Discovering Unrecognized Lead-Smelting Sites by Historical Methods

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A B S T R A C T

Objectives. Our objective was to enumerate unrecognized former lead smelters in the United States.

Methods. Defunct smelters were identified by historical research. The compiled list was compared with government registries of hazardous sites. Soil samples were taken from 10 sites.

Results. Approximately 430 sites were unknown to the federal authorities. Only 5 of 319 sites were known to authorities in the top 8 states. Nine of the 10 sites sampled exceeded residential standards for soil lead level.

Conclusions. Approximately 430 former lead-smelting sites were unrecognized in the United States. Sampling results indicate that the sites may pose a threat to public health. (*Am J Public Health.* 2001;91:625–627)

In this paper, we used historical sources to identify several hundred sites in the United States where secondary lead smelting was done from 1931 to 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust. The Agency for Toxic Substances and Disease Registry and the Environmental Protection Agency (EPA) have ranked lead as the number one priority hazardous substance at EPA Superfund sites and as a serious public health problem, especially for children.[1,2]

Secondary lead smelting is the recovery of lead metal and alloys from scrap, primarily lead-acid batteries. This industry expanded during the early 20th century to take advantage of this new source of scrap. Because batteries are heavy, and therefore expensive to transport, smelters were located near the largest sources of scrap (i.e., in large cities).[3]

Secondary lead smelting produces several wastes that can contaminate the air and soil.[4–6] Lead concentrations in shallow soil may reach percentage levels (i.e., 1% or more) near smelters and may persist indefinitely.[7] Lead in soil, dust, and residential lead paint (which is correlated with lead in soil and dust) are the primary sources of environmental lead exposure.[8–10]

Methods

Data Sources

Historical locations of secondary lead smelters were found in the *Standard Metal Directory*[11] and *Year Book of the American Bureau of Metal Statistics.*[12,13] References 14 through 18 provide information on the structure of the industry.

The regulatory status of sites was determined from the US EPA Facility Index System database and confirmed through Freedom of Information Act requests. State agencies in the 8 states with the largest number of potential unknown smelters were contacted for exhaustive lists of recognized sites[19–23] (also B. P. MacIntosh, California Department of Toxic Substances Control, written communication, April 2000; J. Ogden, Illinois Environmental Protection Agency, written communication, May 1999; D. Dupuree, New York State Department of Environmental Conservation, written communication, April 2000).

The existence of smelters was verified by consulting Sanborn Company fire insurance maps (viewed at the Library of Congress and the Boston Public Library) or by noting which locations were specified as "plant" or "works" in the *Standard Metal Directory*. We visited 12 sites in Baltimore, Md, and Philadelphia, Pa, and collected soil samples at 8 of those sites. Two sites were investigated by state authorities in California and Indiana[24] (also J. Patel and J. Wakakuwa, California Department of Toxic Substances Control, written communication, June 1996; H. Saebfar, California Department of Toxic Substances Control, written communication to H. B. Myers, RSR Corporation, August 1996, and to S. Berkin, Union Pacific Railroad, September 1996).

Results

Secondary Lead Smelter List

We compiled a list of 639 locations where lead smelters operated between 1931 and 1964.[11–13] Potential sites in 6 annual editions of the *Standard Metal Directory* were found in 2 listings: Antimonial (Battery) Lead Smelters and Babbitt and Solder Manufacturers (Babbitt metal is a lead alloy used in wheel bearings). The American Bureau of Metal Statistics list of firms that "comprises the major part of secondary pig lead production" was obtained for 1945 to 1990.[12,13] Sixteen sites that were apparently only office locations were later eliminated.

Structure of the Secondary Lead Smelting Industry

We collected information on the number of firms in the industry from 1941 to 1994.[15–18] Apparently, "hundreds" of plants were in the business from 1941 to 1942.[15,16] In 1969, 150 firms were reported to be in business.[18] By 1994, the number of firms had declined to fewer than 20 and the number of plants to fewer than 30.[6,14,18]

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TABLE 1—Summary of Number of Lead-Smelting Sites, by State

State	Total Sites Compiled	Known to Federal	Known to State	Offices Only	Remaining Sites
New York	94	8	0	5	81
Illinois	82	20	0	3	59
Pennsylvania	69	14	0	2	53
California	56	21	0	0	35
New Jersey	49	17	0	2	30
Massachusetts	34	7	5	1	21
Texas	32	12	0	0	20
Michigan	26	11	0	0	15
Ohio	25	8	...[a]	0	17
Indiana	23	9	...[a]	0	14
Missouri	17	3	...[a]	0	14
Maryland	12	3	...[a]	0	9
Minnesota	10	3	...[a]	0	7
Wisconsin	10	2	...[a]	0	8
Georgia	10	5	...[a]	0	5
Florida	9	3	...[a]	0	6
Nebraska	8	6	...[a]	0	2
North Carolina	7	1	...[a]	0	6
Tennessee	7	5	...[a]	0	2
Oregon	6	2	...[a]	1	3
Connecticut	6	2	...[a]	0	4
Colorado	5	2	...[a]	0	3
Washington	5	2	...[a]	0	3
Kentucky	4	0	...[a]	0	4
Utah	4	2	...[a]	0	2
Louisiana	4	2	...[a]	0	2
Alabama	4	3	...[a]	0	1
Virginia	3	2	1	0	0
Kansas	3	3	...[a]	0	0
Rhode Island	2	0	...[a]	0	2
Hawaii	2	0	...[a]	0	2
Arizona	2	1	...[a]	0	1
District of Columbia	2	0	...[a]	2	0
Oklahoma	1	1	...[a]	0	0
Montana	1	1	...[a]	0	0
Arkansas	1	1	...[a]	0	0
Idaho	1	1	...[a]	0	0
Delaware	1	1	...[a]	0	0
Mississippi	1	1	...[a]	0	0
West Virginia	1	1	...[a]	0	0
Total	639	186	6	16	431

[a]State records not checked.

Comparison of Smelter List to EPA and State Databases

Of the 639 sites, 170 (27%) were listed in the US EPA Facility Index System database; 469 sites were not listed. Through a Freedom of Information Act request, US EPA regional offices reported having files on 14 additional sites (2%). After these 14 sites and 16 "office-only" locations were eliminated, approximately 435 of the 639 sites identified in the literature search (68%) were apparently unknown to the US EPA. A further 5 sites (all in Massachusetts) were listed by state authorities among the 8 states with the largest number of sites, which left about 430 previously unrecognized potential sites (67%).

Of the 170 sites with US EPA identification numbers, 14 were Superfund National Priorities List sites, and 32 had had some action taken under the Resource Conservation and Recovery Act. Thus, 46 of the 170 sites (27%) that the US EPA already knew about were deemed contaminated enough to require federal cleanup; many others are being addressed under state authority.

Table 1 summarizes and ranks the number of sites discovered, by state, including totals and the number already known to the federal and state authorities. (Site names and addresses are available from the corresponding author.) In the 8 states surveyed (New York, Illinois, Pennsylvania, California, New Jersey, Massachusetts, Texas, Michigan), only 5 (2%) of the 319 sites unknown to the federal government were known to state authorities.

Smelter Verification

The American Bureau of Metal Statistics list is specifically given as "plant" locations. The *Standard Metal Directory* published a separate list of "Metal Smelters and Refiners," which often specified whether a site was a "plant" or "works" or listed specific equipment. In the *Standard Metal Directory,* 86 sites were cross-listed as "plant" sites.

Twenty possible smelter locations were confirmed from the Sanborn Company fire insurance maps: 5 in Massachusetts, 12 in Philadelphia, Pa, and 3 in Baltimore, Md.

Table 2 summarizes the preliminary investigations of sites in Baltimore and Philadelphia. Lead concentrations above US EPA guidelines for residential (400 mg/kg) or industrial (1000 mg/kg) land uses were found at 7 of 8 sites. Distances to residential or commercial districts are generally short, indicating a high potential for exposure to lead-contaminated soil and dust. Two sites we reported to authorities in 1994 (International Lead, Los Angeles, Calif, and Vickers Warehouse, Anderson, Ind) were found to have percentage levels of lead in soil, and cleanup has been ordered[24] (also J. Patel and J. Wakakuwa, California Dept of Toxic Substances Control, written communication, June 1996; H. Saebfar, California Dept of Toxic Substances, written communication to H.B. Myers, RSR Corporation, August 1996, and to S. Berkin, Union Pacific Railroad, September 1996).

TABLE 2—Preliminary Investigation of Baltimore and Philadelphia Sites

Site Name	Soil Lead, mg/kg	Distance to Residences, blocks	City
Hanover Metals	730	1	Baltimore
Dixie Metals #1	306	1	Baltimore
Dixie Metals #2	520	2	Baltimore
North American Smelting	548	0	Philadelphia
Metro Smelting	2550	2	Philadelphia
Morgan Smelters	657	0	Philadelphia
J. Rosenthal Sons	1490	2	Philadelphia
Electric Storage Battery	1670	Unknown	Philadelphia

Discussion

We identified approximately 430 potential lead-smelting sites previously unknown to federal and state authorities. Preliminary investigation of 10 sites indicated a high potential for exposure. This should create some sense of urgency for the investigation of the other sites identified here because they may represent a significant source of exposure to lead in their local environments. Our experience indicates that a significant fraction of the sites discovered in this work will require remediation. Most sites will not have viable responsible parties, which means that the state or the federal government will have to pay for any cleanup. □

Contributors

W.P. Eckel performed all the library research and computerized database research, performed the field sampling, interpreted the analysis results, and wrote and edited the paper. M.B. Rabinowitz provided guidance to the research project as an expert in environmental lead, assisted in the editing and revision of the paper, and approved the final version. G.D. Foster provided overall direction of the research project, assisted in the editing and revision of the paper, and approved the final version.

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