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MEMORANDUM

To: Nathan Topham, U.S. Environmental Protection Agency, OAQPS

From: Mike Burr, Donna Lazzari, and Danny Greene, ERG

Date: December 16, 2011

Subject: Development of the RTR Emissions Dataset for the Secondary Lead Smelting Source Category

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This memorandum summarizes the data and methodologies used to develop the site-specific emissions and stack release characteristics that were used to conduct the risk assessment modeling for the Secondary Lead Smelting source category. This memorandum is organized as follows:

1.0 Background
2.0 Release Characteristics and Locations of Stack and Fugitive Emissions Sources
3.0 Metal HAP Emissions From Stacks
4.0 Organic Compound Emissions from Stacks
5.0 Metal HAP Emissions From Fugitive Dust Sources
6.0 Estimating MACT-allowable emissions
7.0 Estimating Short-Term Acute Emissions
8.0 Estimating Emissions Reductions for Control Scenarios

1.0 BACKGROUND

Table 1-1 lists the secondary lead smelters currently in operation or under construction in the United States and Puerto Rico. In June of 2010, the EPA issued an information collection request (ICR) pursuant to section 114 of the Clean Air Act (CAA) to six companies who own 14 secondary lead smelting facilities currently in operation in the United States. The six companies submitted responses for all 14 facilities. The ICR requested available information on process equipment, control devices, stack and fugitive emissions from their perspective facility, stack parameters, as well as other aspects of the facilities' operations. The ICR also requested that each facility submit historical stack test data for any test conducted in 2003 or later. Additionally, 8 facilities were asked, as part of the ICR, to conduct stack tests for a variety of pollutants and processes that were considered representative of the industry. A limited request for information was sent to The Battery Recycling Company in Puerto Rico in August of 2011. The Johnson

Controls facility in Florence, South Carolina will not be operational until 2012 and was not surveyed.

Table 1-1. Secondary Lead Smelters in the U.S. and Puerto Rico

FACILITY NAME	PARENT COMPANY	CITY	STATE	Facility Abbreviation
East Penn Manufacturing Co., Inc.	East Penn Manufacturing Co., Inc.	Lyon Station	Pennsylvania	East Penn
EnviroFocus Technologies, LLC	Gopher Resources, LLC	Tampa	Florida	EnviroFocus
Gopher Resources, LLC	Gopher Resources, LLC	Eagan	Minnesota	Gopher Eagan
Quemetco, Inc., City of Industry, Ca	Eco-Bat Technologies, LTD (Quemetco West, LLC)	City of Industry	California	Quemetco CA
Quemetco, Inc., Indianapolis, In	Eco-Bat Technologies, LTD (Eco-Bat Indiana, LLC)	Indianapolis	Indiana	Quemetco IN
Revere Smelting and Refining Corporation (RSR)	Eco-Bat Technologies, LTD (Eco-Bat New York, LLC)	Middletown	New York	RSR
Sanders Lead Company	Sanders Lead Company	Troy	Alabama	Sanders Lead
Exide Technologies, Baton Rouge, La	Exide Technologies, Inc.	Baton Rouge	Louisiana	Exide Baton Rouge
Exide Technologies, Cannon Hollow Recycling Facility	Exide Technologies, Inc.	Forest City	Missouri	Exide Forest City
Exide Technologies, Frisco, Tx	Exide Technologies, Inc.	Frisco	Texas	Exide Frisco
Exide Technologies, Muncie, In	Exide Technologies, Inc.	Muncie	Indiana	Exide Muncie
Exide Technologies – Reading Recycling	Exide Technologies, Inc.	Reading	Pennsylvania	Exide Reading
Exide Technologies, Vernon, Ca	Exide Technologies, Inc.	Vernon	California	Exide Vernon
Buick Resource Recycling Facility, LLC	The Doe Run Resources Corporation	Boss	Missouri	Buick RRF
The Battery Recycling Company	The Battery Recycling Company	Arecibo	Puerto Rico	BATTERY RECYCLING
Johnson Controls Battery Group, Inc.	Johnson Controls International	Florence	South Carolina	JCI

The emissions and process data collected under the ICR were used to develop site-specific baseline emissions estimates and emissions source release characteristics (i.e., elevation, stack height, stack diameter, stack gas exit velocity, stack gas flow rate, stack gas exit temperature, and stack location (latitude and longitude)) for each of the facilities. The baseline emissions estimates include stack and fugitive dust emissions from secondary lead smelting processes. Table 1-2 summarizes the pollutants included in the baseline emissions estimates for both stack and fugitive emissions. We also evaluated a separate facility-wide dataset that included emissions from other process located on site in addition to those associated with the secondary lead smelting processes. Facility-wide emissions were essentially the same as those of the source category, so a separate facility-wide analysis was not performed. These baseline emissions estimates and emissions source release characteristics were used as the data inputs for the EPA's risk assessment modeling for this source category.

Table 1-2. Pollutants Included in the Secondary Lead Smelting Modeling File.

HAP	STACK	FUGITIVE
1,1,2,2-Tetrachloroethane	✓	
1,3-Butadiene	✓	
1,3-Dichloropropene	✓	
2,3,7,8-TCDD TEQ	✓	
Acetaldehyde	✓	
Acetophenone	✓	
Acrolein	✓	
Acrylonitrile	✓	
Antimony	✓	✓
Arsenic	✓	✓
Benz[a]Anthracene	✓	
Benzene	✓	
Benzo[a]Pyrene	✓	
Benzo[b]Fluoranthene	✓	
Benzo[k]Fluoranthene	✓	
Beryllium	✓	✓
Biphenyl	✓	
Bis(2-Ethylhexyl)Phthalate	✓	
Cadmium	✓	✓
Carbon Disulfide	✓	
Chlorine	✓	
Chlorobenzene	✓	
Chloroform	✓	
Chromium (VI)	✓	✓
Chromium III	✓	✓
Chrysene	✓	
Cumene	✓	
Dibenzo[a,h]Anthracene	✓	
Dibutyl Phthalate	✓	
Divalent Mercury	✓	✓
Elemental Gaseous Mercury	✓	
Ethyl Benzene	✓	
Ethyl Chloride	✓	
Formaldehyde	✓	

Table 1-2. Pollutants Included in the Secondary Lead Smelting Modeling File.

HAP	STACK	FUGITIVE
Hexane	✓	
Hydrochloric Acid	✓	
Indeno[1,2,3-c,d]Pyrene	✓	
Lead	✓	✓
Manganese	✓	✓
Methyl Bromide	✓	
Methyl Chloride	✓	
Methyl Iodide	✓	
Methyl Isobutyl Ketone	✓	
Methylene Chloride	✓	
m-Xylene	✓	
Naphthalene	✓	
Nickel	✓	✓
o-Cresol	✓	
o-Xylene	✓	
Particulate Mercury	✓	✓
Phenol	✓	
Propionaldehyde	✓	
p-Xylene	✓	
Pyrene	✓	
Selenium	✓	✓
Styrene	✓	
Tetrachloroethylene	✓	
Toluene	✓	
Trichloroethylene	✓	
Xylenes (Mixture of o, m, and p)Isomers)	✓	

2.0 RELEASE CHARACTERISTICS AND LOCATIONS OF STACK AND FUGITIVE EMISSIONS SOURCES

Fixed parameters for stack release points, such as elevation, stack height, stack diameter, and stack location, were extracted from the surveys submitted by the facilities. The location coordinates for each emissions source submitted in the ICR surveys were checked using Google Earth©. For the Exide Frisco and the RSR NY facilities, the stack coordinates were found to be inaccurate. Therefore, the stack coordinates for Exide Frisco were extracted from a 2008 modeling file provided by EPA contractor ICF International and the stack coordinates for RSR were estimated using Google Earth©. Google Earth© was also used to estimate the location and dimensions of the fugitive dust emissions sources at each facility. For risk assessment modeling purposes, the coordinates of the fugitive emissions sources were placed at the southwest corner of each facility and the dimensions were chosen such that the source spanned the entire facility.

Values for stack exit velocity, flow rate, and exit temperature were obtained from the corresponding emissions test reports from which emissions data were extracted. In cases where emissions from multiple test reports were averaged, the stack parameters from those reports were averaged. In the event that any of the varying parameters were not available in the test report, estimates provided by the industry in their ICR surveys were used.

3.0 METAL HAP EMISSIONS FROM STACKS

Table 3-1 presents the metal hazardous pollutants (HAP) emissions estimates for stacks at each facility. The emissions estimates shown in Table 3-1 were developed using the site-specific emissions data collected by the ICR. In cases where stack test results included values reported as being below a test method detection limit (BDL), the detection limits specified in the test reports were used in the emissions estimates. For beryllium, none of the emissions test data were above the method detection limit. Consequently, stack emissions estimates for this metal were not developed.

3.1 Lead

Because of the annual (or biannual) performance testing required by the current National Emissions Standards for Hazardous Air Pollutants (NESHAP) for the Secondary Lead Smelting source category (40 CFR part 63, subpart X), a large amount of data were available for lead emissions from stack (i.e., point) sources. Consequently, the site-specific lead emissions estimates were compiled using stack test data obtained for the years 2006 through 2010. In cases where multiple test reports in the 2006-2010 timeframe were available for a particular stack at a facility, the average of the emissions values from the test reports was used in the emissions estimate. If a facility had undergone recent modifications that affected stack emissions, only post-modification emissions were used in the emissions estimates (this holds true for all pollutants).

We obtained lead stack test data for 101 release points, which account for the vast majority of release points. However, site-specific lead emissions data were not available for two stack release points identified in the ICR surveys. For these emissions points, default emissions factors were developed using data from similar processes at other facilities.

3.2 Other Metals

Where available, site-specific data for non-lead metal HAP (i.e., arsenic (As), cadmium (Cd), trivalent chromium (Cr^{+3}), hexavalent chromium (Cr^{+6}), mercury (Hg), manganese (Mn),

Table 3-1. Point Source Metal HAP Emissions Estimates (lbs/yr) by Facility.

Name of Facility	As	Sb	Cd	Cr^{+6}	Cr^{+3}	Elemental Hg*	Divalent Hg*	Particulate Hg*	Pb	Mn	Ni	Se
Buick RRF	2,352.0	441.3	425.6	0.3	11.4	21.4	2.7	2.7	9,389.4	104.4	34.0	117.4
East Penn	3.8	14.1	0.9	0.1	3.2	7.4	0.9	0.9	299.5	15.0	6.0	3.7
Exide Vernon	12.0	23.5	0.4	0.1	9.7	13.9	1.7	1.7	499.6	45.6	16.0	6.2
Exide Reading	27.8	101.5	2.4	0.2	7.4	9.4	1.2	1.2	2,160.1	31.3	14.5	27.0
Exide Muncie	8.8	20.0	0.4	0.1	4.7	6.1	0.8	0.8	425.8	22.1	7.8	5.3
Exide Baton Rouge	42.8	203.9	7.2	0.2	5.6	7.2	0.9	0.9	4337.3	21.3	13.4	54.2
Exide Forest City	5.5	13.5	0.2	0.1	1.8	2.4	0.3	0.3	286.2	7.9	3.7	3.6
Exide Frisco	113.4	110.9	4.3	0.9	23.9	28.6	3.6	3.6	2595.871	87.5	26.5	32.4
Gopher Eagan	31.6	20.6	0.9	0.1	3.2	3.9	0.5	0.5	437.8	10.6	4.9	5.5
EnviroFocus	10.0	45.2	1.3	0.1	2.1	2.8	0.3	0.3	962.7	9.7	4.2	12.0
Quemetco (CA)	4.1	0.8	2.3	0.1	3.7	21.0	2.6	2.6	16.5	19.4	4.4	0.2
Quemetco (IN)	43.5	23.9	1.0	0.1	8.7	35.8	4.5	4.5	507.4	37.3	13.5	6.3
RSR	50.2	40.8	2.9	0.2	10.4	20.7	2.6	2.6	869.0	31.4	15.3	10.9
Sanders Lead	51.2	103.5	4.5	0.3	13.2	10.2	1.3	1.3	2,201.7	40.3	23.3	27.5
Battery Recycling	6.7	5.9	0.2	0.1	0.9	1.3	0.2	0.2	184.0	4.1	2.0	2.3
Total for the Source Category	2763	1169	455	3	110	192	24	24	25173	488	190	315

*Most stack test results for mercury were below the detection limit and the limit of detection was used as the concentration estimate; therefore, these mercury estimates are high-end conservative estimates of emissions. The true mercury emissions are probably much lower.

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and nickel (Ni)) emissions from stacks were used for the emissions estimates. In cases where site-specific data were not available, emissions estimates for non-lead metal HAP were developed using facility lead emissions and ratios of non-lead metal HAP to lead.

Analysis of the available emissions data collected by the ICR survey and test program revealed that a logarithmic relationship between the metal-to-lead ratios and the lead concentrations produced the best correlation. Least-squares regressions analyses were conducted on the logarithmic metal HAP/lead ratios and lead emissions to obtain trend line equations.

Figure 3-1 shows the scatter plots of the data and the corresponding regression equations. The regression line equations and site-specific lead emissions data were used as an empirical model to calculate non-lead metal HAP emissions for emissions points where other metal data were not available.

Stack test data were not collected for selenium and antimony under the ICR test program. Therefore, site-specific estimates were made for these pollutants using the metal-to-lead ratios developed for the EPA's 2002 Inhalation Risk Estimate report[1]. In this report, separate non-lead metal-to-lead ratios were developed from test data for process, process fugitive, and fugitive dust emissions sources. For this analysis, the selenium and antimony ratios for process fugitive emissions were selected because these ratios were most similar to the ratios developed from the ICR data for other metals.

The site-specific emissions estimates for total mercury and chromium were speciated to account for the different oxidation states of these metals. Total mercury emissions were speciated as follows based on the EPA's default mercury speciation profile: 80 percent elemental mercury, 10 percent gaseous divalent mercury, and 10 percent particulate divalent mercury. These profiles are available on the EPA's Technical Transfer Network (TTN) at: http://www.epa.gov/ttn/chief/net/2005inventory.html.

New stack test data for hexavalent chromium (Cr^{+6}) were available for 7 of the emissions points included in the source category; all 7 of these emissions points were stacks containing furnace exhaust. A ratio of Cr^{+6} to total chromium was calculated based on the new stack test data and then used to estimate Cr^{+6} at the remaining furnace emissions points. The difference between total chromium and Cr^{+6} at these emissions points was designated as Cr^{+3}. For non-furnace emissions points, total chromium emissions, that were either extracted from test reports or estimated based on the logarithmic relationship previously outlined, were speciated to one percent Cr^{+6} and 99 percent Cr^{+3} based on speciation profiles provided by the EPA (available at: http://www.epa.gov/ttn/chief/net/2005inventory.html).

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[1] Memorandum from EC/R to EPA, "Updated Draft Population Inhalation Risk Estimates for the Secondary Lead Smelter Residual Risk Assessment," November 26, 2002.

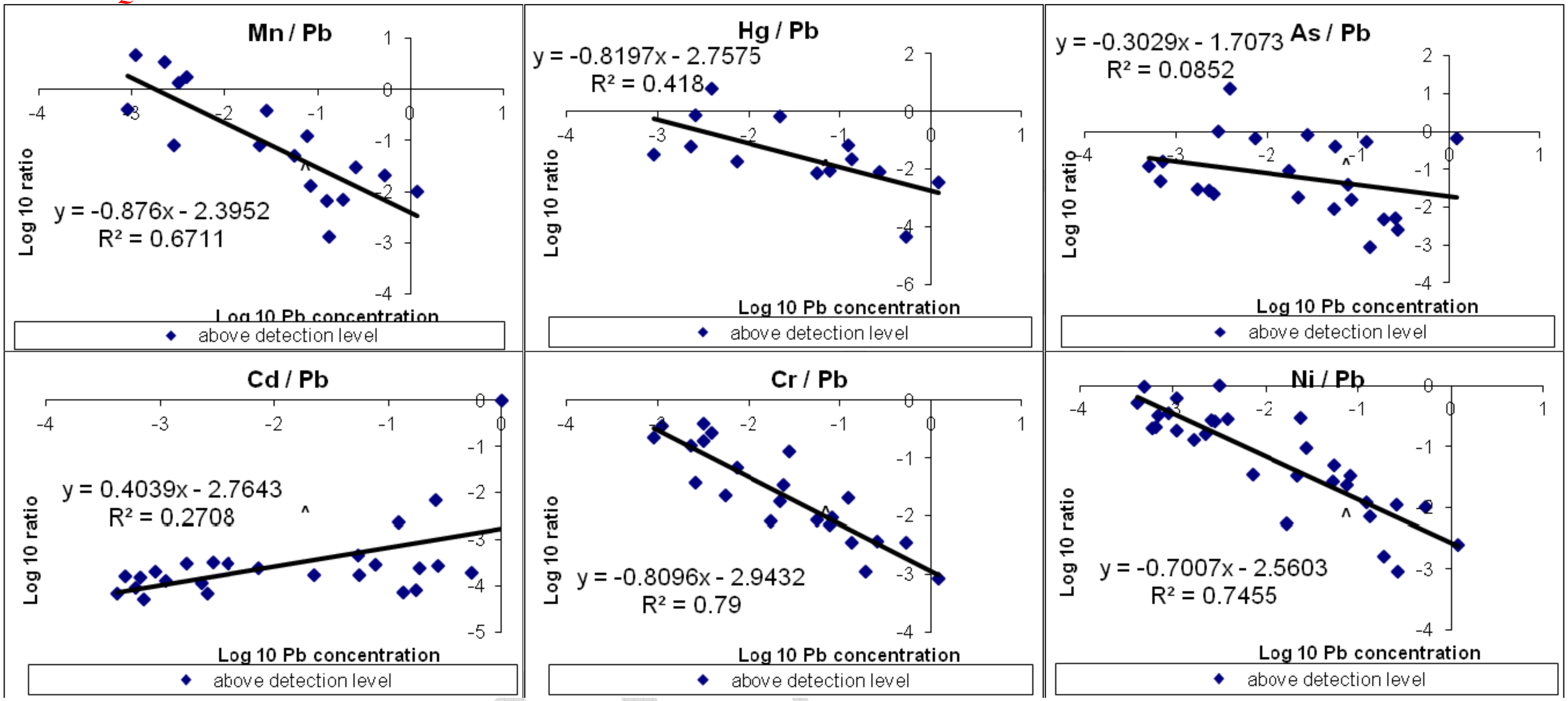

Figure 3-1. Correlations Used to Estimate Stack Emissions of Non-Lead Metal HAP.

4.0 ORGANIC COMPOUND EMISSIONS FROM STACKS

Table 4-1 presents the organic HAP, dioxin and furan (D/F), and total hydrocarbons (THC) emissions for stacks at each facility. The emissions estimates shown in Table 4-1 were developed using the site-specific emissions data collected by the ICR.

4.1 Organic HAP

Emissions of certain organic compounds were available only in the newest stack tests submitted under the ICR. The ICR test program collected emissions data for the following organic compounds: D/F, THC, 1,3-butadiene, naphthalene, and benzene. Note that while THC is not modeled, it is used to estimate emissions of other organic compounds by using ratios of these compounds to THC, as described later in this section. Because the smelting furnaces are the primary source of these pollutants, emissions estimates were made only for emissions points containing furnace exhaust.

Of the 18 emissions points containing furnace exhaust, stack test data for D/F, THC, 1,3-butadiene, naphthalene, and benzene were available for 9 points. Therefore, a methodology for developing emissions of these pollutants for the remaining 9 emissions points was developed. Note that for D/F, emissions are expressed in terms of the Toxic Equivalency Quotient (TEQ), rather than individual D/F congeners. The TEQ values were calculated using the speciated dioxin and furan congener data submitted in the ICR test reports and the Toxic Equivalency Factors (TEFs) recommended by the World Health Organization (WHO) in 2005 (see Table 4-2). Emissions factors for D/F TEQ, 1,3-butadiene, naphthalene and benzene were developed based on the 8 emissions points for which stack test data exists. Because emissions of organic compounds are highly dependent on furnace operating temperature, and thus also on furnace type, emissions factors were chosen for the missing emissions points based on the highest degree of commonality between furnace types. Due to lack of emissions data from rotary furnaces that process lead scrap, organic HAP emissions were not estimated for the rotary furnace emission point at The Battery Recycling Company's Arecibo, Puerto Rico facility.

For other organic compounds not tested under the ICR program, ratios of these compounds to THC were developed based on prior testing data reported in the 2002 Inhalation Risk Estimates report. These ratios were then used to estimate emissions of these compounds at each of the furnace emissions points. These ratios are presented in Table 4-3.

Table 4-1. Organic HAP Emissions Estimates (lbs/yr) by Facility.

Facility	Benzene	1,3-Butadiene	Naphthalene	D/F TEQ	THC
Buick Resource Recycling Facility	17320.73	695.15	1853.72	5.2E-03	3.3E+05

Table 4-1. Organic HAP Emissions Estimates (lbs/yr) by Facility.

Facility	Benzene	1,3-Butadiene	Naphthalene	D/F TEQ	THC
East Penn	7.33	7.02	2.72	4.6E-05	7.0E+02
Exide Vernon	1.37	2.89	44.12	3.9E-06	7.8E+02
Exide Reading	135.50	31.51	96.79	4.0E-05	6.1E+04
Exide Muncie	6.09	5.84	2.26	3.8E-05	6.0E+02
Exide Baton Rouge	592.29	1168.39	279.38	1.3E-02	4.0E+05
Exide Forest City	470.84	1035.84	207.17	1.1E-02	3.4E+05
Exide Frisco	12.00	2.40	3.20	1.3E-04	6.5E+03
Gopher Eagan	10.75	10.31	3.99	6.8E-05	1.0E+03
EnviroFocus	317.35	698.18	139.64	7.6E-03	2.3E+05
Quemetco (CA)	94.2	33.6	28.8	1.6E-05	4.9E+03
Quemetco (IN)	29.70	8.94	11.21	1.5E-05	1.8E+04
RSR	2126.49	3279.81	76.74	1.5E-05	9.9E+04
Sanders Lead	1752.00	3854.40	770.88	4.2E-02	1.2E+06
Battery Recycling[2]	Not Estimated	Not Estimated	Not Estimated	Not Estimated	Not Estimated

Table 4-2. Toxic Equivalency Factors (TEFs) used to Calculate the Toxic Equivalency Quotient (TEQ).

Dioxin/Furan Congener	Toxic Equivalency Factor
2,3,7,8-tetrachlorinated dibenzo-p-dioxin	1.0
1,2,3,7,8-pentachlorinated dibenzo-p-dioxin	0.5
1,2,3,4,7,8-hexachlorinated dibenzo-p-dioxin	0.1
1,2,3,7,8,9-hexachlorinated dibenzo-p-dioxin	0.1
1,2,3,6,7,8-hexachlorinated dibenzo-p-dioxin	0.1
1,2,3,4,6,7,8-heptachlorinated dibenzo-p-dioxin	0.01
octachlorinated dibenzo-p-dioxin	0.001
2,3,7,8-tetrachlorinated dibenzofuran	0.1
2,3,4,7,8-pentachlorinated dibenzofuran	0.05
1,2,3,7,8-pentachlorinated dibenzofuran	0.5
1,2,3,4,7,8-hexachlorinated dibenzofuran	0.1
1,2,3,6,7,8-hexachlorinated dibenzofuran	0.1
1,2,3,7,8,9-hexachlorinated dibenzofuran	0.1
2,3,4,6,7,8-hexachlorinated dibenzofuran	0.1

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[2] Organic HAP emissions for were not estimated for The Battery Recycling Company due to insufficient data.

Dioxin/Furan Congener	Toxic Equivalency Factor
1,2,3,4,6,7,8-heptachlorinated dibenzofuran	0.01
1,2,3,4,7,8,9-heptachlorinated dibenzofuran	0.01
octachlorinated dibenzofuran	0.001

Table 4-3. Ratios of HAPs to THC Used for Emissions Estimates for the Secondary Lead Smelting Source Category.

HAP	RATIO (HAP/THC)	HAP	RATIO (HAP/THC)
1,1,2,2-Tetrachloroethane	0.00E+00	Ethyl Chloride	2.83E-02
1,3-Dichloropropene	4.26E-03	Formaldehyde	3.28E-03
Acetaldehyde	6.70E-02	Hexane	3.85E-02
Acetophenone	1.24E-02	Hydrochloric Acid	0.00E+00
Acrolein	2.64E-02	Indeno[1,2,3-c,d]Pyrene	2.59E-05
Acrylonitrile	1.35E-03	Methyl Bromide	1.45E-02
Benz[a]Anthracene	1.71E-03	Methyl Chloride	5.38E-01
Benzo[a]Pyrene	5.79E-06	Methyl Iodide	6.71E-03
Benzo[b]Fluoranthene	6.49E-04	Methyl Isobutyl Ketone	8.25E-01
Benzo[k]Fluoranthene	1.08E-04	Methylene Chloride	8.46E-03
Biphenyl	6.65E-02	m-Xylene	5.23E-02
Bis(2-Ethylhexyl)Phthalate	1.39E-01	o-Cresol	5.68E-03
Carbon Disulfide	1.57E+00	o-Xylene	1.61E-02
Chlorine	0.00E+00	Phenol	3.86E-02
Chlorobenzene	1.16E-02	Propionaldehyde	0.00E+00
Chloroform	1.61E-03	p-Xylene	5.82E-01
Chrysene	7.50E-03	Pyrene	0.00E+00
Cumene	1.83E-03	Styrene	2.40E-01
Dibenzo[a,h]Anthracene	8.45E-06	Tetrachloroethylene	0.00E+00
Dibutyl Phthalate	6.45E-04	Toluene	1.74E-01
Ethyl Benzene	3.90E-02	Trichloroethylene	0.00E+00
		Xylenes (Mixture of o, m, and p Isomers)	0.00E+00

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5.0 METAL HAP EMISSIONS FROM FUGITIVE DUST SOURCES

Because they cannot be readily captured or directly measured, fugitive emissions are challenging to estimate. For this analysis, we evaluated the estimates of fugitive lead emissions that were submitted by each of the facilities under the 2010 ICR program. The responses we received regarding fugitive emissions varied significantly. Of the 14 facilities surveyed, five facilities provided no estimate for fugitive emissions and five other facilities provided quite incomplete estimates. Additional information was later submitted by one of the facilities (East Penn).

Based on our review, the estimates provided by five facilities (Exide Frisco, Exide Muncie, Exide Vernon, Gopher Eagan, and East Penn) seemed reasonable and relatively complete. Nevertheless, among those facilities, we concluded that Exide Frisco provided the best supported and most complete estimate. Therefore, due to the lack of reasonable estimates at nine facilities and the large amount of variability in emissions estimates and methodologies between the other facilities, the emissions provided by the Exide Frisco facility were selected as a basis for estimating fugitive emissions at all other facilities. This facility was selected because of the estimating methodology (i.e., EPA AP-42 emissions factors and site-specific activity data) and the level of detail provided in the supporting documentation. Each facility was compared to the model facility and an estimate of total lead fugitives was calculated based on a number of factors that described the activity level at the facility.

Table 5-1 is a comparison of the estimates made by the facilities for the ICR, estimates submitted to the TRI, and estimates used to support the proposal and final rule risk assessments using the methodology described in this memo. Only one facility submitted a reasonably complete calculation methodology for the information contained in the survey. Because the TRI information appeared to be inaccurate or incomplete in many cases, we elected not to use the TRI estimates for the purposes of developing an emissions dataset for the RTR risk assessment. Based on this comparison, and the similarity of results between submitted and calculated using the derived method for the facilities that provided reasonably well supported (although incomplete) estimates, we elected to use our estimation method for all facilities. We acknowledge that there is a significant amount of uncertainty associated with all of the fugitive emissions estimates presented in this memo and that substantial changes in the fugitive emissions estimates used as inputs in the risk assessment modeling would likely lead to substantial changes in the modeled impacts.

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Table 5-1. Comparison of Estimated and Submitted Fugitive Lead Emissions Estimates for the Secondary Lead Smelting Source Category

Facility	**Final Rule Fugitive Pb Emissions Estimates (lb/yr)***	**Proposal Fugitive Pb Emissions Estimates (lb/yr)**	**Fugitive Emissions Estimates Submitted in ICR (lb/yr)**	**TRI Fugitive Emissions Estimates (lb/yr)**
Exide Baton Rouge	1277	1680	4	0
Exide Forest City	807	1140	No estimate provided	0
Exide Frisco	1463	2060	1463	458
Exide Muncie	370	520	440	0.0003
Exide Reading	1070	1500	1540	306
Exide Vernon	327	460	206	83
RSR	121	180	No estimate provided	0

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Quemetco (CA)	85	120	No estimate provided	0
Quemetco (IN)	113	160	No estimate provided	0
Sanders Lead	2133	2800	6480	2520
EnviroFocus	472	660	140	426
Gopher Eagan	553	780	700	502
Buick RRF	4773	6260	37.6	25880
East Penn	119	660	No estimate provided, later email received estimated 140	544
Battery Recycling	488	N/A	N/A	7

*These estimates were used in the risk assessment modeling for the final rule. Other estimates are presented for comparison only.

Information provided by each facility regarding the degree of containment of secondary lead smelting processes was used to categorize the facilities as having Level 1 enclosure, Level 2 enclosure, or Level 3 enclosure. The facilities categorized as having Level 3 enclosure generally have complete enclosures with negative pressure for all their process activities. The facilities designated as having Level 2 enclosure have some, but not all parts of their process in negative pressure enclosures, while those facilities designated as having Level 1 enclosure generally did not have any of their major processes under a negative pressure enclosure. The Exide Frisco facility that was as used the model facility for the purpose of our estimates was classified as a level 2 facility. However, the only process at the facility that is currently fully enclosed and vented to a control device is the raw material storage area. Thus, we compared fugitive emissions estimates submitted by the Exide Frisco facility prior to enclosure of the raw materials storage area with the estimates submitted in the ICR. This comparison revealed that the fugitive emissions estimates submitted by Exide Frisco prior to enclosure of the raw materials storage area were 1.07 times higher than the estimates submitted in the ICR.

We then analyzed each facility to determine their level of enclosure in comparison with the Exide Frisco facility. The facilities that were determined to have a lower level of enclosure than Exide Frisco were assigned a factor 1.07. The facilities that were determined to have a greater level of enclosure than the Exide Frisco facility, but did not have all processes enclosed (level 2), were assigned a factor of 0.75. A factor of 0.25 was assigned to facilities with total enclosures for all processes (level 3). These factors were applied to the fugitive lead emission estimates at the facilities to reflect reductions that are likely to occur due to the level of enclosure at each facility. Total enclosures can provide up to 99% control of fugitive emissions from the source inside a building. However, the enclosure alone will not always achieve this level of control without accompanying work practice standards that prevent fugitive dust from being carried out of the enclosure as equipment and vehicles move into and out of the enclosure. Total enclosures can provide a greater level of control for fugitive dust emissions originating from the enclosure than our factor indicates (75% reduction from total enclosure).. However, this factor was chosen as a reasonable conservative (i.e. our value may underestimate the level of control achieved using total enclosures) estimate of the amount of reductions in fugitive emissions that originate from processes that would be enclosed. Lead bearing material that is tracked out of the enclosure on equipment or vehicles or generated during maintenance activities will not be controlled by the enclosure. Therefore, work practice standards and additional housekeeping activities are required to reduce emissions beyond that provided by total enclosures.

A housekeeping factor was also developed to characterize the level of work practices implemented by each facility to control fugitive emissions. Early interaction with industry representatives in preparation for development of the proposed rule provided information that housekeeping was critical to the successful reduction of fugitive emissions and that significant improvements could be made above control achieved through the use of total enclosures. Information reported by the industry in their surveys and during the comment period of the proposed rule was used to determine the extent to which each facility implemented work practices that go beyond the requirements of the current Secondary Lead Smelting NESHAP. Factors ranging from 1.0 (work practices consistent with the current NESHAP) to 0.2 (work practices far beyond the current NESHAP) were then also applied to the fugitive lead estimates at these facilities in order to reflect reductions that are likely to occur due to the work practices in place at each facility. Taken together, full enclosure and implementation of work practices sufficient to prevent re-entrainment of lead bearing dust are estimated to achieve well over a 90% reduction in fugitive emissions compared to the estimates of fugitive emissions based on facilities employing the minimum enclosure and work practice requirements of the 1997 NESHAP. Table 5-2 summarizes the enclosure and housekeeping factors used for each facility and lists the estimated fugitive lead emissions for each facility. The size factors were developed based on the activity level of each facility based on several factors (e.g. vehicle traffic, facility footprint and arrangement, as well as other factors) supplied in the ICR.

The lead emissions estimates for each facility were calculated by multiplying the fugitive lead emissions rate for the Exide Frisco facility (0.71 tons/yr) by the site-specific size factor, enclosure factor, and housekeeping factor. For example, we estimated a size factor of 0.76 for Exide Forest City. Additionally, Exide Forest City is a level 2 enclosure (0.75) and does work practices consistent with the requirements of the current NESHAP (i.e., housekeeping factor = 1). Therefore, the estimated fugitive lead emissions for Exide Forest City, MO are calculated as follows:

$$0.71 \text{ tons/yr} \times 0.76 \times 0.75 \times 1.0 = 0.41 \text{ tons per year.}$$

In this analysis, we did not take into consideration the legacy sources of fugitive lead emissions at the facilities. These sources of lead on or near the facility grounds could contribute to higher levels of airborne lead emissions from roadways or other wind-blown dust. We expect there to be differences in the amount of lead from legacy sources at these facilities, but were not able to quantify them for this assessment.

The estimates of fugitive lead emissions that are shown in table 5-2 were used as input to the risk assessment modeling. To estimate fugitive emissions for metals other than lead (i.e., arsenic, cadmium, chromium, manganese, mercury, and nickel), a ratio of these other metals to lead was developed based on total stack emissions of these pollutants from all the facilities (see Table 5-3). This industry-wide ratio for each metal was multiplied by the individual facility lead fugitive emissions estimate to produce estimates of fugitive emissions of non-lead metal HAP.

There is some uncertainty associated with the fugitive emissions estimates that is derived from the uncertainty involved in determining the housekeeping and enclosure factors. This uncertainty could have important impacts on the estimated fugitive emissions and the resulting modeled ambient concentration. For example, if the level of control assumed through the use of full enclosure and robust housekeeping were both increased from 75% to 85%, the estimated fugitive emissions at the RSR facility would be about 43 pounds (roughly three times lower than those estimated in this rule). If the level of control assumed through the use of full enclosure and robust housekeeping were both decreased from 75% to 65%, the estimated fugitive emissions at the RSR facility would be about 240 pounds (roughly two times higher than those estimated in this rule). As shown in this example, changing the estimates of control efficiency achieved with full enclosure and robust housekeeping practices by 10% each could impact the resulting fugitive emission estimates for facilities employing that level of control by two to three times.

Stack test data for selenium and antimony were not available, and therefore, the process fugitive ratios included in the 2002 Inhalation Risk Estimates report were used. These ratios were then applied to the fugitive lead emissions at each facility. The arsenic emissions at Buick RRF were identified as an outlier and were not considered when developing the arsenic to lead ratio.

Table 5-2. Summary of Fugitive Lead Emissions Estimates for the Secondary Lead Smelting Source Category.

Facility	Size Factor	Enclosure Factor	Housekeeping Factor	Fugitive Pb Emissions (lbs/yr)
Exide Baton Rouge	0.84	1.07	1.0	1277
Exide Forest City	0.76	0.75	1.0	807
Exide Frisco	1.03	1.00	1.0	1463
Exide Muncie	1.04	0.25	1.0	370
Exide Reading	1.00	0.75	1.0	1070
Exide Vernon	1.84	0.25	0.5	327

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RSR	1.36	0.25	0.25	121
Quemetco (CA)	1.19	0.25	0.2	85
Quemetco (IN)	1.27	0.25	0.25	113
Sanders Lead	1.40	1.07	1.0	2133
EnviroFocus	0.44	0.75	1.0	472
Gopher Eagan	1.55	0.25	1.0	553
Buick RRF	3.13	1.07	1.0	4773
East Penn	1.34	0.25	0.25	119
Battery Recycling	0.32	1.07	1.0	488

Table 5-3. Ratios Used to Estimate Fugitive Emissions of Metals Other than Lead.

HAP	HAP/Pb Ratio
Arsenic	2.54E-02
Beryllium	1.73E-04
Cadmium	1.86E-02
Chromium	3.76E-03
Chromium^{+6}	3.76E-05
Chromium^{+3}	3.72E-03
Manganese	1.71E-02
Mercury	8.37E-03
Elemental Hg	6.70E-03
Divalent Hg	8.37E-04
Particulate Hg	8.37E-04
Nickel	7.07E-03
Selenium	1.25E-02
Antimony	3.20E-02

6.0 ESTIMATING SHORT-TERM ACUTE EMISSIONS

As part of the risk assessment conducted for the Secondary Lead Smelting source category, the potential for hazard via acute short term exposures is analyzed. Because the dataset described in this document is based on the development of estimates of annual emissions for each facility, a means of estimating maximum one-hour emissions rates associated with each emissions point was needed. For this analysis, it was assumed that the maximum one-hour emissions rate from any source other than those resulting in fugitive dust emissions were 10 times the average annual hourly emissions rate for that source. The factor of 10 is not applied to fugitive dust sources because these emissions decrease during the meteorological conditions associated with the worst-case short-term impacts (i.e., during low-wind, stable atmospheric conditions). Information regarding the development of this factor and other details regarding the emissions data used for the acute exposure assessment can be found in the Residual Risk Assessment for the Secondary Lead Smelting Source Category document available in the docket.

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7.0 ESTIMATING MACT-ALLOWABLE EMISSIONS

The emissions data in our data set represent the estimates of mass of emissions actually emitted on an annual basis for stacks and fugitives for the 2008-2010 timeframe. With most source categories, we generally find that "actual" emissions levels are lower than the emissions levels that a facility is allowed to emit and still comply with the MACT standards. The emissions levels allowed to be emitted by the MACT standards are referred to as the "MACT-allowable" emissions levels. This represents the highest emissions level that could be emitted by facilities without violating the MACT standards.

For the Secondary Lead Smelting source category, we evaluated actual emissions versus allowable emissions for both stack emissions and fugitive dusts emissions. As described above, the actual emissions data for this source category were compiled based on the ICR responses, available test data, various calculations, and the NEI. Most of this analysis (on actual versus allowable emissions) was focused on lead compound emissions, which we considered the most important HAP emitted from this source category based our preliminary risk assessments.

With regard to fugitive dust emissions, based on available information, we believe that the higher emitting facilities (and higher risk facilities) are implementing the basic work practice standards pursuant to the requirements described in the MACT standards and not doing extra work practices (no practices beyond those required by the MACT standard). Therefore, we assume that "actual" fugitive dust emissions are equal to "allowable" fugitive dust emissions for these facilities. Based on available information (such as ICR responses and other information gathered and analyzed about this industry), we do believe that some facilities are implementing work practices beyond those required by the MACT standard, and therefore their actual fugitive dust emissions are probably lower than allowable. However, we cannot quantify how much lower the actual emissions are compared to allowable. Moreover, even if we did have estimates of allowable emissions of fugitive dusts from these sources, this information would not affect the conclusions about the risks due to fugitive dust emissions (described in the Risk Assessment Report) and would not affect the EPA's requirements to address fugitive emissions from this source category (described in the preamble). Therefore, we have not calculated "allowable" fugitive dust emissions for these sources. Therefore, for our analyses, we assume that "actual" fugitive dust emissions are equal to "allowable" fugitive dust emissions for all facilities.

In contrast, we did calculate allowable emissions for the stacks. To estimate emissions at the MACT-allowable level from the stacks (e.g., process vents and building vents), we developed a ratio of MACT-allowable to actual emissions for each facility in the source category. We calculated these ratios by first estimating the emissions from stacks that would occur if facilities were emitting lead exactly at the maximum allowed by the standard (i.e., 2.0 mg/m^3) from all vents. Then we compared these estimated "allowable emissions" to the

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estimated emissions using the actual stack test data for lead for each facility. Estimates of actual and allowable lead emissions from this source category are shown in table 8-1. Based on this analysis, we conclude that all facilities are emitting lead at levels lower than allowable; however, the range is significant. For 2 facilities, the estimated actual emissions were only moderately lower than allowable (about 2-3 times lower). The vast majority of facilities have estimated actual emissions in the range of about 10 to 100 times lower than allowable. Finally, one facility, which has highly advanced controls, has estimated actual emissions of about 1500 times below the MACT allowable emissions level.

Table 8-1. Estimated Ratios of Actual Emissions to MACT-Allowable Emissions For Secondary Lead Smelting Facilities.

Facility	Actual Lead Emissions Rate (lb/hr)	MACT Allowable Emissions (lb/hr)	Ratio of MACT-Allowable to Actual
Quemetco (CA)	0.00	2.84	1513.5
Exide Muncie	0.05	4.92	95.3
Exide Vernon	0.06	4.92	77.7
Gopher Eagan	0.05	3.06	59.4
Quemetco (IN)	0.06	3.27	56.5
East Penn	0.04	1.45	34.8
RSR	0.10	3.19	32.2
Exide Forest City	0.04	0.64	17.9
Battery Recycling	0.021	0.29	13.6
Exide Reading	0.26	2.73	10.6
EnviroFocus	0.12	1.16	9.9
Exide Frisco	0.31	2.63	8.6
Sanders	0.25	1.66	6.6
Exide Baton Rouge	0.53	1.43	2.7
Doe Run	1.21	2.97	2.5

After developing these ratios, we applied these ratios on a facility-by-facility basis to the maximum modeled ambient lead concentrations (i.e., ratios were applied to stack emissions while leaving fugitive dust emissions at actual levels since, as described above, actual fugitive dust emissions were considered equal to allowable fugitive dust emissions) to estimate the maximum ambient concentrations that would occur if all stacks were emitting at maximum allowable levels. This analysis and the results are described in the Risk Assessment Report.

8.0 ESTIMATING EMISSIONS REDUCTIONS FOR CONTROL SCENARIOS

To assess the reduction in risk associated with implementation of the control options presented in the final rulemaking for the Secondary Lead Smelting Source category, we estimated reductions in baseline emissions that will occur after the controls are installed. The development of the post-control emissions estimates are described in the following sections. The resulting risk analysis based on these emissions can be found in the Residual Risk Assessment for the Secondary Lead Smelting Source Category.

8.1 Post-Control Stack Emissions of Metal HAP

In order to assess the reductions in stack emissions of metal HAP that will occur as a result of the revised lead emissions limit, we performed an analysis for each emissions point at each facility to determine whether added control would be needed in order to meet the limit.

We identified seven baghouses that by our estimation will need to be replaced. These include three baghouses at Doe Run, two baghouses at Sanders, one baghouse at Exide Baton Rouge, and one baghouse at Exide Reading. We also identified three additional baghouses that will need maintenance in order for the facilities to comply with the revised lead emissions limit. These include one baghouse at Doe Run, one baghouse at Exide Frisco, and one baghouse at Exide Baton Rouge. In order to estimate emissions from an upgraded/replaced baghouse, we assumed that the emissions would be reduced to a level consistent with the average lead emissions calculated from all emissions points in the source category. We assumed that the reductions in emissions of other metal HAP from these emissions points would be reduced proportionally to lead.

8.2 Post-Control Fugitive Dust Emissions of Metal HAP

As described in the Residual Risk Assessment for the Secondary Lead Smelting Source Category, fugitive dust emissions are the primary driver in exceedances of the lead NAAQS as well as a substantial contributor to the chronic cancer risks and potential acute non-cancer risks. We estimated the reduction in fugitive emissions of metal HAP that would occur as a result of the implementation of the fugitive dust controls outlined in the final rulemaking for this source category. These emissions estimates were used to estimate the post-control risks described in the risk assessment document.

Section 5.0 describes how we estimated the baseline fugitive metal HAP emissions for each facility. These baseline fugitive lead emissions estimates were used as the starting point for the development of post-control fugitive emissions estimates. We adjusted the baseline housekeeping and enclosure factors for each facility to reflect the level of fugitive dust control required in the final rule. This included level 3 enclosure (enclosure factor of 0.25) and implementation of work practices beyond the current NESHAP which are described in the final rule (housekeeping factor of 0.2) for each facility. The resulting post-control fugitive lead emissions estimates are shown in Table 9-1.

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After we determined the post-control fugitive lead emissions for each facility, we used the ratios (shown in table 5-2 above) to estimate post-control emissions of all other metal HAP by applying the ratios to the estimates shown for lead in table 9-1.

Table 9-1. Estimated Post-Control Fugitive Lead Emissions.

Facility	Post-Control Fugitive Pb Emissions (TPY)
Exide Baton Rouge	0.03
Exide Forest City	0.03
Exide Frisco	0.04
Exide Muncie	0.04
Exide Reading	0.04
Exide Vernon	0.07
RSR	0.05
Quemetco (CA)	0.04
Quemetco (IN)	0.05
Sanders Lead	0.05
EnviroFocus	0.02
Gopher Eagan	0.06
Buick RRF	0.11
East Penn	0.05
Battery Recycling	0.01

8.3 Post-Control Stack and Fugitive Emissions of PM

In order to assess the co-reductions in emissions of PM resulting from the revisions to the Secondary Lead Smelting NESHAP, we developed a ratio of lead to PM based on emissions data submitted in the ICR. Based on that data, we calculated a lead to PM ratio of 1 to 10.1 and applied it to the lead emissions reductions from stack and fugitive sources. In order to estimate the fraction of the PM emissions reductions that are $PM_{2.5}$, we developed a range of particle size distributions for secondary lead smelters based on AP-42 emissions data and a 2009 emissions inventory for the Exide Frisco facility. Based on this information, we estimated that between 30 and 48 percent of the PM emissions from secondary lead smelters is $PM_{2.5}$.

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