

Table 9. Health Effects of Take-Home Lead Exposure (Case Reports/Case Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Anonymous [1952]	Philippines	Storage battery factories	Case reports Case 1: 1 Lead-exposed worker, 1 child age 3  Case 2: 1 Lead-exposed worker, 1 child age 2.5  Case 3: 1 Lead-exposed worker, 1 child age 2	Case 1: Symptomatic child was misdiagnosed as a case of poliomyelitis and later died.  Case 2: Symptomatic child died after 3 days of treatment  Case 3: Symptomatic child was chelated and recovered.	Workers made storage batteries in or near where the families lived. No BLLs reported.
Joshua et al. [1971]	India	Gold and silver recovery	Case report 1 Family (9 adults, 9 children); 3 generations	BLL levels ranged from 52 to 72 $\mu\text{g}/\text{dL}$ in children and 37 to 61 $\mu\text{g}/\text{dL}$ in adults.	House and work areas were adjacent. Severe lead poisoning including convulsions and death.
Winegar et al. [1977]	Minnesota, USA	Lead smelting	Case series 38 Workers (87 family members)	Median BLL of workers was 72.5 $\mu\text{g}/\text{dL}$ (range 21-112 $\mu\text{g}/\text{dL}$ ) and median BLL of family members was 17 $\mu\text{g}/\text{dL}$ (range 8-44 $\mu\text{g}/\text{dL}$ ). 5 children under age 10 had BLLs $\geq 30 \mu\text{g}/\text{dL}$ . Free erythrocyte protoporphyrin of family members ranged from 10-94 $\mu\text{g}/100 \text{ mL}$ .	Few family members had symptoms of lead poisonings. Headache and fatigue 20% each. 4 family members with the highest BLLs were asymptomatic.
Dolcourt et al. [1978] CDC [1977b]	North Carolina, USA	Battery factory	Case series 58 Children of unknown number of workers	40 (69%) of children had BLLs $\geq 30 \mu\text{g}/\text{dL}$ . Levels highest in children age 3 and statistically significant decline with age. Maximum 90 $\mu\text{g}/\text{dL}$ .	Used capillary sampling. All children were asymptomatic and all had normal findings on physical and neurological exams. No anemia. 6 children showed metaphyseal lead lines. 6 children with BLL 44-90 required chelation on at least one occasion.
Hung [1980]	Taiwan	Battery processing, stabilizer manufacturing	Case series 2 Families - 5 children (age 16 months - 6 years), 8 adults	4 children had BLLs of at least 80 $\mu\text{g}/\text{dL}$ (2 had lead encephalopathy, 2 had severe abdominal symptoms); 1 child had a BLL of 50-79 $\mu\text{g}/\text{dL}$ (no symptoms). 2 adults had BLLs of at least 80 $\mu\text{g}/\text{dL}$ (both were symptomatic), 4 had BLLs of 50-79 $\mu\text{g}/\text{dL}$ (1 symptomatic), and 2 had BLLs of 30-49 $\mu\text{g}/\text{dL}$ .	Male heads of household worked inside the residence; living areas in both homes were contaminated with lead dust.

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Richter et al. [1980]	Israel	Polyvinyl chloride (PVC) factory	Case series 13 Workers (6 spouses, 12 children)	Workers' mean BLL was 27.6 $\mu\text{g}/\text{dL}$ . Mean BLL was elevated among children (12.3 $\mu\text{g}/\text{dL}$ ) but not among spouses (8 $\mu\text{g}/\text{dL}$ ). Mean BLL in 4 children whose fathers showered and changed before leaving work was significantly lower at 10.3 $\mu\text{g}/\text{dL}$ (9.2-12.0 $\mu\text{g}/\text{dL}$ ) than in children whose fathers did not (14.7 range 10.0-20.0 $\mu\text{g}/\text{dL}$ ). Child with BLL of 20 $\mu\text{g}/\text{dL}$ had hemoglobin of 11.2 g/dL. One wife had BLL of 6 $\mu\text{g}/\text{dL}$ , free erythrocyte protoporphyrin in red blood cells of 124 $\mu\text{g}/\text{dL}$ and hemoglobin 9.4 g/dL.	
Dolcourt et al. [1981]	North Carolina, USA	Battery factory	Case report (Family 1) 1 Worker 22 Exposed family members  (Family 2) 1 Worker 6 Exposed family members	All children had BLLs over 30 $\mu\text{g}/\text{dL}$ . The highest observed levels were in a 3-year-old male (256 $\mu\text{g}/\text{dL}$ ) and a 3-year-old female (220 $\mu\text{g}/\text{dL}$ ). Erythrocyte protoporphyrin of 400 hemoglobin 6 and 9.9. Erythrocyte protoporphyrin was > 100 in 10 children. 20-year-old woman had BLL of 52 $\mu\text{g}/\text{dL}$ .  2 children age 7 and 16 months had BLLs of 64 and 63 $\mu\text{g}/\text{dL}$ , respectively.  4 women had BLLs of 24-46 $\mu\text{g}/\text{dL}$ . 16-month-old had erythrocyte protoporphyrin of 252.	Discarded battery casings were burned as fuel in home. Used capillary sampling. Basophilic stripping of red blood cells in 7 family members 15 months-9 years old. Metaphyseal encephalopathy and lead lines in 15-month-old. Erythrocyte protoporphyrin 313 and 404, hemoglobin 9.6 and 10.4.  Worker was operating illicit battery recycling in home. Used capillary sampling.  16-month-old had hematocrit of 38.
Kawai et al. [1983]	Japan	Cutlery tempering and type printing (at home)	Case series 62 Family members from 15 exposed households	Children < age 12 had higher mean BLL levels than family members not doing lead work (21.8 vs. 13.7 $\mu\text{g}/\text{dL}$ for cutlery-tempering and 27.6 vs. 11.7 $\mu\text{g}/\text{dL}$ for type-printing households).	2 children had excessive $\delta$ -aminolevulinic acid in urine; 2 children had excessive coprotoporphyrin in urine.

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Pitts [1986] Garrettson [1988]	Virginia, USA	Radiator repair	Case report 1 Worker 3 Children 1 Spouse	Radiator worker with BLL of 78 µg/dL had children under age 7 with BLLs of 79, 48, and 27 µg/dL. Lead dust found in worker's van, and in house where dirty clothes stored. Wife had BLL of 12 µg/dL.	2-year-old child with BLL of 79 and erythrocyte protoporphyrin of 100 was asymptomatic but underwent chelation therapy.
Novotny et al. [1987]	Colorado, USA	Firing range	Case series 4 Workers 3 Spouses	BLLs levels in workers ranged from 41 to 77 µg/dL. Spouse BLLs ranged from 6 to 11 µg/dL.	No health effects reported in wives.
CDC [1989b]	Colorado, USA	Plaque production	Case report 1 Worker 4 Exposed family members (3 children)	Children's BLLs ranged from 13 to 37 µg/dL; wife's BLL 15 µg/dL. Children's free erythrocyte protoporphyrin 92-196 µg/dL.	4-year-old daughter's X-ray showed dense metaphyseal density in long bones.
Pichette et al. [1989]	Texas, USA	Battery manufacturing and recycling	Case series 71 Lead-exposed workers 101 Children (50% under age 6)	12% of children had BLLs of 25-49 µg/dL. Mean BLLs for children by age were 19 µg/dL for 0-3; 13 µg/dL for 4-6; and 10 µg/dL for children age 7 and over. Children of battery recycling workers had significantly higher BLLs than children of other battery workers (p=.001). Mean BLL level of spouses who laundered workers clothes was 13 µg/dL compared to 8.4 µg/dL when clothes were laundered by the company.	No health effects reported.
Lussenhop et al. [1989]	Minnesota, USA	Radiator repair	Case series 12 Workers 16 Children < age 6	All but 1 child had BLLs below 15 µg/dL. Mean BLL was 9.3 µg/dL.	No health effects in children reported.
Molovich [1991]	Indiana, USA	Welding	Case report 1 Worker 1 Child age 4	Child was reported to have consecutive lead levels of 0.3 and 0.47 (units and media not reported) and was symptomatic.	Family car was contaminated with lead. Child had seizures; neurological measurements normal.

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Author (year)	Location	Industry	Study Design	Results	Comments
Fischbein et al. [1991, 1992]	USA	Pottery	Case report 1 Worker 2 Exposed family members	Worker and her daughter had BLLs of 48 and 54 $\mu\text{g}/100\text{ml}$ , respectively. Spouse's BLL was 20 $\mu\text{g}/100\text{ml}$ .	Physical exams, complete blood counts and routine biochemistry screens were within normal limits. Erythrocyte protoporphyrin levels in artist 225 $\mu\text{g}/100\text{ mL}$ of red blood cells.
CDC [1992a]	Utah, USA	Construction	Case report 2 Workers (number of family members not reported)	BLLs in 1 family all < 4 $\mu\text{g}/\text{dL}$ . Other family had a 7 mo old with BLL of 17 $\mu\text{g}/\text{dL}$ . Home inspection revealed no other sources of lead exposure.	Daughter 162 $\mu\text{g}/100\text{ mL}$ of red blood cells. $\delta$ -aminolevulinic acid in urine abnormal in all family members. No health effects reported.
State of Alabama [1992]	Alabama, USA	Pottery manufacturing	Case report 2 Workers (parents) 2 Children	Children (age 2 and 14 mos) had elevated BLLs (no other data reported)	Pottery shop adjacent to home. No health effects reported.
Anonymous [1992]	Virginia, USA	Not available	Case report 1 Child of 2 workers	A 1-year-old child had a BLL of 56 $\mu\text{g}/\text{dL}$ . Mother (BLL = 67 $\mu\text{g}/\text{dL}$ ) and father (BLL = 21 $\mu\text{g}/\text{dL}$ ) both worked in a lead industry.	Child received erythrocyte protoporphyrin 73 $\mu\text{g}/\text{dL}$ chelatin therapy. No other health effects reported.
Nunez et al. [1993]	New York, USA	Radiator repair	Case series 7 Children of workers	Mean blood lead level 10 $\mu\text{g}/\text{dL}$ (range 4-21 $\mu\text{g}/\text{dL}$ ); 3 children had levels $\geq$ 10 $\mu\text{g}/\text{dL}$ . 79% of workers reported usually changing their clothes and shoes before leaving work.	Over 50% of radiator shops declined to participate. No health effects reported.
de Silva [1993]	Maryland, USA	Construction	Case report Adult blood lead registry 2 Children	Construction worker with elevated BLL (86 $\mu\text{g}/\text{dL}$ ) had a child with BLL of 26 $\mu\text{g}/\text{dL}$ . Second report was of a construction worker with BLL of 35 $\mu\text{g}/\text{dL}$ who had a child with BLL of 17 $\mu\text{g}/\text{dL}$ .	No health effects reported.

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Author (year)	Location	Industry	Study Design	Results	Comments
Amato [1994]	Virginia, USA	Radiator repair  Propane tank manufacturing  Battery manufacturing	Case reports 1 Worker 2 Children  1 Worker 1 Family member  Number of workers not given 2 Children	Children had elevated BLLs (no other data reported)  Family member had elevated BLL (no other data reported)  Children had "mildly elevated" BLLs (no other data reported)	No health effects reported.
Barnett [1994]	Oregon, USA	Bronze foundry	Case report 2 Children of exposed workers	2 children under 2 years of age had BLLs of 14 and 23 $\mu\text{g}/\text{dL}$ .	No health effects reported.
Czachur et al. [1995]	New Jersey, USA	Construction; Battery manufacturing; General manufacturing	Case series 15 Workers 28 Children	8 children (29%) had BLLs 10-19 $\mu\text{g}/\text{dL}$ ; highest BLL was 26 $\mu\text{g}/\text{dL}$ .	Study was a follow-back of workers with BLLs over 25 $\mu\text{g}/\text{dL}$ from adult blood lead registry; 46% response rate. No health effects reported.
Jung [1994]	Connecticut USA	Painting	Case report 1 Worker 2 Children	Children's BLLs were 16 and 19 $\mu\text{g}/\text{dL}$ . Worker's BLL was 29.9 $\mu\text{g}/\text{dL}$ .	No health effects reported.
Natarajan [1994]	USA	Radiator repair	Case report 1 Worker 1 Child	Child was found to have a BLL of 24 $\mu\text{g}/\text{dL}$ . Father had BLLs of 52 and 64 $\mu\text{g}/\text{dL}$ .	Worker changed clothes before going home but did not shower. No health effects reported.

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Author (year)	Location	Industry	Study Design	Results	Comments
Osorio [1994]	California, USA	Lead recycling/ bullet manufacturing  Radiator repair  Cable cutting  Cable salvage  Battery repair	Case reports 1 Worker (2 children)  1 Worker (2 children)  2 Workers (3 children)  1 Worker (1 child)  1 Worker (1 child)	2-year-old with BLL of 44 $\mu\text{g}/\text{dL}$ and 1-year with BLL of 36 $\mu\text{g}/\text{dL}$ .  Children age 4 and 1.5 had BLLs in 20's.  BLLs of children ages 3 and 5 years, and 9 mos were 28, 27, and 21 $\mu\text{g}/\text{dL}$ respectively.  Child (age 10 mos) had a BLL of 26 $\mu\text{g}/\text{dL}$ .  Child (age 6) had BLL of 36 $\mu\text{g}/\text{dL}$ . Father had BLL of 121 $\mu\text{g}/\text{dL}$ .	Environmental sources ruled out.  Home was constructed post-1978; no lead paint identified.  Child had learning and behavioral problems.
Pollock [1994]	Mississippi, USA	Trucking	Case report 1 Worker 2 Children	Children (age 1 and 3) had BLLs of 24 and 28 $\mu\text{g}/\text{dL}$ , respectively.	No environmental sources of lead identified. No health effects reported.
Wiehrdt [1994]	Illinois, USA  Indiana, USA  Ohio, USA	Battery plant  Not given  Metals	Case report 2 Children of 1 worker  Case report At least 1 child of 5 related workers  Case report Unknown number of children	"Gross contamination" of home.  At least 1 child had a BLL of 50 $\mu\text{g}/\text{dL}$ .  Children of 3 workers had elevated BLLs (levels not provided)	2 children were hospitalized and underwent chelation therapy. 1 child underwent chelation therapy.
O'Tuama et al. [1979]	North Carolina, USA	Burning lead battery terminals	Case report 1 Worker 3 Children Children of coworkers	20-month-old son had high blood lead. 2 siblings plus children of 5 coworkers showed evidence of increased lead absorption.	No health effects reported.

Table 10. Health Effects of Take-Home Exposure to Caustic Substances

AUTHOR (YEAR) LOCATION	CONTAMINANT	INDUSTRY	STUDY DESIGN	RESULTS	COMMENTS
Christensen [1994] Denmark	Caustic Products	Agriculture		Cases were reported of milk pail cleaner poisonings.	Reports were of hospitalizations. Decrease attributed to media campaign generating awareness.
Neidich [1993] South Dakota	Caustic Farm Products	Agriculture	Case report	14 children identified as receiving emergency medical care.	8/14 cases incurred second degree esophageal burns. 6/7 CIP product ingestions occurred from other than the original containers.
Young [1994] Wisconsin	Caustic CIP products	Agriculture	Case report	9 cases of caustic exposure requiring treatment among farm children were identified in Wisconsin for alkali injuries during February 1990 through October 1992.	4 cases were liquid CIP ingestions (all admitted to hospital), 4 cases were eye injuries by caustic cleaning agents, and 1 was a skin burn from liquid CIP.
Edmonson [1987] Wisconsin	Caustic Alkali Ingestions (Clean-in-Place or CIP products)	Agriculture	Case report	10 children in Wisconsin were identified in which CIP poisoning occurred over a period of 10 years and presented to 4 WI hospitals.	All 10 cases for farm children involved liquid dairy pipe line cleaner (sodium hydroxide or potassium hydroxide).
Pelegri [1995] Wisconsin	Caustic Alkali Ingestions	Agriculture	Case report	4 children were admitted to Wisconsin hospital from March 1993 to Jan 1995.	All 4 suffered esophageal burns (2 severe) and 1 incurred gastric burns, too.
Geisinger Medical Center [1991] Pennsylvania	Caustic Alkali Ingestions (Clean-in-Place or CIP products)	Agriculture	Case reports	4 children were identified that had been admitted to a mid-state hospital in PA. during a year period in 1990-91.	1 fatality, a 17-month-old boy, was attributed to CIP products and a 2½-year-old sustained esophageal stricture and perforation.
Leach and Leach [1992] Maryland	CIP products and pipe line cleaner	Agriculture	Case report	19-month-old boy swallowed about 1 teaspoon of heavy duty CIP and pipe line cleaner.	He suffered esophageal burns resulting in scar tissue build-up in the esophagus.
Jorgenson [1990] Wisconsin	Cleaner	Agriculture	Case report	21-month-old girl swallowed cleaner while in barn with parents.	Girl suffered second and third degree burns in her mouth, throat and esophagus.

Table 11. Health Effects of Take-Home Pesticide Exposure

AUTHOR YEAR LOCATION	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	COMMENTS AND ISSUES
McGee et al. [1952] USA	Chemical Processing Plant Toxaphene Farming	Toxaphene poisoning (convulsions or death)	1 Son  1 Son  1 Son	2-year-old son died after playing in yard where storage barn had been built from strips of metal taken from drums that had contained toxaphene. The metal was taken home from a processing plant. 17-month-old son died after drinking from tin cup containing toxaphene while his father was mixing a spray for tobacco. 2-year-old son recovered from convulsions after drinking toxaphene while his mother was working in a cotton field.
Johnston [1953] Washington	Farming Parathion	Acetylcholinesterase inhibition (nausea to death)	1 Daughter  1 Son, 1 daughter  2 Sons	9-month-old daughter died after playing with a can containing parathion which her father had discarded in the yard. 2½-year-old son and his 5-year-old sister played with sacks containing powdered parathion. Boy became ill, was hospitalized, and recovered. Girl had no symptoms. 23-month-old son and his 3-year-old brothers played with a can of parathion that they found in their basement. Only the younger boy had an acetylcholinesterase test indicating serious poisoning. The younger boy was hospitalized and recovered. The older boy showed no symptoms.
Simon [1963] Washington	Farming Parathion	Acetylcholinesterase inhibition (Coma and convulsions). Recovered.	1 Son	4-year-old son was poisoned after playing with a bag of parathion in the barn on his family's farm.
MacMillan [1964] Canada	Farming Parathion	Acetylcholinesterase inhibition (respiratory distress, semi-coma). Recovered.	1 Child	2-year-old boy was poisoned after he smeared the remaining contents of "an empty jar" of parathion that he found in the barn over his face and lips.
Olorio [1994] California	Farming Diazinon Chlorpyrifos Propoxur	Risk of acetylcholinesterase inhibition by diazinon	3 Children < 5 years of age	Diazinon, chlorpyrifos, and propoxur were found at elevated levels in homes of farmworkers. Of the farm workers' children, 3 had diazinon at 52-220 ng and 2 of these had chlorpyrifos at 20-100 ng on their hands. No pesticides were found on hands of children of non-farmworkers.
West [1959]	Crop spraying by airplane. Demeton	Acetylcholinesterase inhibition	1½-year-old daughter	Father came home after spraying a crop and cleaned his boots with paper towels. He threw the towels in the waste basket and placed his boots in the bathroom. His daughter either contacted the boots or the paper towels.
Eitzman and Wolfson [1967] Florida	Farming Parathion	Acetylcholinesterase inhibition: Death	5 Children  6 Children  7 Children	Deaths of 30 children between 1959 and 1964 were reported due to parathion exposure mainly because of adult misuse, or improper storage or disposal practices included in the report were: Children ages 1-5 years ingested parathion stored in improper containers, such as soft drink bottles. Children aged 9 months-10 years ate parathion that they found on the floor or window sill where it had been placed to kill roaches. Children aged 1-9 years inhaled or had skin contact with parathion powder, 3 of these children were siblings who died after playing on a swing that they made from a burlap sack heavily contaminated with parathion.



Table 11. (Continued) Health Effects of Take-Home Pesticide Exposure

AUTHOR YEAR LOCATION	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	COMMENTS AND ISSUES
Davies and Enos [1980]	Farming Chlorpyrifos	Pesticide poisoning. Symptoms not specified.	1 Child	3-year-old boy ingested chlorpyrifos, shown by the excretion of alkyl phosphate and phenolic metabolites. The authors note that agricultural workers' wives and children may be heavily exposed. These exposures occur in the field and also from materials brought back to the home.
Griffin and O'Malley [1992] California	Farming Aldicarb	Acetylcholinesterase inhibition (lethargia, respiratory distress). Recovered.	1 Daughter	3-year-old girl was hospitalized with symptoms of poisoning typical of those resulting from exposure to a carbamate anticholinesterase insecticide. The girl, who recovered, lived in a mobile home on a dairy farm where her father worked. It was determined that a tractor parked near the house contained a box of Aldicarb, and the soil 15 feet from the house showed 1.84 percent Aldicarb.
Barnett [1994] Oregon	Wood treatment Chloropicrin	Eye irritation, nausea, vomiting, coughing	Neighbors (2 adults, 3 children)	Employee of wood treating company brought home his company vehicle which contained 6 containers of chloropicrin. The containers fell and split open, spilling 1 gallon on the driveway and it affected the neighbors.
Anderson et al. [1965] California	Salvage Cottage industry Parathion	Acetylcholinesterase inhibition: mild symptoms (nausea, vomiting) to respiratory distress, coma. All recovered.	2 Sons, 1 neighbor child	Father operated a salvage business at home. Flannelette sheets purchased from an insurance adjustor were contaminated with parathion. The children were exposed to parathion when they slept on the sheets which were used in the home.
Cannon et al. [1978] Taylor et al. [1978] Kelly [1977] Hopewell, Virginia	Chemical Manufacture Kepone	Kepone poisoning (subjective nervousness, objective tremor)	Wives of 2 workers had objective tremor	19% of the 214 community residents had detectable levels of kepone in their blood (0.005-0.0325 ppm). 94% of family members had detectable levels of kepone in their blood (ranging from 0.003-0.39 ppm). Wives of 2 workers had demonstrable tremor. Both gave a history of having washed their husband's work clothing.

Table 12. Health Effects of Take-Home Chlorinated Hydrocarbons Exposure

AUTHOR YEAR LOCATION	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	COMMENTS AND ISSUES
Fulton and Matthews [1936] Pennsylvania	Manufacture of insulated wire and electrical cable	Acne-like dermatitis (Chloracne)	Wife 1 Daughter 1 Son	Workers exposed to hexachloronaphthalene and chlorodiphenyl used in coating wire and electrical cable developed chloracne. The wife, 11-month-old daughter and 2 1/4-year-old son of one of these workers also developed chloracne. The father wore dirty work clothes home and played with his son without changing into clean clothes. It was recommended that adequate protective clothing, lockers, and other sanitary facilities should be provided to the workers.
Good and Pensky [1943] New York	Marine electrical work	Acneform dermatitis, lassitude, occasional impotence, weight loss, taste disturbances	Wives	52 electricians exposed to Halowax in shipbuilding developed chloracne, as did a few of their wives. After this outbreak, preventive measures were initiated which stressed the importance of cleanliness, frequent showering and changing clothes. Work uniforms were provided.
Jensen et al. [1972a] Jensen et al. [1972b] May [1973] Derbyshire, Britain	2,4,5-trichlorophenol manufacture	Chloracne	1 Son 1 Wife	Workers at a factory producing 2,4,5-trichlorophenol developed chloracne following an explosion. Contaminants at the plant after the explosion included 2,3,6,7-tetrachlorinated dibenzodioxin. Later 2 pipefitters working on a tank that had been steam cleaned developed chloracne. The son of 1 of these who played with his father while he was wearing his dirty work clothes, and the wife of the other developed chloracne. As a result of this outbreak, the plant initiated a program for laundering work clothes and encouraged the workers to shower regularly, wear clean undergarments, and to change into clean clothing before leaving work.
Fischbein and Wolff [1987] New York	Transformer maintenance	Elevated serum or adipose polychlorinated biphenyl (PCB) levels	2 Wives	2 railway maintenance workers who repaired transformers containing PCBs developed chloracne. Their serum PCB levels (77 ng/mL, 101 ng/mL) had a PCB pattern resembling Aroclor 1254. Wives of the workers did not have significantly elevated levels of PCBs but the PCB pattern also resembled Aroclor 1254. Both wives reported laundering their husbands work clothes. Prudent industrial hygiene measures were recommended to prevent the transmission of chemical from the workplace to the home.
Baker et al. [1980] CDC [1978] Bloomington, Indiana	Municipal Sewage Treatment	Elevated serum polychlorinated biphenyl (PCB) levels	19 Family members	After PCB was released into the municipal sewage treatment plant by an electrical manufacturing firm, PCB levels in the serum of workers, their family members, community residents and people who applied sludge from the plant on their yards were determined. The mean PCB values were: 17.4 ppb in 89 people who had applied sludge to their yards; 75.1 ppb in 18 sewage treatment workers; 33.6 ppb in 19 family members of the workers; 24.4 ppb in 22 community residents without unusual exposure. No chloracne or systemic poisoning was reported. It was suggested that family members may have contacted PCBs on the shoes, clothing, skin or hair of the workers.
ATSDR [1989b] Hesse [1991] Kalamazoo, Michigan	Specialty plastics manufacture	Not addressed	Potential exposure of an unspecified number of family members to 4,4'-methylene-bis(2- chloroaniline) (MOCA).	A study was conducted in 1980 to determine the presence of MOCA in homes of employees of the Roto-Finish Company. Vacuum cleaner dust and dryer lint contained a maximum level of 2.6 and 0.65 ppm MOCA, respectively. Maximum MOCA concentrations in urine of 12.1 ppb in a family member and 746 ppb in an employee were found.

Table 12. (Continued) Health Effects of Take-Home Chlorinated Hydrocarbons Exposure

AUTHOR YEAR LOCATION	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	COMMENTS AND ISSUES
ATSDR [1989a, 1990b] Hesse [1991] Adrian, Michigan	Chemical manufacture	Exposure to 4,4'-methylene bis(2-chloroaniline) (MOCA)	Spouses and children	MOCA was produced by the Anderson Development Company. The Michigan Department of Public Health conducted urine analyses on the workers' spouses and their children. MOCA was found at concentrations up to 15 ppb.
ATSDR [1991b] Muskegon County, Michigan	Chemical manufacture (pesticides, herbicides, 3,3'-dichlorobenzidine (DCB))	Exposure to 3,3'-dichlorobenzidine	Unspecified number of family members of workers	Chemical production, including 3,3'-dichlorobenzidine (DCB), began at a site near Muskegon, Michigan in 1960. In 1980-1981, the Michigan Department of Public Health conducted a study of DCB in homes of employees. Samples collected from vacuum cleaner bags from homes of some of the employees had up to 10.5 ppm DCB, and dryer lint contained up to 0.74 ppm. From 0.006 to 0.281 ppm DCB was found in the urine of employees and family members.
Townsend et al. [1982] Midland, Michigan	Chlorophenol production	Survey for adverse pregnancy outcomes (stillbirths, spontaneous abortions, congenital malformations)	370 Wives	Pregnancy outcome in 370 wives of workers potentially exposed to dioxin formed as a byproduct in the production of 2,4,5-trichlorophenol were compared to outcomes in wives of workers with no exposure to dioxin. Results indicated that there was no statistically significant association between potential for exposure to dioxin and pregnancy outcome. Exposure potential was categorized on the basis of job classification and wipe tests of plant surfaces.
Smith et al. [1982] New Zealand	Herbicide applicators	Surveyed for miscarriages, congenital defects	989 Applicators and wives	Applicators who sprayed 2,4,5-trichlorophenol products, reported to contain the contaminant, an animal teratogen, were surveyed to determine pregnancy outcomes. The wives of New Zealand sprayers reported helping their husbands spray and handle the herbicide. No detectable reproductive effects were reported.
Bagnell and Ellenberger [1977] Halifax, Canada	Dry-Cleaning	Obstructive jaundice and hepatomegaly	Daughter	The breast-fed daughter of a woman who regularly visited the father during lunch at a dry-cleaning establishment developed jaundice. The mother's blood contained 0.3 mg/dL tetrachloroethylene (TCE) and the breast milk, 1.0 mg/dL. No TCE was present in the blood of the infant when examined 1-week after breast feeding was stopped. Liver function returned to normal.

Table 13. Health Effects of Take-Home Mercury Exposure

Author (year)	Location	Industry	Study Design	Results	Comments
Ehrenberg et al. [1986, 1991] Hudson et al. [1985, 1987]	Vermont	Thermometer plant	60 Workers' children 32 Control children	Workers' children had urine mercury levels of 25 µg/L vs 5 µg/L controls. Childrens' urine levels correlated with worker parents' levels. No clinical effects were found in the children.	NIOSH trailer in which workers were examined became contaminated with mercury (22.5 µg/m <sup>3</sup> ). Workers' homes were also contaminated. The median concentration of mercury in air was 0.26 µg/m <sup>3</sup> , range 0.02-10 µg/m <sup>3</sup> .
ATSDR [1990a]	Tennessee	Chemical workers	115 Members of exposed workers' families.	Urine mercury levels of family members in normal range, mean 5.1±4.4 ng/mL.	Individuals living in households that were vacuumed were more likely to have elevated urine mercury values than those who did not. Floor washing was also associated with higher levels of mercury in urine.
Haddad and Stenberg [1963]	California	Gold extraction in the home	Case report	Husband and wife had acute bronchitis, fever, chills and nausea. Urine mercury levels, 540 µg/L in husband, 80 µg/L in wife.	
Hallee [1969]	Washington	Gold extraction in the home	Case report	Husband, wife and three children had acute interstitial pneumonia, nausea, hypoxemia and headaches. Urine mercury excretion, 33-560 µg/24 hrs.	
King [1954]	Arizona	Gold extraction in the home	Case report	Husband had severe coughing, vomiting and cyanosis; wife did not report symptoms.	
Hatch [1990]	Arizona	Gold extraction in the home	Case report	Woman had gastrointestinal disturbances. Blood mercury level after 3 weeks of chelation was 193 mg/dL.	26 air samples in home 6 weeks after incident averaged 0.83 µg/m <sup>3</sup> .

Table 14. Health Effects of Take-Home Exposure to Other Substances

AUTHOR (YEAR) LOCATION	CONTAMINANT	INDUSTRY	STUDY DESIGN	RESULTS	COMMENTS
Katzenellenbogen [1956] Klorfin and Bartine [1956] Israel	Diethylstilbestrol	Pharmaceutical manufacturing	Case reports	5 children of pharmaceutical workers developed hyperestrogenic syndromes.	2 children improved after the parent changed employment.
Budzynska et al. [1967] Pacynski and Robaczynski [1968] Poland	Diethylstilbestrol	Pharmaceutical manufacturing	Case report	6 children of employees who worked with estrogens developed hyperestrogenic syndromes.	Exposure through in utero exposure vs. take-home exposure was discussed. However, a stepchild who did not live with the worker until the child was 4-years old ruled out in utero exposure in that case.
Pacynski et al. [1971] Poland	Diethylstilbestrol	Pharmaceutical manufacturing	Case report	6 children of employees who worked with estrogens developed hyperestrogenic syndromes.	Same children as in prior 2 articles. However, in this article it stated that after the workplace was investigated and recommendations were carried out, the hyperestrogenic syndromes disappeared in all the children and diminished in the workers.
Aw et al. [1985] Indiana	Zeranol	Pharmaceutical manufacturing	Cross-sectional study of employees working with hormones	3 male children of current workers and two children of former workers determined to have breast enlargement.	In the children of former workers, the breast enlargement diminished after the parent left employment at this workplace.
Bierbaum [1993] Kansas	Diethylstilbestrol	Feedlot repair	Case reports	1976 NIOSH memos dealing with 4 children (ages 3 and 6) with gynecomastia and pubic hair.	The 2 fathers of these 4 children repaired feedlot bins containing feed supplemented with diethylstilbestrol.

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Wilken-Jensen [1983] Denmark	Animal allergen	Veterinary medicine	Case report	Children suffered from asthma every time they went to work with their father or every time he came home from work.	Children were not exposed to animal hairs in the home.
	Grain dust	Miller	Case report	Son developed asthma if the father did not change clothes when he came home from the mill.	
	Mushroom mycelium	Mushroom farming	Case report	The son developed allergic symptoms when mushroom mycelium was exchanged.	
Venables and Newman-Taylor [1989] United Kingdom	Animal allergen	Laboratory animal work	Case report	Husband developed asthma due to animal allergens brought home on the wife's person.	Initial sensitization probably due to pet rat but specific asthma symptoms occurred specifically after contact with the wife, an animal handler.
	Platinum	Precious metal refining	Case report	Wife developed recurrence of asthma after change in husband's job.	Symptoms occurred when husband returned from work. No symptoms on weekends. Positive skin prick tests to platinum salts used in his job.
U.S. Senate [1991a] North Carolina	Otto fuel	Hazardous waste incineration	Case report	2 children developed severe asthma after exposure to hazardous waste (primarily thought to be Otto fuel) on parental clothing.	The children's illnesses improved after the fathers stopped working at the incinerator.
Klemmer et al. [1975] Hawaii	Arsenic	Wood treatment: pesticide use	Survey of arsenic in house dust		Higher values were found in the homes of employees of pest control firms or firms dealing with wood preservation with chemicals.
Falk et al. [1981] United States	Arsenic	Copper smelter	Case report	Hepatic angiosarcoma	Exposure from fathers clothing, outside environment and water supply.

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AUTHOR (YEAR) LOCATION	CONTAMINANT	INDUSTRY	STUDY DESIGN	RESULTS	COMMENTS
Carvalho et al. [1986] Brazil	Cadmium	Lead smelter	Cohort of 396 children ages 1-9 years living less than 900 m from primary lead smelter.	Geometric mean and standard deviation of CdB were 0.087 and 2.5 µg/L resp., range 0.004-0.511 380 children (96%) had CdB > than 0.0089 µg/L The relationship between parental employment in the smelter and children's CdB levels was not significant, but the CdB level was significantly (0.0001) higher among children living in households in which "smelter dross" (an industrial residue obtained from lead ore containing variable content of Cd and used for paving) was present, than in children in whose households smelter dross was not found. Higher CdB was significantly (0.00001) associated with shorter distance from home to smelter.	
Brockhous et al. [1988] Stolberg	Cadmium	Lead and zinc smelters	Cohort of 9 children from families of lead workers and 195 children from other families, ages 4-17 years.	Children from families of lead workers (n = 5) had significantly higher GM CdU of 0.34 (GSD 2.6) than children from other families whose GM CU was 0.13 (GSD 2.2), p < 0.01. CdB among children from families of lead worker were higher than in children from other families but the difference was not statistically significant.	
Carvalho et al. [1989] Brazil	Cadmium	Lead smelter	Cohort of 263 children 1-9 years old, living less than 900 m from lead smelter. Measured cadmium in hair.	The mean cadmium in hair was significantly (P < 0.0001) higher at 6.0 ppm for children whose fathers worked in the lead smelter than for children whose fathers had other jobs (3.7 ppm).	

Table 14. (Continued) Health Effects of Take-Home Exposure to Other Substances

AUTHOR (YEAR) LOCATION	CONTAMINANT	INDUSTRY	STUDY DESIGN	RESULTS	COMMENTS
Maravelias et al. [1989] Greece	Cadmium	Lead smelter	Cohort of 514 children age 5-12 from 4 schools located within various distances from the smelter: a. 500 m b. 900 m c. 1500 m d. 1500 m	Average cadmium in blood of these children was 0.36 µg/L, range 0.1-3.1 µg/dL; it was higher in children from school closest to the smelter (500 m) as compared to the other schools but no relationship was found with parental employment in the smelter.	On average boys had significantly higher CdB than girls, CdB increases with age (r = 0.1917, p<0.001).
Hofstetter et al. [1990] Germany	Cadmium	Lead smelter	Cohort 229 children ages 6-7 years. Measured cadmium in blood (CdB).	Mean concentration of CdB 0.14 µg/dL, range <0.1 -0.5 µg/dL. Significantly higher CdB are observed among children from 2 schools (p < 0.01 and p < 0.001) located in the vicinity of the smelter as compared to school located the farthest distance from the smelter. CdB among children whose fathers were employed at the smelter was higher than those of fathers who had other jobs not statistically significant.	
Madoff [1962] Unknown	Fibrous glass	Home	Case report	Deep excoriations of the skin were found on a 5-year-old boy's trunk and shoulders. The boy's 2 younger sisters also developed the same symptom later.	The cause was traced to clothes washed in a contaminated washing machine where several pairs of fibrous glass curtains had been washed.
Abel [1966] New York	Fibrous glass	Home	Case report	A mother and her 3 children developed severe pruritus.	The mother had washed a fiberglass curtain with the family laundry in the washing machine.
Peachey [1967] Unknown	Fibrous glass	Home	Case reports	A woman and her 6 children, and another family of 3, developed pruritus. The man of the former family did not have the symptom.	Both cases were traced to mixing glass-fibre curtains with the family clothes in the same washing machines. The clothes of the man who was not affected were handwashed separately.



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Woody et al. [1986]	RDX (cyclotrimethylenetri nitramine)	Explosives manufacture	Case report	Child developed episodes of status epilepticus.	Mother worked in explosives manufacturing plant and transported clumps of RDX home on clothing and shoes which the child ate.