

5. PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL

5.1 PRODUCTION

The most important lead ore is galena (PbS) followed by anglesite (PbSO₄) and cerussite (PbCO₃). The latter two minerals are formed from the weathering of galena. Five lead mines in Missouri plus lead-producing mines in Alaska, Idaho, Montana, and Washington produce most of the primary lead. In 2003, Alaska and Missouri (“lead-belt” in southeastern part of the state) accounted for 96% of domestic mine production. Lead can be recovered from ore deposits of lead, zinc, lead-zinc, and silver. Lead ore is mined underground except when it is mined with copper ores, which are typically open pit mines. The United States is third in world lead production after Australia and China. Together with Peru, Canada, and Mexico, these six countries account for 82% of the world's mine production.

Primary lead is obtained from mined ore. The crude ore is first beneficiated, which involves processes such as crushing, dense-medium separation, grinding, and froth floatation to obtain concentrates with higher lead concentrations. Primary metal is generally produced from the sulfide concentrate by a two-step process involving (1) an oxidative roast to remove sulfur with the formation of PbO and (2) blast furnace reduction of the PbO. Lead concentrates produced from ore were processed into primary metal at two smelter refineries operated by a company in Missouri.

Secondary lead is obtained from scrap lead. Ninety-nine percent of secondary production of lead was produced at 23 plants in the United States, 15 of which had annual capacities of 15,000 tons or more. In 2003, secondary lead accounted for 82% of refined lead production. Secondary lead is obtained primarily from recycled lead-acid batteries. Almost all of the lead recycled in 2003 was produced by 7 companies operating 15 plants in Alabama, California, Florida, Indiana, Louisiana, Minnesota, Missouri, New York, Tennessee, and Texas (USGS 2003).

Tables 5-1 and 5-2 list facilities in each state that respectively manufacture, process, or use lead and lead compounds, the intended use, and the range of maximum amounts of these substances that are stored on site. The data listed in Tables 5-1 and 5-2 are derived from the Toxics Release Inventory (TRI04 2006). Only certain types of facilities were required to report. Therefore, this is not an exhaustive list. In comparing Toxics Release Inventory (TRI) data with that of previous years, it is important to note that starting in 2001 the threshold for reporting lead was reduced to 100 pounds. Previously, reporting was only required of facilities that manufactured or processed 25,000 pounds or more annually or that used 10,000 pounds or more annually. Additionally, in 1998, additional industries were required to report,

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Table 5-1. Facilities that Produce, Process, or Use Lead

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
AK	10	100	99,999	1, 5, 7, 9, 12, 13, 14
AL	126	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
AR	74	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
AZ	76	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
CA	281	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
CO	56	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
CT	104	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
DC	4	100	99,999	1, 8, 11, 12, 13
DE	15	100	9,999,999	2, 3, 7, 8, 9, 11, 12, 13, 14
FL	119	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
GA	117	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
GU	3	0	999	1, 5, 12
HI	15	0	999,999	1, 7, 8, 11, 12, 13, 14
IA	91	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
ID	37	0	9,999,999	1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14
IL	217	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
IN	174	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
KS	61	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
KY	107	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
LA	77	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MA	103	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MD	51	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
ME	39	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
MI	176	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MN	84	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MO	112	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MS	74	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MT	19	0	99,999	1, 2, 5, 6, 7, 8, 9, 12, 13, 14
NC	138	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
ND	17	0	99,999	1, 2, 3, 5, 7, 8, 9, 10, 12, 13, 14
NE	58	0	9,999,999	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NH	44	0	999,999	1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14
NJ	161	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NM	28	0	49,999,999	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 14
NV	55	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
NY	178	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
OH	268	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
OK	93	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
OR	75	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

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Table 5-1. Facilities that Produce, Process, or Use Lead

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
PA	238	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
PR	31	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12
RI	50	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
SC	113	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
SD	21	0	499,999,999	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
TN	156	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
TX	223	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
UT	63	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
VA	109	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
VI	3	100	99,999	1, 5, 12, 14
VT	17	0	9,999,999	2, 6, 7, 8, 9, 10, 11, 12, 13, 14
WA	90	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
WI	129	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
WV	64	0	49,999,999	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14
WY	15	0	999,999	1, 4, 7, 8, 9, 12, 13, 14

^aPost office state abbreviations used

^bAmounts on site reported by facilities in each state

^cActivities/Uses:

- | | | |
|--------------------------|--------------------------|-----------------------------|
| 1. Produce | 6. Impurity | 11. Chemical Processing Aid |
| 2. Import | 7. Reactant | 12. Manufacturing Aid |
| 3. Onsite use/processing | 8. Formulation Component | 13. Ancillary/Other Uses |
| 4. Sale/Distribution | 9. Article Component | 14. Process Impurity |
| 5. Byproduct | 10. Repackaging | |

Source: TRI04 2006 (Data are from 2004)

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Table 5-2. Facilities that Produce, Process, or Use Lead Compounds

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
AK	30	0	999,999,999	1, 2, 4, 5, 7, 9, 10, 12, 13, 14
AL	159	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
AR	111	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
AZ	129	0	10,000,000,000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
CA	324	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
CO	87	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
CT	111	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
DE	38	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
FL	136	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
GA	187	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
GU	5	0	9,999	1, 2, 3, 4, 5, 7, 9, 12, 13, 14
HI	11	0	99,999	1, 2, 5, 7, 9, 12, 13, 14
IA	107	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
ID	41	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
IL	287	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
IN	259	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
KS	104	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
KY	148	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
LA	116	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MA	148	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MD	80	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
ME	33	0	999,999	1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14
MI	209	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MN	103	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MO	161	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MP	4	0	9,999	1, 2, 3, 4, 5, 7, 9, 12, 13, 14
MS	93	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
MT	43	0	10,000,000,000	1, 2, 3, 4, 5, 6, 7, 9, 12, 13, 14
NC	156	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
ND	17	0	999,999	1, 2, 5, 7, 9, 10, 12, 13, 14
NE	65	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NH	51	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NJ	182	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NM	55	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
NV	74	0	999,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
NY	197	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
OH	330	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
OK	96	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

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Table 5-2. Facilities that Produce, Process, or Use Lead Compounds

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
OR	92	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
PA	331	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
PR	38	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
RI	59	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
SC	123	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
SD	24	0	9,999,999	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
TN	166	0	49,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
TX	288	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
UT	88	0	499,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
VA	120	0	9,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
VI	7	0	999,999	1, 2, 3, 4, 5, 7, 8, 9, 10, 12
VT	18	0	9,999,999	1, 2, 3, 5, 6, 7, 8, 11, 12, 13, 14
WA	113	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
WI	136	0	99,999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
WV	70	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
WY	36	0	999,999	1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 13, 14

^aPost office state abbreviations used

^bAmounts on site reported by facilities in each state

^cActivities/Uses:

- | | | |
|--------------------------|--------------------------|-----------------------------|
| 1. Produce | 6. Impurity | 11. Chemical Processing Aid |
| 2. Import | 7. Reactant | 12. Manufacturing Aid |
| 3. Onsite use/processing | 8. Formulation Component | 13. Ancillary/Other Uses |
| 4. Sale/Distribution | 9. Article Component | 14. Process Impurity |
| 5. Byproduct | 10. Repackaging | |

Source: TRI04 2006 (Data are from 2004)

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including metal mining, coal mining, electrical utilities, and Resource Conservation and Recovery Act (RCRA)/Solvent Recovery. Table 5-3 lists the producers of primary lead metal and selected lead compounds. Companies listed are those producing lead compounds in commercial quantities, exceeding 5,000 pounds or \$10,000 in value annually. Table 5-4 shows the U.S. production volumes for lead for 1999 through 2003. During this time, the primary lead production declined while secondary lead production was fairly constant.

5.2 IMPORT/EXPORT

No lead in ore and concentrates and base bullion were imported into the United States in 2003, while 175,000 metric tons were imported in pigs, bars, and reclaimed scrap. Imports were down from 1999 when 12,300 metric tons, 90 metric tons, and 311,000 metric tons were imported in ore and concentrates; base bullion; and pigs bars and reclaimed scrap, respectively. In 2003, 36,000 metric tons, lead content of lead pigments and compounds were imported in the United States (USGS 2003).

Exports of lead in ore and concentrates and lead materials, excluding scrap, rose from 93,500 and 103,000 metric tons in 1999 to 253,000 and 123,000 metric tons, respectively, in 2003. In 2003, 92,800 metric tons of lead scrap were exported (USGS 2003).

5.3 USE

Lead may be used in the form of metal, either pure or alloyed with other metals, or as chemical compounds. The commercial importance of lead is based on its ease of casting, high density, low melting point, low strength, ease of fabrication, acid resistance, electrochemical reaction with sulfuric acid, and chemical stability in air, water, and soil (King and Ramachandran 1995; Shea 1996; Sutherland and Milner 1990). Lead is used in the manufacture of storage batteries; lead alloys used in bearings, brass and bronze and some solders; sheets and pipe for nuclear and x-ray shielding, cable covering, noise control materials; chemical resistant linings; ammunition; and pigments and lead compounds used in glass making, ceramic glazes, plastic stabilizers, caulk, and paints. Consumption of lead in lead-acid batteries, including SLI (Start, Light, Ignition) batteries used in cars, trucks, and other vehicles and industrial type lead acid batteries is the major use of lead today. In 2003, the U.S. consumption for lead was: 84.2%, storage batteries; 3.5%, ammunition, shot, and bullets; 2.6%, other oxides (paint, glass and ceramic products, other pigments and chemicals); 2.3%, casting metals (electrical machinery and equipment, motor vehicles and equipment, other transportation equipment, and nuclear radiation shielding); and 1.7%, sheet lead (building construction, storage tanks, process vessels, etc., and medical radiation

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Table 5-3. Current U.S. Manufacturers of Lead Metal and Selected Lead Compounds^a

Company	Location
Lead metal ^b :	
Doe Run Resources Corp.	St. Louis, Missouri
Lead chromate (Yellow 34):	
Dominion Colour Corp. (USA)	Paterson, New Jersey
Engelhard Corporation	Louisville, Kentucky
Nichem Corp.	Chicago, Illinois
Rockwood Pigments, NA, Inc.	Beltsville, Maryland
Wayne Pigment Corporation	Milwaukee, Wisconsin
Lead fluoborate:	
Atotech USA Inc	Rock Hill, South Carolina
General Chemical Corporation	Claymont, Delaware
OMG Fidelity, Inc.	Newark, New Jersey
Solvay Fluorides, LLC.	St. Louis, Missouri
Lead molybdenum chromate (Red 104):	
Englehard Corporation	Louisville, Kentucky
Wayne Pigment Corporation	Milwaukee, Wisconsin
Lead nitrate:	
GFS Chemicals, Inc.	Columbus, Ohio
Lead oxide, yellow:	
Eagle-Picher Industries, Inc	Joplin, Missouri
Hammond Group, Inc.	Hammond, Indiana, Pottstown, Pennsylvania
OMNI Oxide	Lancaster, Ohio
Lead sulfate:	
Nichem Corp. ^c	Chicago, Illinois
Hammond Group, Inc. ^d	Hammond, Indiana
Eagle-Pitcher Industries, Inc. ^e	Joplin, Missouri

^aDerived from SRI 2004 unless otherwise noted. SRI reports production of chemicals produced in commercial quantities (defined as exceeding 5,000 pounds or \$10,000 in value annually) by the companies listed.

^bUSGS 2004. Primary producer

^cLead sulfate, Dibasic lead sulfate (2PbO.PbSO₄) and Tribasic lead sulfate (3PbO.PbSO₄)

^dDibasic lead sulfate (2PbO.PbSO₄) and tribasic lead sulfate (3PbO.PbSO₄)

^eTribasic lead sulfate (3PbO.PbSO₄)

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Table 5-4. U.S. Lead Production 1999–2003

Production	Production volumes in metric tons				
	1999	2000	2001	2002	2003
Mined (recovered): domestic ores, recoverable lead content	503,000	449,000	454,000	440,000	449,000
Primary (refined): domestic/foreign ores and base bullion	350,000	341,000	290,000	262,000	245,000
Secondary (refined): lead content	1,110,000	1,130,000	1,100,000	1,120,000	1,150,000

Source: USGS 2003

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shielding) (USGS 2003). Certain dispersive uses of lead that led to widespread exposure, such as tetraethyl lead in gasoline, water pipe, solder in food cans, lead shot and sinkers, and in house paints, have been or are being phased out due to environmental and health concerns (Larrabee 1998).

Prior to the EPA beginning to regulate the lead content in gasoline during the early 1970s, approximately 250,000 tons of organic lead (e.g., tetraethyl lead) were added to gasoline on an annual basis in the United States (Giddings 1973). These lead-based “anti-knock” additives increased the octane rating of the gasoline and as a result increased engine efficiency (Giddings 1973). In 1971, the average lead content for a gallon of gasoline purchased in the United States was 2.2 grams per gallon (Giddings 1973). After determining that lead additives would impair the performance of emission control systems installed on motor vehicles, and that lead particle emission from motor vehicles presented a significant health risk to urban populations, EPA, in 1973, initiated a phase-down program designed to minimize the amount of lead in gasoline over time. By 1988, the phase-down program had reduced the total lead usage in gasoline to <1% of the amount of lead used in the peak year of 1970 (EPA 1996a).

In 1990, a Congressional amendment to the Clean Air Act (CAA) banned the use of gasoline containing lead or lead additives as fuel in motor vehicles. On February 2, 1996, the EPA incorporated the statutory ban in a direct final rule which defined unleaded gasoline as gasoline containing trace amounts of lead up to 0.05 gram per gallon (EPA 1996a). The definition still allowed trace amounts of lead but expressly prohibited the use of any lead additive in the production of unleaded gasoline. The term “lead additive” was defined to include pure lead as well as lead compounds (EPA 1996a). Although the regulatory action of Congress banned the use of leaded gasoline as fuel in motor vehicles, it did not restrict other potential uses of gasoline containing lead or lead additives (EPA 1996a). Gasoline produced with lead additives continues to be made and marketed for use as fuels in aircraft, race cars, and non-road engines such as farm equipment engines and marine engines, to the extent allowed by law (EPA 1996a), but tetraethyl lead has not been produced in the United States since March 1991. All gasoline sold for motor vehicle use since January 1, 1996, has been unleaded (EPA 1997).

Table 5-5 lists the uses of the specific lead compounds identified in Chapter 4.

Lead arsenate, basic lead arsenate, and lead arsenite were formerly used as herbicides, insecticides, or rodenticides. Until the 1960s, they were widely used to control pests in fruit orchards, especially apple orchards (EPA 2002; PAN Pesticides Database 2004; Peryea 1998; Wisconsin Department of Health and

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Table 5-5. Current and Former Uses of Selected Lead Compounds

Compound	Uses
Lead acetate	Dyeing of textiles, waterproofing, varnishes, lead driers, chrome pigments, gold cyanidation process, insecticide, anti-fouling paints, analytical reagent, hair dye
Lead azide	Primary detonating compound for high explosives
Lead bromide	Photopolymerization catalyst, inorganic filler in fire-retardant plastics, general purpose welding flux
Lead chloride	Preparation of lead salts, lead chromate pigments, analytical reagent
Lead chromate	Pigment in industrial paints, rubber, plastics, ceramic coatings; organic analysis
Lead fluoborate	Salt for electroplating lead; can be mixed with stannous fluoborate to electroplate any composition of tin and lead as an alloy
Lead iodide	Bronzing, printing, photography, cloud seeding
Lead molybdate	Analytical chemistry, pigments
Lead nitrate	Lead salts, mordant in dyeing and printing calico, matches, mordant for staining mother of pearl, oxidizer in the dye industry, sensitizer in photography, explosives, tanning, process engraving, and lithography
Lead oxide, black	Storage batteries, ceramic cements and fluxes, pottery and glazes, glass, chromium pigments, oil refining, varnishes, paints, enamels, assay of precious metal ores, manufacture of red lead, cement (with glycerol), acid-resisting compositions, match-head compositions, other lead compounds, rubber accelerator
Lead phosphate	Stabilizing agent in plastics
Lead styphnate	Primary explosive
Lead sulfate	Storage batteries, paints, ceramics, pigments, Electrical and other vinyl compounds requiring high heat stability
Lead sulfide	Ceramics, infrared radiation detector, semi-conductor, ceramic glaze, source of lead
Tetraethyl lead	Anti-knock agent in aviation gasoline

Sources: Boileau et al. 1987; Carr 1995; EPA 2001

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Family Services 2002). All insecticidal use of lead arsenate was officially banned on August 1, 1988. However, all registrations for its insecticidal use had lapsed before that time.

5.4 DISPOSAL

Although certain uses of lead preclude recycling (e.g., use as a gasoline additive), lead has a higher recycling rate than any other metal (Larrabee 1998). In 2002, about 81% of refined lead production in the United States was recovered from recycled scrap. The primary source was recycled lead-acid batteries. About 6% of recycled lead was obtained from other sources, namely new scrap, obtained from primary lead production, building construction materials, cable covering, and solder. About 99% of the 1.10 million tons of lead recycled in 2002 was produced by 7 companies operating 15 secondary smelter-refineries in Alabama, California, Florida, Indiana, Louisiana, Minnesota, Missouri, New York, Pennsylvania, Tennessee, and Texas. An estimated 90–95% of the lead consumed in the United States is considered to be recyclable. In 1996, 77.1% of U.S. lead consumption was satisfied by recycled lead products (mostly lead-acid batteries). This compares to 69.5% in 1990 and 55.2% in 1980 (Larrabee 1997, 1998; USGS 2002).

Disposal of wastes containing lead or lead compounds is controlled by a number of federal regulations (see Chapter 8). Lead is listed as a toxic substance under Section 313 of the Emergency Planning and Community Right to Know Act (EPCRA) under Title III of the Superfund Amendments and Reauthorization Act (SARA) (EPA 2001e). Lead-containing waste products include storage batteries, ammunition waste, ordnance, sheet lead, solder, pipes, traps, and other metal products; solid waste and tailings from lead mining; items covered with lead-based paint; and solid wastes created by mineral ore processing, iron and steel production, copper and zinc smelting, and the production and use of various lead-containing products (EPA 1982a).

Presently, 37 states have enacted legislation to encourage recycling of lead-acid batteries. These states have adopted laws that prohibit disposal of lead-acid batteries in municipal solid waste streams and require all levels of the collection chain to accept spent lead-acid batteries. Four other states ban only the land-filling and incineration of lead-acid batteries. Battery recycling rates are determined by comparing the amount of lead recycled from batteries with the quantity available for recycling in a given year. Recycling facilities can usually provide data on the amount of lead produced from scrapped batteries; however, the amount of lead available for recycling is largely influenced by the battery's useful life span. Therefore, to determine the amount of lead available from batteries for a given year requires historical

5. PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL

data on battery production and average lead content, as well as import and export data on new batteries, vehicles containing batteries, scrap lead and scrapped batteries (Larrabee 1998). According to the Battery Council International, 97% of all lead-acid batteries are recycled and new batteries contain between 60 and 80% recycled lead and plastic (Battery Council International 2003).