heat stack (1999)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 4, Source 40004-5.

Production Data
2005 Average Daily Production Rate = 438 Tons-Rough Lead-Produced/day

(Refined Lead Produced) / 0.97
Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. Rough Lead Produced (10/1/98-4/30/99) = 156450 tons. 151470/156450=0.97.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
438 (Tons-Rough Lead-Produced/day) * 5.19E-04 (lb-Pb/Tons-Rough Lead-Produced) * 1 Sources =
0.2273 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.2273 (lb-Pb/day) * 365 (day/yr) =
83 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

40006
Dross Plant Fugitives

Emission Factor
Pb Emission Factor = 6.55E-03 lb-Pb/Tons-Rough Lead-Produced

40001-3 2000 SIP pre-control emission factor (1.31E-01 lb/ton) with a 95% capture efficiency
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 4, Source 40001-3.
As part of the 2000 SIP control strategy the dross aerovents were removed (40001-3). A baghouse was added to ventilate the dross plant (40007, Baghouse No. 7).

Production Data
2005 Average Daily Production Rate = 438 Tons-Rough Lead-Produced/day

(Refined Lead Produced) / 0.97
Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. Rough Lead Produced (10/1/98-4/30/99) = 156450 tons. 151470/156450=0.97.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
438 (Tons-Rough Lead-Produced/day) * 6.55E-03 (lb-Pb/Tons-Rough Lead-Produced) * 1 Sources =
2.8692 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
2.8692 (lb-Pb/day) * 365 (day/yr) =
1047 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

40007
Baghouse No. 7

Emission Factor
Pb Emission Factor = 9.48E-03 lb-Pb/Tons-Sinter-Charged to the Blast Furnace

12/3/2002 Stack Test
0.5/52.75=9.48e-3 lb/ton
This is a new baghouse added as part of the 2000 SIP control strategy.

Production Data
2005 Average Daily Production Rate = 1166 Tons-Sinter-Charged to the Blast Furnace/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

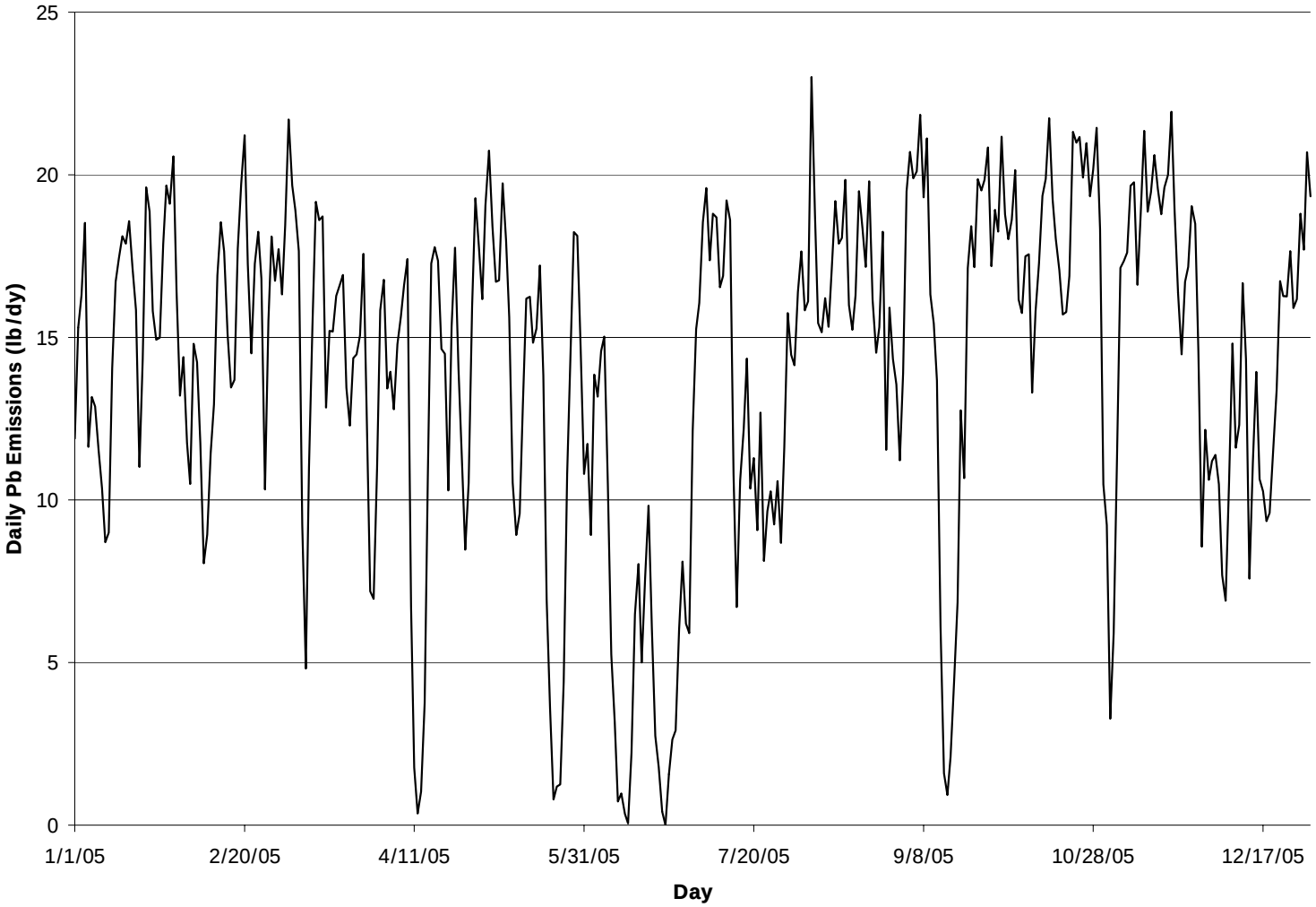
2005 Average Daily Pb Emissions =
1166 (Tons-Sinter-Charged to the Blast Furnace/day) * 9.48E-03 (lb-Pb/Tons-Sinter-Charged to the Blast Furnace) * 1 Sources =
11.0479 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
11.0479 (lb-Pb/day) * 365 (day/yr) =
4032 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

Figure 5-1. Daily Dross Plant Emissions



6.0 Refinery

50006
Refinery Plant Fugitives

Emission Factor
Pb Emission Factor = 6.80E-03 lb-Pb/Tons-Refined Lead-Produced

50001-2,4-5 2000 SIP pre-control emission factor (1.36E-01 lb/ton) with a 95% capture efficiency
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 5.
As part of the 2000 SIP control strategy the refinery roof monitors (50001-2) and aerovents (50004-5) were removed. Two baghouses were added to ventilate the refinery (50007, Baghouse 8 and 50008, Baghouse 9).

Production Data
2005 Average Daily Production Rate = 425 Tons-Refined Lead-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
425 (Tons-Refined Lead-Produced/day) * 6.80E-03 (lb-Pb/Tons-Refined Lead-Produced) * 1 Sources =
2.8893 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
2.8893 (lb-Pb/day) * 365 (day/yr) =
1055 lb-Pb/yr

Hourly Lead Emissions

Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

50007
Baghouse No. 8

Emission Factor
Pb Emission Factor = 1.27E-02 lb-Pb/Tons-Refined Lead-Produced

12/5/2002 Stack Test
0.21/16.58=1.27e-2 lb/ton
This is a new baghouse added as part of the 2000 SIP control strategy.

Production Data
2005 Average Daily Production Rate = 425 Tons-Refined Lead-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
425 (Tons-Refined Lead-Produced/day) * 1.27E-02 (lb-Pb/Tons-Refined Lead-Produced) * 1 Sources =
5.3817 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
5.3817 (lb-Pb/day) * 365 (day/yr) =
1964 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

50008
Baghouse No. 9

Emission Factor
Pb Emission Factor = 8.58E-02 lb-Pb/Tons-Refined Lead-Produced

12/4/2002 Stack Test
1.44/16.79=8.58e-2 lb/ton
This is a new baghouse added as part of the 2000 SIP control strategy.

Production Data
2005 Average Daily Production Rate = 425 Tons-Refined Lead-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
425 (Tons-Refined Lead-Produced/day) * 8.58E-02 (lb-Pb/Tons-Refined Lead-Produced) * 1 Sources =
36.4416 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
36.4416 (lb-Pb/day) * 365 (day/yr) =
13301 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

50011-18
Kettle Setting Heat Stacks

Emission Factor
Pb Emission Factor = 7.09E-04 lb-Pb/Tons-Refined Lead-Produced

Stack test of No. 3 kettle heat stack (1999)
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 5, Sources 50011-18.

Production Data
2005 Average Daily Production Rate = 425 Tons-Refined Lead-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
425 (Tons-Refined Lead-Produced/day) * 7.09E-04 (lb-Pb/Tons-Refined Lead-Produced) * 8 Sources =
2.4100 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
2.4100 (lb-Pb/day) * 365 (day/yr) =
880 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

Figure 6-1. Daily Refined Lead Production

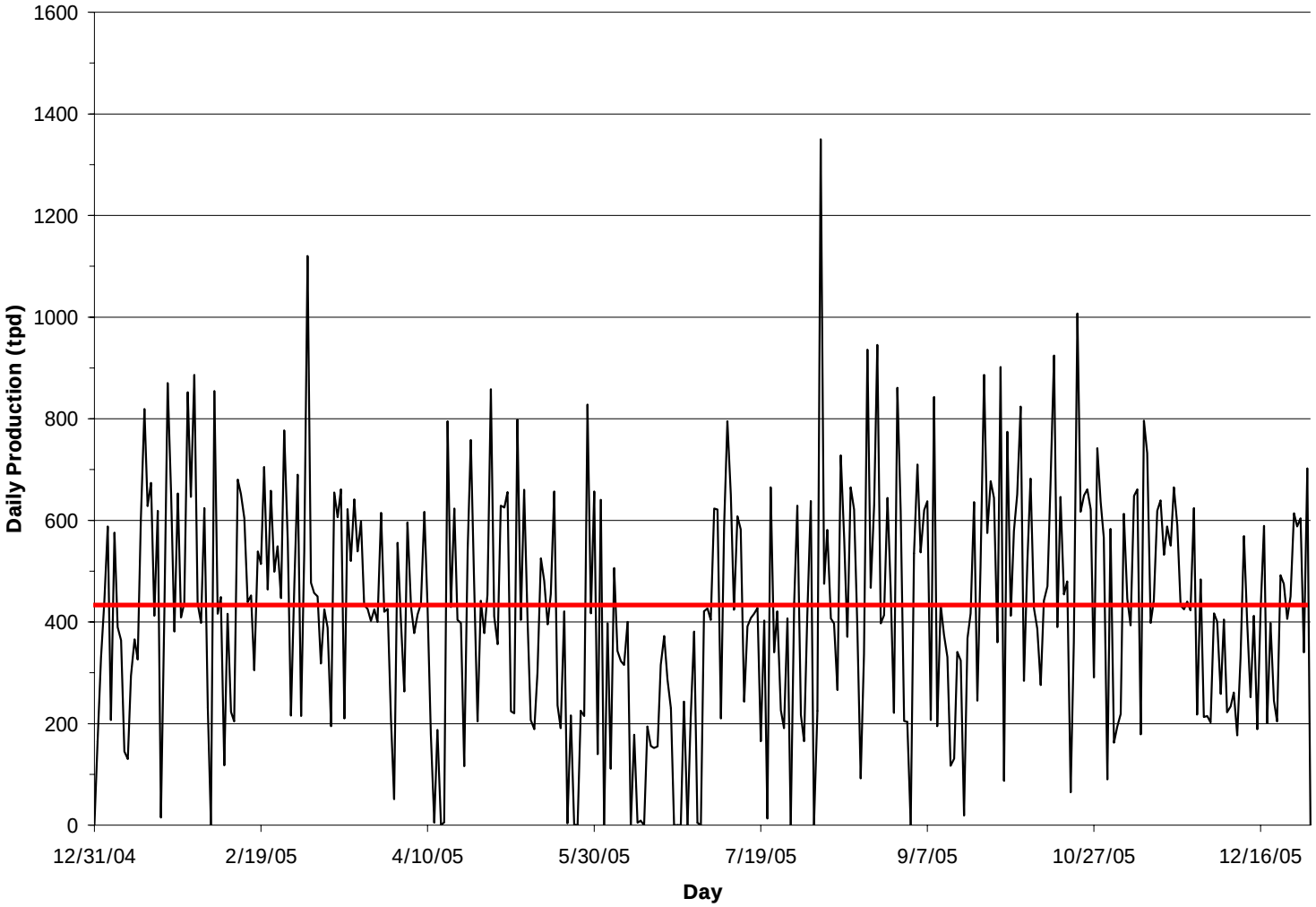
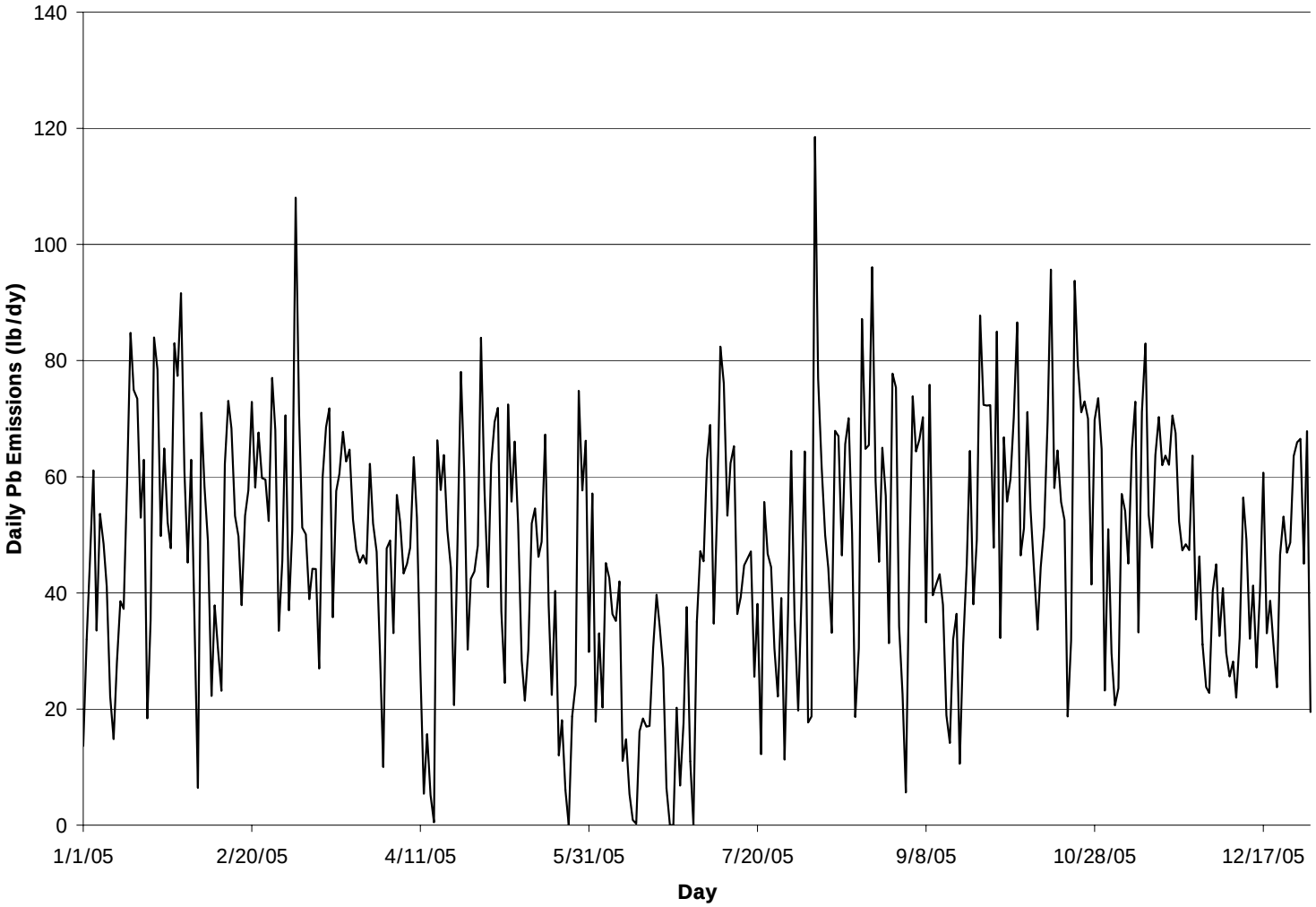


Figure 6-2. Daily Refinery Emissions



7.0 Strip Rolling Mill

60001,2
Strip Mill Heat Stacks

Emission Factor
Pb Emission Factor = 2.13E-04 lb-Pb/Tons-Lead Strip-Produced

Stack test of No. 3 kettle heat stack (1999) proportioned down to the size of the unit (30% of the refinery unit). 0.000709 lb/ton * 0.3
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 6, Sources 60001-2.

Production Data
2005 Average Daily Production Rate = 8 Tons-Lead Strip-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
8 (Tons-Lead Strip-Produced/day) * 2.13E-04 (lb-Pb/Tons-Lead Strip-Produced) * 2 Sources =
0.0032 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0032 (lb-Pb/day) * 365 (day/yr) =
1 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

60003
Strip Mill Baghouse

Emission Factor
Pb Emission Factor = 1.12E-05 lb-Pb/Tons-Lead Strip-Produced

Uncontrolled emission factor from AP-42, Table 2.3-2 (0.0007 lb/ton). A 98.4% control efficiency for the fabric filter was then utilized (AP-42, Table 2.3-5). TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 6, Source 60003.

Production Data
2005 Average Daily Production Rate = 8 Tons-Lead Strip-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
8 (Tons-Lead Strip-Produced/day) * 1.12E-05 (lb-Pb/Tons-Lead Strip-Produced) * 1 Sources =
0.0001 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0001 (lb-Pb/day) * 365 (day/yr) =
0.04 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

60004
Low Alpha Baghouse

Emission Factor
Pb Emission Factor = 3.58E-01 lb-Pb/Tons-Lead Bearing Material-Charged to the Low Alpha Furnace

Stack Testing (1999). Note that the emission factor used in the 2000 SIP was based on lb-Pb per lb-charge. This was updated to a lb/ton basis for consistency with other sources. 1.79e-4*2000=0.358 lb/ton.
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 6, Source 60004.

Production Data
2005 Average Daily Production Rate = 0.04 Tons-Lead Bearing Material-Charged to the Low Alpha Furnace/day

(Refined Lead Produced) * 9e-5
Low Alpha Charge (10/1/98-4/30/99) = 14 tons. Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. 14/151470 = 9e-5.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
0.04 (Tons-Lead Bearing Material-Charged to the Low Alpha Furnace/day) *
3.58E-01 (lb-Pb/Tons-Lead Bearing Material-Charged to the Low Alpha Furnace)
* 1 Sources =
0.0137 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0137 (lb-Pb/day) * 365 (day/yr) =
5 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 6 hours between 6a and 12a.

60005-8
Strip Mill Roof Vents

Emission Factor
Pb Emission Factor = 2.21E-03 lb-Pb/Tons-Lead Strip-Produced

Personnel Sampling. Emission factor is for each vent. 8.84e-3/4=2.21e-3 lb/ton. TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 6, Source 60005.

Production Data
2005 Average Daily Production Rate = 8 Tons-Lead Strip-Produced/day

Given

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
8 (Tons-Lead Strip-Produced/day) * 2.21E-03 (lb-Pb/Tons-Lead Strip-Produced) * 4 Sources =
0.0670 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0670 (lb-Pb/day) * 365 (day/yr) =
24 lb-Pb/yr

Hourly Lead Emissions
Daily emissions prorated over the day (typically operates 24 hr/dy). The production data utilized in the anlaysis is referenced to the "production day" 6a of day i to 6a of day (i+1).

Figure 7-1. Daily Lead Strip Production

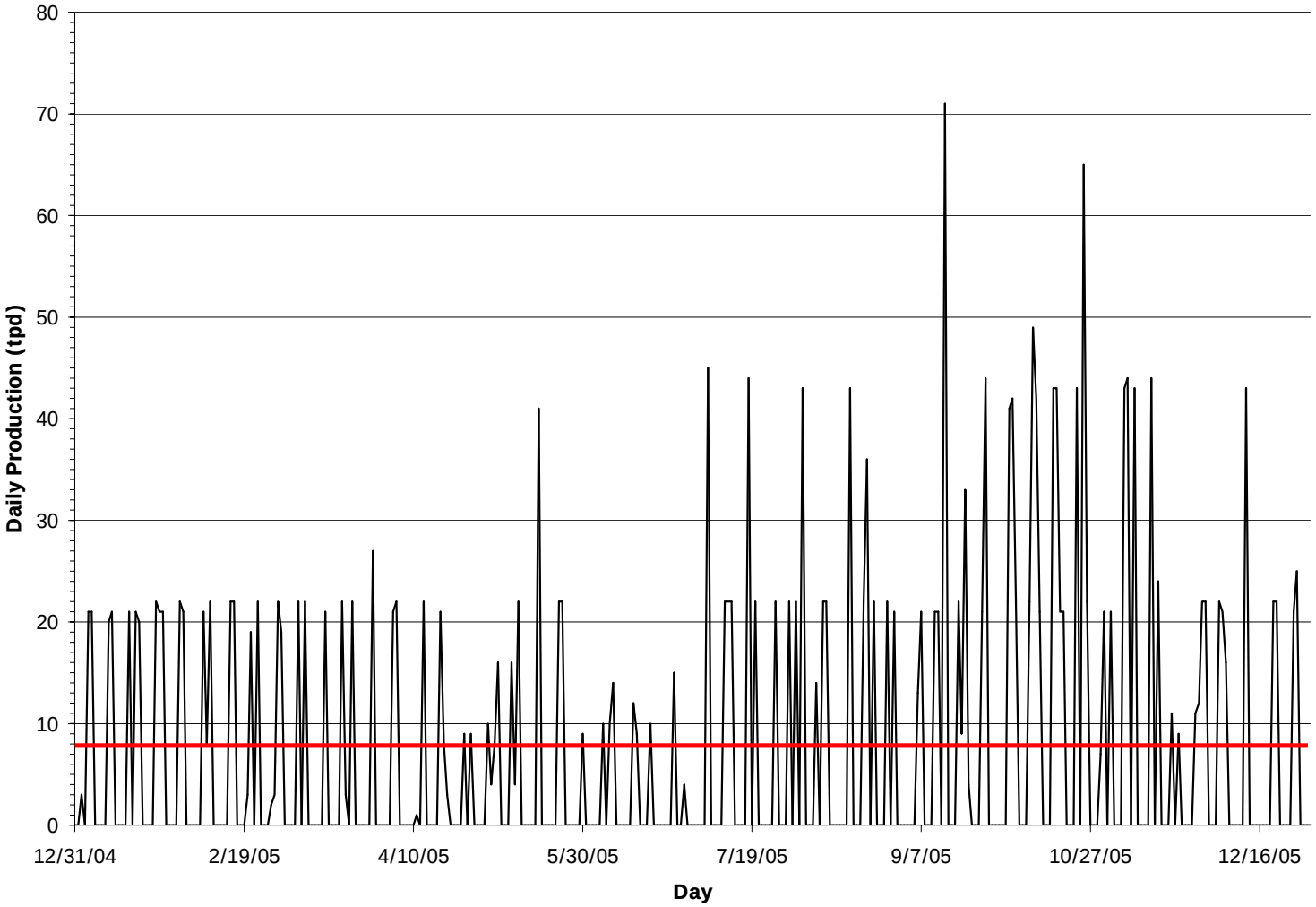
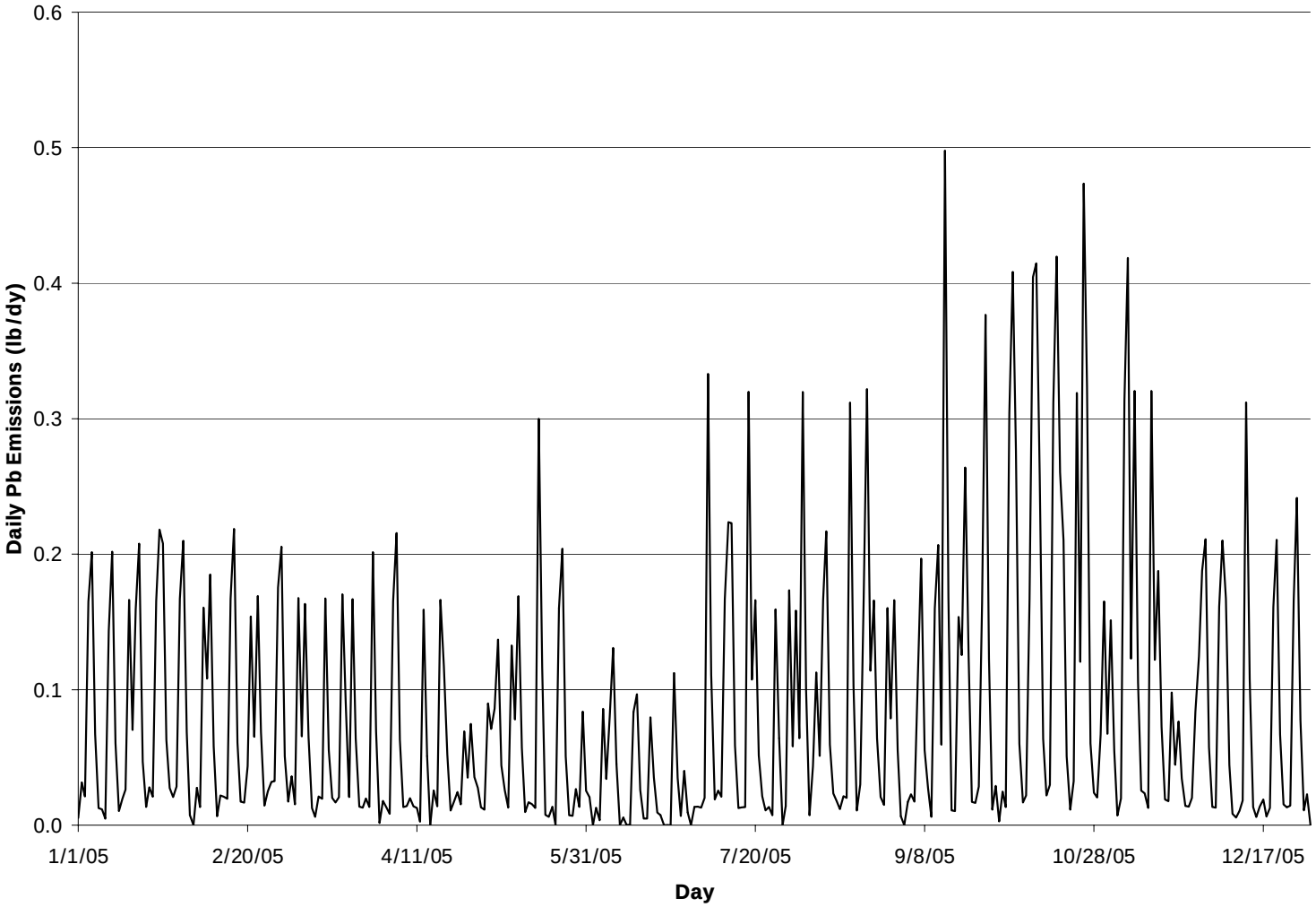


Figure 7-2. Daily Strip Rolling Mill Emissions



8.0 Fugitive Emissions

8.1 Storage Piles-Material Handling

Production for the fugitive handling sources was assumed proportional to the refined lead produced.
Dross – Refined lead produced times 0.046
Slag – Refined lead produced times 0.032
Secondaries - Refined lead produced times 0.058

Material is handled at the storage piles approximately 12 hours per day from 6a to 6p.

The fugitive particulate handling emissions were calculated using the methodology presented in AP42, Section 13.2.4 (Aggregate Handling and Storage Piles). The equation has been presented below:

$$E = 0.74 * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4} * (Pb/100)$$

E = Lead emission factor (lb/ton)

U = Average wind speed (mph)

M = Material moisture content (%)

Pb = Material lead content (%)

The lead and moisture contents have been provided in Table 8-1. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70001
Fugitive Dross Handling

Emission Factor
Pb Emission Factor = Varies lb-Pb/Tons-Material-Handled

AP42, Section 13.2.4
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Material Handling.
Hourly emissions vary by avg. hourly wind speed and material throughput. Emissions are also dependent upon the material moisture content and lead fraction.

Production Data
2005 Average Daily Production Rate = 20 Tons-Material-Handled/day

(Refined Lead Produced) * 0.046
Dross to Storage (10/1/98-4/30/99) = 6916 tons. Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. 6916/151470 = 0.046.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
20 (Tons-Material-Handled/day) * Varies (lb-Pb/Tons-Material-Handled) * 1 Sources =
0.0290 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0290 (lb-Pb/day) * 365 (day/yr) =
11 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 12 hours between 6a and 6p.

70007
Fugitive Slag Handling

Emission Factor
Pb Emission Factor = Varies lb-Pb/Tons-Material-Handled

AP42, Section 13.2.4
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Material Handling.
Hourly emissions vary by avg. hourly wind speed and material throughput. Emissions are also dependent upon the material moisture content and lead fraction.

Production Data
2005 Average Daily Production Rate = 14 Tons-Material-Handled/day

(Refined Lead Produced) * 0.032
Slag to Storage (10/1/98-4/30/99) = 4739 tons. Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. 4739/151470 = 0.032.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
14 (Tons-Material-Handled/day) * Varies (lb-Pb/Tons-Material-Handled) * 1 Sources =
0.0004 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0004 (lb-Pb/day) * 365 (day/yr) =
0.15 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 12 hours between 6a and 6p.

70009
Fugitive Secondaries Handling

Emission Factor
Pb Emission Factor = Varies lb-Pb/Tons-Material-Handled

AP42, Section 13.2.4
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Material Handling.
Hourly emissions vary by avg. hourly wind speed and material throughput. Emissions are also dependent upon the material moisture content and lead fraction.

Production Data
2005 Average Daily Production Rate = 25 Tons-Material-Handled/day

(Refined Lead Produced) * 0.058
Plant and Sump Cleanings to Storage (10/1/98-4/30/99) = 8763 tons. Refined Lead Produced (10/1/98-4/30/99) = 151470 tons. 8763/151470 = 0.058.

Daily Lead Emissions
The average daily Pb emissions were then calculated for each production day (6am to 6am of the following day). A sample calculation using the average daily production rate has been provided below:

2005 Average Daily Pb Emissions =
25 (Tons-Material-Handled/day) * Varies (lb-Pb/Tons-Material-Handled) * 1 Sources =
0.0037 lb-Pb/day

Annual Lead Emissions
The annual lead emissions can be calculated from the average daily lead emissions:

2005 Annual Pb Emissions =
0.0037 (lb-Pb/day) * 365 (day/yr) =
1 lb-Pb/yr

Hourly Lead Emissions
Daily Emissions prorated over the 12 hours between 6a and 6p.

8.2 Storage Piles-Wind Erosion

The fugitive wind erosion emissions were calculated using the methodology presented in AP42, Section 13.2.5 (Industrial Wind Erosion). The equation has been presented below for friction velocities exceeding the threshold friction velocity:

$$P = (58 * (u^* - u_t^*)^2 + 25 * (u^* - u_t^*)) * (Pb/100)$$

P = Lead Erosion (g/m^2)

u^* = Friction velocity (m/s)

u_t^* = Threshold friction velocity (m/s)

Pb = Material lead content (%)

If the friction velocity is less than the threshold friction velocity, the erosion is assumed equal to zero.

The friction velocity is calculated by multiplying the maximum hourly 5-minute average wind speed in mph by 0.0053. The 5-minute average wind speed corresponds well with the typical time of an erosion event.

The lead content, storage pile area, and threshold friction velocity for each storage pile have been provided in Table 8-1.

70002
Dross Storage Fugitive Wind Erosion

Emission Factor
Pb Emission Factor = Varies lb-Pb/m2-hr

AP42, Section 13.2.5
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Wind Erosion.
A potential emission rate was calculated for each hour using the referenced equation and the material lead content. The friction velocity was calculated by multiplying the 5-min. maximum wind speed by 0.053. If the friction velocity was geater than the

Production Data
2005 Average Daily Production Rate = Emissions are referenced to storage area not throughput.

465 square meters
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Pb and Moisture of Materials Stored Outside (Table).
100*50*.3048^2 = 465

Annual Lead Emissions
2005 Annual Pb Emissions = 0 lb-Pb/yr
There were no wind events during 2005 that exceeded the threshold friction velocity of the storage pile.

70004
Conc. Storage Fugitive Wind Erosion

Emission Factor
Pb Emission Factor = Varies lb-Pb/m2-hr

AP42, Section 13.2.5
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Wind Erosion.
A potential emission rate was calculated for each hour using the referenced equation and the material lead content. The friction velocity was calculated by multiplying the 5-min. maximum wind speed by 0.053. If the friction velocity was geater than the

Production Data
2005 Average Daily Production Rate = Emissions are referenced to storage area not throughput.

1161 square meters
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Pb and Moisture of Materials Stored Outside (Table).
250*50*.3048^2 = 1161

Annual Lead Emissions
2005 Annual Pb Emissions = 0 lb-Pb/yr
There were no wind events during 2005 that exceeded the threshold friction velocity of the storage pile.

70006
Sinter Storage Fugitive Wind Erosion

Emission Factor
Pb Emission Factor = Varies lb-Pb/m2-hr

AP42, Section 13.2.5
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Wind Erosion.
A potential emission rate was calculated for each hour using the referenced equation and the material lead content. The friction velocity was calculated by multiplying the 5-min. maximum wind speed by 0.053. If the friction velocity was geater than the

Production Data
2005 Average Daily Production Rate = Emissions are referenced to storage area not throughput.

1742 square meters
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Pb and Moisture of Materials Stored Outside (Table).
375*50*.3048^2 = 1742

Annual Lead Emissions
2005 Annual Pb Emissions = 0 lb-Pb/yr
There were no wind events during 2005 that exceeded the threshold friction velocity of the storage pile.

70008A,B
Slag Storage Fugitive Wind Erosion

Emission Factor
Pb Emission Factor = Varies lb-Pb/m2-hr

AP42, Section 13.2.5
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Wind Erosion.
A potential emission rate was calculated for each hour using the referenced equation and the material lead content. The friction velocity was calculated by multiplying the 5-min. maximum wind speed by 0.053. If the friction velocity was geater than the

Production Data
2005 Average Daily Production Rate = Emissions are referenced to storage area not throughput.

72565 square meters
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Pb and Moisture of Materials Stored Outside (Table).

Annual Lead Emissions
2005 Annual Pb Emissions = 80 lb-Pb/yr

70010
Sec Storage Fugitive Wind Erosion

Emission Factor
Pb Emission Factor = Varies lb-Pb/m2-hr

AP42, Section 13.2.5
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Wind Erosion.
A potential emission rate was calculated for each hour using the referenced equation and the material lead content. The friction velocity was calculated by multiplying the 5-min. maximum wind speed by 0.053. If the friction velocity was geater than the

Production Data
2005 Average Daily Production Rate = Emissions are referenced to storage area not throughput.

465 square meters
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Pb and Moisture of Materials Stored Outside (Table).
100*50*.3048^2 = 465

Annual Lead Emissions
2005 Annual Pb Emissions = 0 lb-Pb/yr
There were no wind events during 2005 that exceeded the threshold friction velocity of the storage pile.

8.3 Haul Roads

The haul roads at the facility were broken out into twelve segments:

A-B	Hwy 55 to Joachim Bridge Exit
B-C	Joachim Bridge Exit to Plant Entrance
C-D	Plant Entrance to NW Corner of Strip Mill Building
D-E	NW Corner of Strip Mill Building to Concentrate Hopper
E-F	Concetrate Hopper to SW Corner of Strip Mill Building
D-F	NW Corner of Strip Mill Building to SW Corner of Strip Mill Building
F-G	SW Corner of Strip Mill Building to North End of Slag Haul Road
G-H	North End of Slag Haul Road to Refinery Dock
G-K	South Slag Haul Road (Paved)
H-L	North End of Main Building to Refinery Dock
I-J	Sinter Plant to Sinter Storage
K-M	South Slag Haul Road (Unpaved)

The results from the sampling of the streets in and around the facility have been summarized in Table 8-2.

Maps showing the locations of each road segment have been provided as Figures 8-1, 8-2, and 8-3.

The emissions from the paved haul roads were calculated using AP42, Section 13.2.1, Equation 1 and the lead content:

$$E = 0.082 * (sL/2)^{0.65} * (W/3)^{1.5} * (Pb/100)$$

E = Lead Emission Factor (lb/VMT)

sL = Surface Silt Loading (g/m^2)

W = Average Vehicle Weight (tons)

Pb = Material Lead Content (%)

The emissions from the unpaved haul roads were calculated using AP42, Section 13.2.2, Equation 1a.

$$E = 4.9 * (s/12)^{0.7} * (W/3)^{0.45} * (Pb/100)$$

E = Lead Emission Factor (lb/VMT)

sL = Surface Silt Content (%)

W = Average Vehicle Weight (tons)

Pb = Material Lead Content (%)

The daily lead emissions were calculated based on the daily amount of material hauled. The hourly emissions were apportioned using the traffic scalars. The traffic scalars were developed, and approved for use in the 2000 SIP study (Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7 and Figure 2-1).

The vehicle miles traveled for each segment were calculated based on the amount of material hauled (each day), the average payload for each material hauled, and the length of the segment. For example, on segment A-B (outside plant haul road) concentrate, refined lead, and lead strip product are hauled. The concentrate, refined lead, and lead strip hauled during 2005 were 226812 tons, 155088 tons, and 2766 tons, respectively. The average payload for the trucks is 25 tons which equates to 9072 concentrate delivery trucks, 6204 refined lead product trucks, and 111 lead strip product trucks for the year of 2005. This equates to 15387 total trucks traveling over the A-B segment. The length of segment A-B is 4683 ft, therefore the total vehicle miles traveled for 2005 over segment A-B was 27295 miles.

2005 Haulage on Segment A-B =

15387 (trucks/yr) * 4683 (ft) / 5280 (ft/mi) * 2 =

27295 miles/yr

Emissions were assumed negligible for hours that had at least 0.01” of precipitation.

Paved Haul Roads
70100-122
Hwy 55 to Joachim Bridge Exit (Segment A-B)

Parameters
Segment Length = 4683 ft
2005 Annual Traffic Rate = 27295 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 0.3491 g/m^2
Station Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
0.3491 (g/m^2) * (7.5/100) =
0.0262 g/m^2

2005 Average Truck Weight = 26.74 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 2.73%
Station Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.0262 (g/m^2)/2]^{0.65} * [26.74 (tons)/3]^{1.5} *$ [Station Sample (%)/100] * 27295 (VMT/yr) =
97 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70150-213
Joachim Bridge Exit to Plant Entrance (Segment B-C)

Parameters
Segment Length = 12819 ft
2005 Annual Traffic Rate = 74718 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 0.6545 g/m^2
Main & Curved Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
0.6545 (g/m^2) * (7.5/100) =
0.0491 g/m^2

2005 Average Truck Weight = 26.74 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 6.52%
Main & Curved Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.0491 (g/m^2)/2]^{0.65} * [26.74 (tons)/3]^{1.5}$ * [Main & Curved Sample (%)/100] * 74718 (VMT/yr) =
955 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70250-252
Plant Entrance to NW Corner of Strip Mill Building (Segment C-D)

Parameters
Segment Length = 465 ft
2005 Annual Traffic Rate = 2711 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.4312 g/m^2
Truck Wash Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.4312 (g/m^2) * (7.5/100) =
0.1073 g/m^2

2005 Average Truck Weight = 26.74 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 7.17%
Truck Wash Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.1073 (g/m^2)/2]^{0.65} * [26.74 (tons)/3]^{1.5}$ * [Truck Wash Sample (%)/100] * 2711 (VMT/yr) =
63 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70300
NW Corner of Strip Mill Building to Concentrate Hopper (Segment D-E)

Parameters
Segment Length = 151 ft
2005 Annual Traffic Rate = 260 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.4312 g/m^2
Truck Wash Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.4312 (g/m^2) * (7.5/100) =
0.1073 g/m^2

2005 Average Truck Weight = 38.70 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 7.17%
Truck Wash Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.1073 (g/m^2)/2]^{0.65} * [38.70 (tons)/3]^{1.5}$ * [Truck Wash Sample (%)/100] * 260 (VMT/yr) =
11 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70350-358
Concetrate Hopper to SW Corner of Strip Mill Building (Segment E-F)

Parameters
Segment Length = 746 ft
2005 Annual Traffic Rate = 1360 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.4312 g/m^2
Truck Wash Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.4312 (g/m^2) * (7.5/100) =
0.1073 g/m^2

2005 Average Truck Weight = 15.77 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 7.17%
Truck Wash Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.1073 (g/m^2)/2]^{0.65} * [15.77 (tons)/3]^{1.5}$ * [Truck Wash Sample (%)/100] * 1360 (VMT/yr) =
14 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70400-406
NW Corner of Strip Mill Building to SW Corner of Strip Mill Building (Segment D-F)

Parameters
Segment Length = 544 ft
2005 Annual Traffic Rate = 2234 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.4312 g/m^2
Truck Wash Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.4312 (g/m^2) * (7.5/100) =
0.1073 g/m^2

2005 Average Truck Weight = 21.85 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 7.17%
Truck Wash Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.1073 (g/m^2)/2]^{0.65} * [21.85 (tons)/3]^{1.5}$ * [Truck Wash Sample (%)/100] * 2234 (VMT/yr) =
39 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70450-454
SW Corner of Strip Mill Building to North End of Slag Haul Road (Segment F-G)

Parameters
Segment Length = 413 ft
2005 Annual Traffic Rate = 1013 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.4312 g/m^2
Truck Wash Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.4312 (g/m^2) * (7.5/100) =
0.1073 g/m^2

2005 Average Truck Weight = 27.25 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 7.17%
Truck Wash Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.1073 (g/m^2)/2]^{0.65} * [27.25 (tons)/3]^{1.5}$ * [Truck Wash Sample (%)/100] * 1013 (VMT/yr) =
24 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70500-513
North End of Slag Haul Road to Refinery Dock (Segment G-H)

Parameters
Segment Length = 1073 ft
2005 Annual Traffic Rate = 4716 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.0094 g/m^2
Dock Exit Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.0094 (g/m^2) * (7.5/100) =
0.0757 g/m^2

2005 Average Truck Weight = 30.34 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 10.62%
Dock Exit Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.0757 (g/m^2)/2]^{0.65} * [30.34 (tons)/3]^{1.5} * [\text{Dock Exit Sample } (\%)/100] * 4716 (VMT/yr) =$
157 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70550-553
South Slag Haul Road (Paved) (Segment G-K)

Parameters
Segment Length = 276 ft
2005 Annual Traffic Rate = 535 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.0094 g/m^2
Dock Exit Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.0094 (g/m^2) * (7.5/100) =
0.0757 g/m^2

2005 Average Truck Weight = 34.26 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 10.62%
Dock Exit Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.0757 (g/m^2)/2]^{0.65} * [34.26 (tons)/3]^{1.5} * [\text{Dock Exit Sample } (\%)/100] * 535 (VMT/yr) =$
21 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70650-669
Sinter Plant to Sinter Storage (Segment I-J)

Parameters
Segment Length = 1377 ft
2005 Annual Traffic Rate = 434 VMT/yr

Silt Content = 7.5%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Paved Haul Roads.

Dust Loading = 1.0094 g/m^2
Dock Exit Sample

Silt loading was calculated by multiplying the dust loading by the silt content.

Silt Loading =
1.0094 (g/m^2) * (7.5/100) =
0.0757 g/m^2

2005 Average Truck Weight = 34.19 tons
Calculated from the weight and traffic rate of the individual trucks that travel on the segment.

Lead Content of Road Dust = 10.62%
Dock Exit Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$0.082 * [0.0757 (g/m^2)/2]^{0.65} * [34.19 (tons)/3]^{1.5} * [\text{Dock Exit Sample } (\%)/100] * 434 (VMT/yr) =$
17 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

Unpaved Haul Roads
70600-612
North End of Main Building to Refinery Dock (Unpaved) (Segment H-L)

Parameters
Segment Length = 1229 ft
2005 Annual Traffic Rate = 2383 VMT/yr

Silt Content = 8.3%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Unpaved Haul Roads.

2005 Avg. Truck Weight = 32.59 tons

Lead Content = 10.62%
Dock Exit Sample

Annual Emission Calculation
2005 Annual Pb Emissions =
$4.9 * [8.3(\%)/12]^{0.7} * [32.59\ (tons)/3]^{0.45} * [10.62\ (\%)/100] * 2383\ (VMT/yr) =$
2801 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

70700-703
South Slag Haul Road (Unpaved) (Segment K-M)

Parameters
Segment Length = 463 ft
2005 Annual Traffic Rate = 897 VMT/yr

Silt Content = 8.3%
TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7, Unpaved Haul Roads.

2005 Avg. Truck Weight = 32.59 tons

Lead Content = 3.00%
Slag Lead Content. Typical is 1%, however the fraction was increased to 3% to be conservative. This was agreed upon after consultation with MDNR.

Annual Emission Calculation
2005 Annual Pb Emissions =
$4.9 * [8.3(\%)/12]^{0.7} * [32.59\ (tons)/3]^{0.45} * [3.00\ (\%)/100] * 897\ (VMT/yr) =$
298 lb-Pb/yr

The emissions were calculated for each day and segment. Daily emissions were apportioned to each hour using the traffic scalars. Refer to TRC Environmental, "Doe Run Lead Emission Inventory Herculaneum Smelter", March 2000, Section 7.

Table 8-1. Material/Storage Pile Information

Material	Dross	Conc.	Sinter	Slag	Sec
Moisture Content (%)	2			2	8
Lead Content (%)	56	79	44	1	40
Storage Pile Area (m^2)	465	1161	1742	72565	465
Threshold Friction Velocity (m/s)	1.12	1.12	1.12	0.45	1.12

Wind Erosion

70002	Dross
70004	Concentrate
70006	Sinter
70008	Slag
70010	Secondaries

Fugitive Handling

70001	Dross
70007	Slag
70009	Secondaries

Table 8-2. Street Sample Summary

Sample Date	Lead Fraction (%)				Lead Loading (mg/ft^2)				Dust Loading (g/m^2)			
	Station	Main & Curved	Dock Exit	Truck Wash	Station	Main & Curved	Dock Exit	Truck Wash	Station	Main & Curved	Dock Exit	Truck Wash
1/12	1.12	5.33	3.40	3.63	0.69	3.62	1.66	0.59	0.66	0.73	0.53	0.17
1/21	2.95	10.07	13.15	10.14	1.17	7.81	19.75	24.67	0.43	0.83	1.62	2.62
1/28	4.47	6.92	16.54	3.90	1.21	4.02	12.08	14.94	0.29	0.62	0.79	4.13
2/11	1.64	8.21	7.20	5.77	1.67	9.07	8.40	17.48	1.10	1.19	1.26	3.26
2/18	1.45	6.05	11.22	4.46	0.65	3.93	9.90	17.98	0.48	0.70	0.95	4.34
3/1	2.10	4.39	10.07	4.58	0.35	1.64	4.34	5.17	0.18	0.40	0.46	1.21
3/8	1.85	3.79	14.85	2.91	0.47	1.48	8.72	2.60	0.27	0.42	0.63	0.96
3/21	4.64	7.45	14.15	6.93	0.63	2.48	8.10	7.68	0.15	0.36	0.62	1.19
4/18	2.81	5.13	15.39	2.50	0.80	3.58	15.68	2.06	0.31	0.75	1.10	0.89
5/25	1.97	4.59	11.47	4.00	0.23	1.25	7.21	1.25	0.13	0.29	0.68	0.34
7/5	2.65	2.83	4.71	4.27	0.29	2.16	8.06	2.47	0.12	0.82	1.84	0.62
8/2	2.65	2.83	4.71	4.27	0.28	0.95	1.76	1.17	0.12	0.36	0.40	0.30
8/29	2.55	8.23	4.87	9.09	0.36	2.10	6.51	2.22	0.15	0.27	1.44	0.26
10/5	2.93	11.51	14.21	12.71	0.82	7.11	12.10	8.26	0.30	0.66	0.92	0.70
11/7	2.92	4.77	6.52	6.64	1.30	2.87	9.72	3.92	0.48	0.65	1.60	0.64
12/2	5.02	12.21	17.38	28.95	1.96	15.84	21.48	33.96	0.42	1.40	1.33	1.26
Avg	**2.73**	**6.52**	**10.62**	**7.17**	**0.81**	**4.37**	**9.72**	**9.15**	**0.35**	**0.65**	**1.01**	**1.43**

Sample	No.	Pb %	DL (g/m2)
Station	1	2.73	0.35
Main & Curved	2	6.52	0.65
Dock Exit	3	10.62	1.01
Truck Wash	4	7.17	1.43

Figure 8-1. Haul Roads

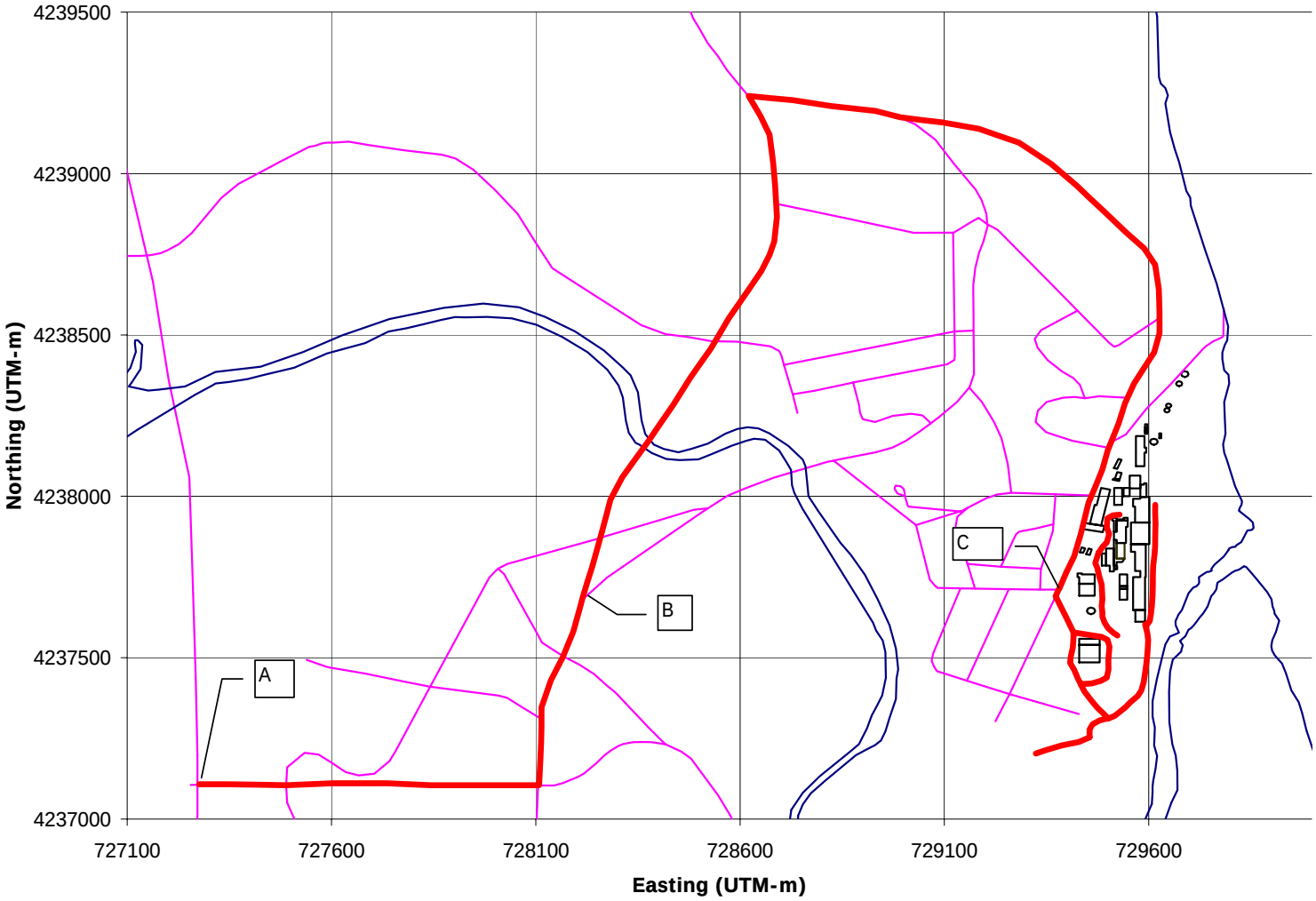


Figure 8-2. Haul Roads (Continued)

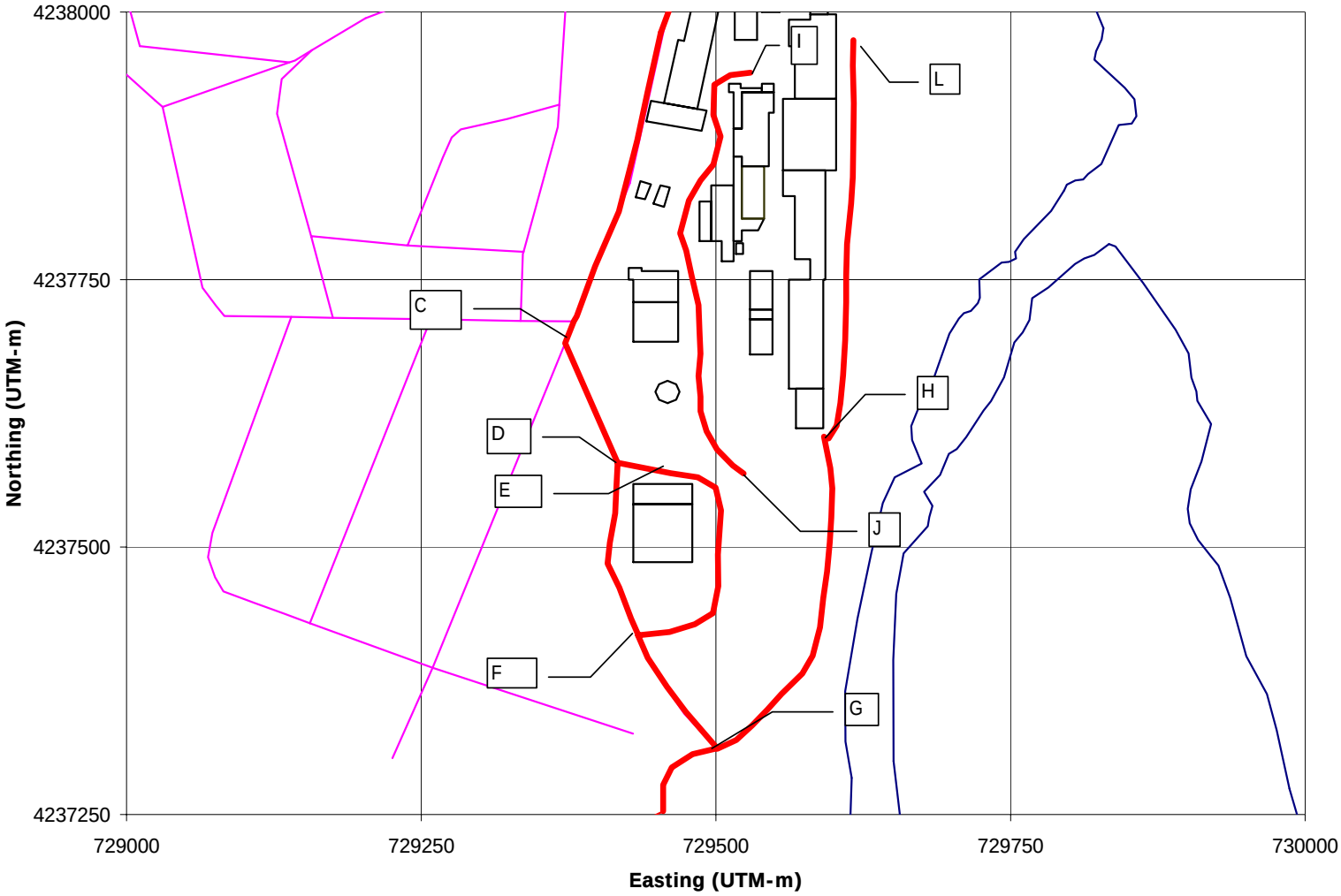


Figure 8-3. Haul Roads (Continued)

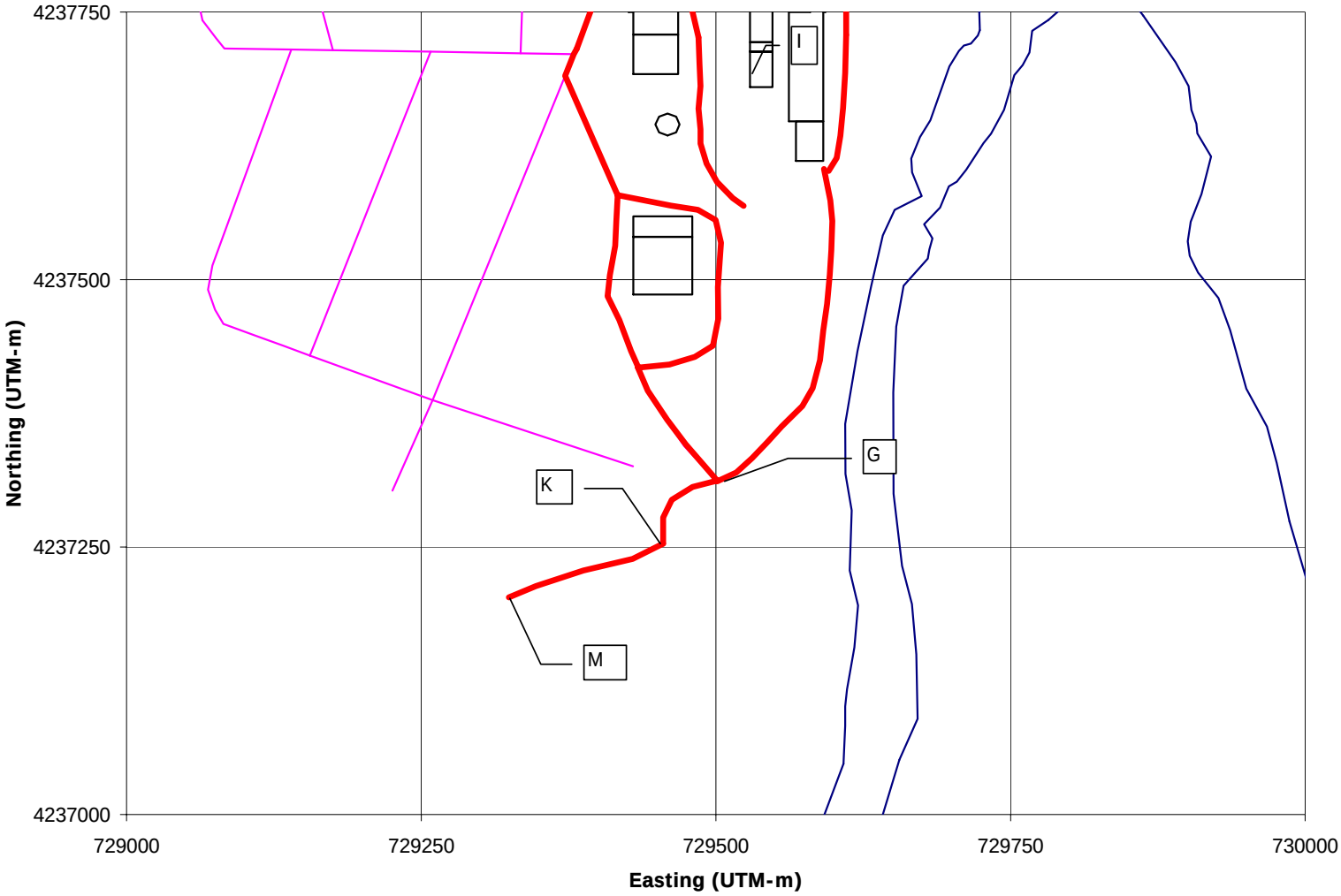
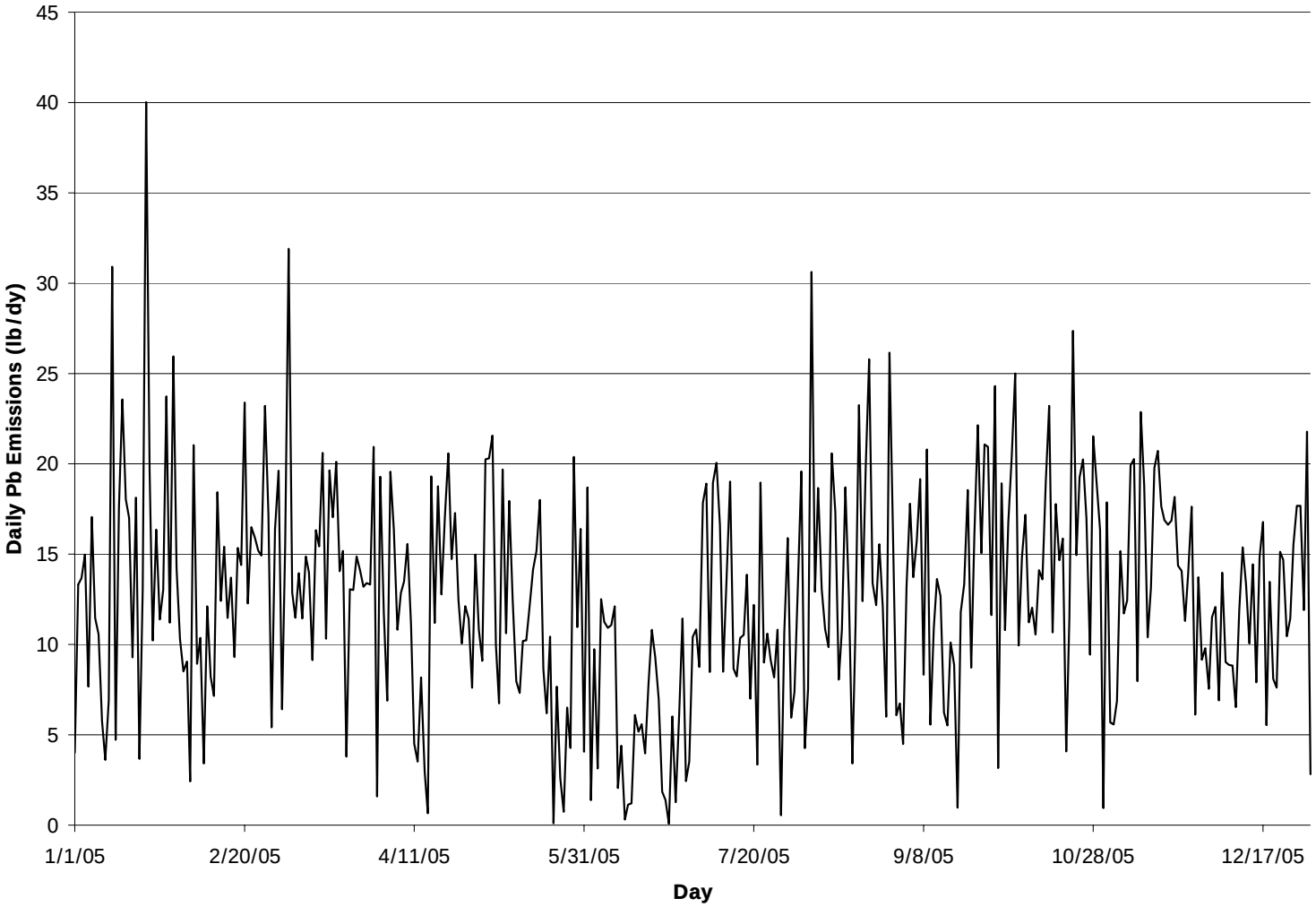



Figure 8-4. Daily Fugitive Emissions