Table 1. Health Effects of Take-Home Beryllium Exposure (Case Reports/Case Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Hardy [1948]	Massachusetts	Fluorescent bulb manufacture	Case report	Woman with chronic beryllium disease from household contact.	Exposed for 2 years caring for a fatally ill daughter in home (daughter was a beryllium worker who died of beryllium disease).
Eisenbud et al. [1949]	Ohio	Beryllium plant	Case report	Woman with chronic beryllium disease from household contact.	Woman laundered husband's work clothes for 3 months. Estimated that a single laundering resulted in inhalation of 17 μg of beryllium.
Chesner [1950] DeNardi et al. [1949]	Ohio	Beryllium plant	Case reports	Chronic beryllium disease in: 26-year-old woman whose neighbor worked at the plant. 8-year-old girl. 26-year-old woman.	Woman used bags in which beryllium had been shipped as dish clothes; 10 year latency; infant child may also be a case. Girl's father worked at plant for 1 year before her birth; her uncle had chronic pneumonitis and lived in home for a few months the year before the girl became ill. He had worked at the plant for a few weeks about 7 years earlier. Husband worked in beryllium plant for 8 weeks; she denied cleaning his clothes.
Newman and Kreiss [1992]	Ohio	Beryllium plant	Case report	56-year-old woman whose husband worked in plant for 26 years before initiation of symptoms of chronic beryllium disease.	Woman had only incidental exposure; plant required change of clothes and shower before going home.
Chamberlin et al. [1957]	Pennsylvania	Beryllium plant	Case series	5 women ages 24-56, with chronic pulmonary fibrosis all deceased.	Exposed to contaminated work clothes. Beryllium in lungs 0.02-0.20 μg/100g of dried lung.
Lieben and Metzner [1959]	Pennsylvania	Beryllium plant	Case series	19 cases of beryllium disease ages 10-60 yrs, 9 deceased, 21 neighborhood cases, exposures ages 10-80 yrs.	All had contact with contaminated clothing for 2 months to 13 years; beryllium was found in the lungs.
Metzner and Lieben [1961]	Pennsylvania	Beryllium plant	Case series	Added 3 contact cases and 5 neighborhood cases to those reported by Lieben and Metzner [1959].	Two of the cases were a brother and sister who were often present when the mother washed their father's clothes.
Dattoli et al. [1964]	Pennsylvania	Beryllium plant	Case series	Added 1 contact case and 3 neighborhood cases to those reported by Metzner and Lieben [1961].	Beryllium found in lungs of contact case who handled contaminated clothes for 5 years and also had neighborhood exposure.
Lieben and Williams [1969]	Pennsylvania	Beryllium plant	Case series	Added 3 cases of beryllium disease to those reported by Dattoli et al. [1964]. Total of 26 cases ages 17-59 among household contacts of workers; 22 were female, 18 deceased.	Exposed to clothing or home environment of beryllium workers before 1959.

Table 1. (Continued) Health Effects of Take-Home Beryllium Exposure (Case Reports/Case Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Hardy [1965] Hardy et al. [1967]	U.S.A.	Various	Beryllium Case Registry (1952-1966)	40 cases from household contact.	All exposed to contaminated work clothes; 13 also exposed by air pollution.

Table 2. Health Effects of Take-Home Asbestos Exposure (Cohort Studies)

Author (year)	Location Industry/ Population at Risk	Study Design	Results	Comments
Anderson [1983] Anderson et al. [1976, 1979a, 1979b]	Patterson, New Jersey Amosite workers employed 1941-1945 in thermal insulation materials factory	Cohort study. Morbidity and mortality among 2,218 household contacts of amosite workers identified. 679 of 1,545 alive through 1980 were examined. Occupational, residential, smoking, medical history questionnaire administered to the exposed cohort. Vital status follow-up is through 1980. Radiographs were taken 20+ years after first exposure. For radiographic analysis, a frequency matched (age, gender) control group was assembled of 326 unexposed people from the same urban New Jersey community who presented for chest radiograph 1975-1976.	3/663 observed deaths were due to mesothelioma. Lung cancer overall SMR=152 (25 observed/16.4 expected) after 20 years latency SMR=185. Among females, there were 8 respiratory cancers observed vs. 6.4 expected. Excess risk was confined to those with 20+ years latency (8 observed vs. 4.7 expected, SMR=170. Among males with 20+ years latency, there were 12 lung cancer deaths observed vs. 6.1 expected (SMR=197). Increased frequency of asbestos-associated radiographic abnormalities among household contacts. Prevalence of radiographic abnormality associated with secondary exposure was 35% vs. 5% expected based on the comparison population ($p<0.001$). Prevalence of abnormalities increased with duration since first exposure; 40% prevalence among those with longest latency ($p<0.01$). Those with 10+ years of household exposure had a prevalence of abnormal radiographs of 53%. For 1971 ILO classification 1/1 and greater, a prevalence of 10.3 observed vs. 0.6% in controls. Prevalence of parenchymal or pleural abnormality 20+ years after first household exposure (1979b): 48% among wives, 21% among daughters, 42% among sons, and 37% among siblings.	Mesothelioma deaths occurred 20+ years after childhood domestic exposure (2 female; 1 male). There were 2 additional mesotheliomas among children of workers that were excluded from analysis. Dust from work clothes, shoes, hair assumed causal. No changing facilities at factory.
Magnani et al. [1993]	Italy Asbestos cement workers	Retrospective cohort mortality study of 1,964 wives of asbestos cement workers; cohort had no history of occupational exposure. Husbands employed 1950-1985; deaths occurred 1965-1988.	Between 1965-1988, there were 4 pleural tumors (1 mesothelioma) observed vs. 0.5 expected; 6 lung cancer vs. 4.0 expected. Expected based on local rates. Among women with domestic exposure, cancer of the pleura was significantly elevated SMR=792.3 (95% CI 215.9 - 2,028.8).	This plant had no laundering facilities, and work clothes were laundered at home. All 6 cases reported more than 10 years of exposure. There were 2 additional mesotheliomas observed after 1988.

Table 2. (Continued) Health Effects of Take-Home Asbestos Exposure (Cohort Studies)

Author (year)	Location Industry/ Population at Risk	Study Design	Results	Comments
Joubert et al. [1991]	New Jersey Amosite asbestos workers	Cohort study. Followed household contacts of amosite asbestos workers employed at a single facility 1941-1954. Of 4,044 household contacts, 878 were examined 1973-1976.	Vital status follow-up through January 1990 indicates that 28% died of lung cancer, 23% died from cancer of the gastrointestinal tract, and 9% died of mesothelioma. The authors state that cancer deaths were 2 times expected based on national estimates.	Some figures reported in the paper seem contradictory. This appears to be additional follow up of the Anderson et al. studies.
Navratil and Trippe [1972]	Czechoslovakia Chrysotile asbestos product processing	Cohort study. Prevalence of pleural calcification in three asbestos exposed groups compared with prevalence in non-exposed residents of the same area (Group #4). Group #1 800 workmen employed for more than 10 years at a factory. Group #2 155 persons living in the neighborhood of the factory. Group #3 114 persons older than 20 years who were relatives of factory employees. Group #4 8,127 persons over the age of 40 who lived in the same district as the factory but not in the same neighborhood as the factory.	Each group was evaluated by X-ray for the prevalence of pleural calcification, with or without other signs of asbestosis. Observed statistically significant ($p<0.01$) increased risk of calcification among each asbestos exposed group compared with Group #4. Group #1 42/800 (5.3%) observed vs. 2.75 expected Group #2 9/155 (5.8%) observed vs. 0.53 expected Group #3 4/114 (3.5%) observed vs. 0.39 expected Group #4 28/8127 (0.34%)	In group #2, 5 were also relatives but were counted in group #2 rather than group #3. Blood relations were assumed to have increased exposure due to contact with workers wearing contaminated work clothes.

Table 3. Health Effects of Take-Home Asbestos Exposure (Community Studies)

Author (year)	Location/ Industry/ Population at Risk	Study Design	Results	Comments
Kilburn et al. [1985, 1986]	Los Angeles County Shipyard workers	Community-based cohort. Prevalence of radiographic evidence of asbestos among shipyard workers and their household contacts with at least 20 years latency (n = 1017) was compared with that of 2 previously studied comparison groups (Long Beach census tract and Michigan adults). Medical and occupational history obtained by examination and interview.	Prevalence among household contacts without occupational exposure was reported. Among 274 wives of shipyard workers, 11.3% had radiographic evidence of asbestosis (profusion 1/0 or greater), compared with prevalence of 0.6% in the California and 0.0% in the Michigan comparison groups. Prevalence increased with time since first exposure; the prevalence rate among those with longest latency was 32%. Among 140 female children, the prevalence rate was 2.1%; a prevalence of 7.6% was observed among 79 sons of shipyard workers.	Possible selection bias resulting from volunteer study participants. No difference in prevalence observed by smoking status. Most shipyard workers had indirect (bystander) exposure. Families of insulators appear to be at increased risk of asbestosis compared with other shipyard workers. (1% of shipyard workers were insulators; about 25% of asbestosis in workers' families occurred in families of insulators.)

Table 4. Health Effects of Take-Home Asbestos Exposure (Case-Control Studies)

Author (year)	Location	Industry/ Population at Risk	Study Design	Results	Comments
Newhouse and Thompson [1965]	London, England	Hospital-based	Matched case-control. Cases (n=83) were autopsy series who died of mesothelioma (pleural and peritoneal) 1917-1964; matched on gender and birth date (+/- 5 years) to in-patient controls from same hospital who were hospitalized 1964. Two other comparison groups were used to verify results, but not reported in paper: 1. matched on gender, birth date, and date of admission, and 2. 17 patients from same hospital pathology series who were misdiagnosed as mesothelioma.	9/76 cases (7 female; 2 male) reported domestic exposure compared with 1/76 controls from the inpatient series.	Most female exposures from laundering work clothes; 2 males exposed in childhood to family members who worked in asbestos factory; latency ranged from 16-55 years.
Vianna and Polan [1978]	New York State	Population-based	Matched case-control. Cases were 52 (30 pleural/20 peritoneal) histologically confirmed female mesothelioma (pleural and peritoneal) deaths (1967-1977); one-to-one matching on gender, race, county of residence, marital status, age and year at death; controls died from causes other than cancer; occupational history by questionnaire, medical and industrial records.	Relative Risk from matched pairs analysis for domestic exposure (included 2 with occupational exposure) reported as 10 (95% CI=1.4-37.4). Analysis on subset of 46 non-occupationally exposed cases: 8/46 reported domestic exposure vs. 1/46 controls (p=0.02).	All 10 domestic cases exposed during hand-laundering of work clothes.

Table 4. (Continued) Health Effects of Take-Home Asbestos Exposure (Case-Control Studies)

Author (year)	Location	Industry/ Population at Risk	Study Design	Results	Comments
McDonald and McDonald [1980]	Canada and USA	Population-based autopsy series (Canada 1960-1972: USA 1972)	Matched case-control. 557 pleural and peritoneal mesotheliomas with autopsy; matched on hospital, gender, age, and year of death to controls with pulmonary metastases from non-pulmonary primary who were autopsied; occupational, residential, smoking, and non-occupational exposure histories from interview (blind) with relatives for 490 matched pairs. Occupational exposures coded blind and cumulated to 10 years before death of case.	8/557 cases vs. 2/557 controls reported domestic exposure to asbestos dust on work clothes of household contact ($p=0.08$ for matched pairs analysis).	5/8 non-occupational cases and 2 controls were exposed to contaminated clothing in childhood. 3/8 cases and 1 control were exposed to clothing of a chrysotile production worker; 5 cases and 1 control were exposed to contaminated clothing of insulation factory workers.
Whitwell et al. [1977]	England	Hospital-based	Case-control. Asbestos fiber content in lungs of 100 consecutive pleural mesothelioma autopsies compared with 100 lung cancer cases and 100 lungs of people who died from causes other than industrial lung disease or lung cancer for whom occupational histories were available. Occupational and residential history obtained from patients or relatives.	1 mesothelioma reported in asbestos worker's family. Although not explicitly stated in published report, apparently no cases were observed in either control series in asbestos workers' families.	Father worked in gas mask production and brought work home. Lungs of his son had 50,000-100,000 asbestos fibers/gram dried lung tissue.

Table 4. (Continued) Health Effects of Take-Home Asbestos Exposure (Case-Control Studies)

Author (year)	Location	Industry/ Population at Risk	Study Design	Results	Comments
McEwen et al. [1971]	Scotland	Population-based	Matched case-control. 83 mesothelioma cases who died 1950-1967 from all pathology departments in Scotland. Two control groups were matched on age and gender to the nearest chronologic pathology report from the same hospital: (1) coronary artery disease deaths, and (2) lung and gastric carcinoma cases were matched to pleural and peritoneal mesothelioma cases, respectively.	Only a few cases and controls had shared households with asbestos workers. No statistically significant differences between these two groups.	The number of non-occupational cases was not reported in the publication. The case of a woman who washed the clothes of her husband who was a dockworker is described.
Rubino et al. [1972]	Italy (Piedmont)	Various industries; Piedmont produces only chrysotile	Case-control study of 50 confirmed cases of pleural mesothelioma admitted to 2 Turin clinical settings 1960-1970. Controls were 50 patients from the same institution matched on gender and age.	12% of mesothelioma reported in the case series were in workers' family members; 3 cases (2 men and 1 woman) had lived with persons employed in the asbestos industry, compared with none in the control group.	The wife of a man worked in the asbestos industry, and 1 woman's brother worked in an asbestos cement factory. Occupational exposure was unequivocally demonstrated in 5 men. Asbestos bodies were found in only one case.
Ashcroft and Heppleston [1970]	Britain	Shipbuilding	Case-control study of 23 cases of mesothelioma (20 pleura, 3 peritoneum; 19 males, 4 females) that came to autopsy compared with 46 hospital controls matched on sex and age, free from malignant disease.	91% of the cases had a history of exposure to asbestos vs. 41% of 46 matched controls ($p<0.001$); 1 of the cases resulted from domestic exposure.	A widow of an asbestos worker was exposed for 3 years to asbestos dust brought home on her husband's clothes, hair and shoes. Paper includes table of fiber and asbestos body counts.

Table 5. Health Effects of Take-Home Asbestos Exposure (Case Reports)

AUTHOR(S) (YEAR) COUNTRY	INDUSTRY	HEALTH EFFECT	# CASES/RELATIONSHIP	AGE(S) AT DEATH OR DIAGNOSIS	COMMENTS
Rusby [1968] England	Asbestos	Mesothelioma	1 Female	71	Woman laundered clothing of 3 daughters who had worked in an asbestos factory for 1-2 years. 26 year latency.
Teyssier and Lesobre [1968]	Asbestos	Asbestosis Pleural plaques	Case report of asbestosis in a man exposed as a teen to his father's work clothes worn home from an asbestos plant.		May also have had environmental exposure since he lived near an asbestos plant for 2 years.
Champion [1971] Canada	Asbestos	Mesothelioma	1 Male	31	Father was a pipe lagger and had asbestosis. Son never had occupational exposure.
Knappmann [1972] West Germany	Asbestos	Mesothelioma	Man lived for several years with sister who was an asbestos worker who came home with dusty clothes and hair.	66	42 years from beginning of exposure to onset of tumor.
Lillington et al. [1974] USA	Asbestos	Familial mesothelioma	1 Wife	52	Domestic case resulting from residence in the same house as an asbestos worker who died of mesothelioma.
Li et al. [1978] USA	Asbestos	Familial mesothelioma	1 Mother, and 1 daughter	51,34	Father was shipyard insulation worker who had asbestosis and died of lung cancer. His wife and eldest daughter died of mesothelioma. Wife laundered dusty work clothes.
Epler et al. [1980] USA	Asbestos	Pleural changes Mesothelioma	2 Wives of asbestos workers 2 Brothers	60,56, 33 and 27	Wives were involved with cleaning husbands' clothes resulting in mesothelioma in one and pleural changes in the other. Brothers played as children in room used as muffler shop. Both developed pleural changes in young adulthood, although changes in one could have been related to subsequent occupational exposure.
Risberg et al. [1980] USA	Construction	Familial pleural and peritoneal mesothelioma	Father, 2 brothers and 1 sister	61,71, 60, and 52	All cases smoked. Father died of peritoneal mesothelioma. The 2 sons and their sister died of tubulo-papillary mesothelioma. No asbestos industry employment; father and sons worked in construction industry.
Jorgensen [1981] Denmark	Asbestos (insulation work)	Pleural plaques	3 Wives of insulation workers	71,54 and 58.	Exposure was limited to laundering of clothes, dusty shoes, etc. Of the 3 women, 2 smoked and 2 had other relatives who were insulation workers.

Table 5. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Reports)

AUTHOR(S) (YEAR) COUNTRY	INDUSTRY	HEALTH EFFECT	# CASES/RELATIONSHIP	AGE(S) AT DEATH OR DIAGNOSIS	COMMENTS
Martensson et al. [1984b] Sweden	Asbestos (foundry)	Familial pleural mesothelioma	Sister and brother	52,58	Brother dead, sister survived. Father's work clothes hung in kitchen when they were children.
Krousel et al. (1986) USA	Asbestos	Familial pleural mesothelioma	Mother, son and daughter of a lumber and shingle company worker.	74, 40, and 35.	Son was only one with possible occupational exposure, but diagnosis at age 35 suggests childhood exposure.
Magee et al. [1986] Italy	Chrysotile ore contaminated with tremolite and actinolite.	Mesothelioma	Single male case.	41	Indirect exposure to asbestos from Canari Mine in Corsica. Exposed as child in pub in house. Analysis of lung mineral content showed chrysotile at background and elevated levels of tremolite and actinolite asbestos. Fiber size and mesothelial carcinogenesis discussed. Paper contains data on lung fiber burden.
Huncharek et al. [1989] USA	Asbestos	Pleural mesothelioma	Single case (female)	76	Indirect exposure to husband, a shipyard machinist, who dismantled boilers and other related machinery for 34 years. She laundered his clothes. Paper contains data on lung fiber burden.
Li et al. [1989] USA	Asbestos	Familial mesothelioma	2 Female cases. Father worked in asbestos plant.	32, 49	Cotton cloth sacks in which molded asbestos insulation had been transported had been used to make diapers for children. Results were the deaths of the mother, a sister, and a young uncle who lived there and worked as insulator. In addition, the father died of asbestosis. Mother laundered asbestos-contaminated diapers and work clothes.
Otte et al. [1990] Denmark	Amosite asbestos cement	Familial mesothelioma	Family cluster of 3 deceased.	74, 79, 45.	Family produced asbestos cement in their home. Used dry hand mixing procedure. Mother, father and a son died of mesothelioma; 2 sons and a daughter survived. All decedents smoked.

Table 5. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Reports)

AUTHOR(S) (YEAR) COUNTRY	INDUSTRY	HEALTH EFFECT	# CASES/RELATIONSHIP	AGE(S) AT DEATH OR DIAGNOSIS	COMMENTS
Oern et al. [1991] Norway	Asbestos (various)	Pleural mesothelioma	1 Woman	79	Family made up of 2 brothers, a sister and her husband. All males were asbestosis insulators and 2 were smokers. Oldest brother (alive) has asbestosis. Other brother and sister died from mesothelioma. Brother-in-law died from cancer bronchiale. Woman cleaned asbestos-contaminated work clothes.
Anonymous [1993b] England	Asbestos	Pleural plaques	3 Daughters	63,62 60	Daughters of pipe lagger. Exposure was laundering of work clothes; 2 younger daughters were asymptomatic but all 3 had varying degrees of pleural plaques. Father died of peritoneal mesothelioma.

Table 6. Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH EXPOSURE	COMMENTS/ ISSUES
Lieben and Pistawka [1967] USA	Asbestos (insulation, shipbuilding)	Mesothelioma: 1 pleural and 2 peritoneal.	3-year-old girl whose father worked with asbestos insulation. 40-year-old woman whose father and brother were asbestos insulation workers. 67-year-old woman whose two sons were shipyard asbestos insulation workers.	3, 40, 67. No numerical exposure data given.	Of 42 mesothelioma cases reported from 152 Pennsylvania hospitals 1958-1963, 3 were family members of asbestos workers.
Dalquen et al. [1970] Germany	Asbestos	Pleural plaques	22 cases among domestic contacts		133 cases of pleural plaques and 145 cases of asbestosis from the Hamburg area are reviewed. Of 92 cases of pleural plaques with a history of exposure to asbestos dust, 34 were occupationally exposed, 22 domestically, 21 by urban dwelling and 10 by multiple cause. 5 had no history of asbestos exposure. The latency period for plaques was 40.2 years.
Heller et al. [1970] USA	Asbestos	Pleural mesothelioma	1 woman. Washed pipefitter husband's asbestos-contaminated work clothes.		Radiological review of a series of 10 cases of pleural mesothelioma seen at Massachusetts General Hospital 1960-1967, 1 case was the wife of an asbestos worker.
Bittersohl and Ose [1971] Germany	Asbestos (insulation and products such as cords, seals, plates, etc.)	Pleural mesothelioma	1 woman whose husband was exposed to asbestos insulation at a chemical plant. She laundered his work clothes.	Exposure data given in terms of East German standard.	26 cases of pleural mesotheliomas from chemical plants in the district of Merseburg, East Germany. This group is made up of 22 patients from the Leuna Chemical combine, 2 patients from the Beuna Chemical Combine, 1 patient from a metal foundry, and 1 case in the wife of a chemical plant workers. Chemical plant workers were exposed to asbestos insulation. All occupational cases had been exposed to dust levels exceeding the East German standard. This group includes workers not directly working with asbestos, but working near-by. Of the cases, 46% occurred after retirement.

Table 6. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH EXPOSURE	COMMENTS/ ISSUES
Vianna et al. [1981] USA	Six New York counties	Mesothelioma	Of 7 cases of indirect exposure, 6 were females.		Population-based incidence study (case series). Descriptive survey of 31 (22 male; 9 female) histologically confirmed mesothelioma cases diagnosed 1973-1978; occupational histories from cases or relative. No control group.
Grundy and Miller [1972] USA	U.S. population-based	Childhood mesothelioma	13 cases of childhood mesothelioma in US children.	Age range: 4 through 17.	U.S. population-based death certificate search. No exposure history, although occupational history of some fathers consistent with asbestos exposure. Apparent short latency in children compared to adults.
Greenberg and Davies [1974] England/Wales	Asbestos	Mesothelioma	2 women with mesotheliomas associated with household exposure of 2 and 3 years duration; 1 woman's husband worked in an asbestos factory, and 1 was exposed to her brother's work clothes.		1967-1968 mesothelioma case series (n=413: 365 pleural; 48 peritoneal) from population-based registry. Asbestos exposure history obtained by interview from cases, relatives, employers and workmates. For 246 of the 413 cases, the diagnosis was histologically confirmed.
Milne [1976] Australia	Asbestos (asbestos/cement)	Mesothelioma	1 case in a woman whose father worked in the asbestos cement industry.	No exposure in the series began after 1943; length of exposure ranged from 6 months to 30 years.	Retrospective survey of 32 cases of mesothelioma in Victoria, Australia. These authors found occupational history equally effective as an asbestos body count to indicate past exposure. In 16% of cases, there was no evidence of exposure to asbestos, and 2 cases of peritoneal cancer were in siblings without asbestos exposure.
Edge and Choudhury [1978] England	Asbestos (shipyard workers)	Pleural mesothelioma	1 woman married to shipyard plumber who may have brought dust home on clothes.		47 men and 3 women diagnosed with pleural mesothelioma 1966-1976 among 64,000 residents, 7,000 of whom worked in ship construction. All 50 cases of pleural mesothelioma histologically proven and accepted by Pneumoconiosis Panel. All men plus 1 woman occupationally exposed; 1 woman exposed at home, another had no known exposure. Asbestos content of last 20 cases was measured; 18 cases substantially exceeded that of the general population. Metastases, frequent at necropsy, occurred in 25 of 47 cases autopsied.

Table 6. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH EXPOSURE	COMMENTS/ ISSUES
Bianchi et al. [1982] Italy	Asbestos (shipyard work)	Pleural mesothelioma	1 woman whose husband was a shipyard worker.		Of 70 cases (64 men; 6 women) seen at Institute of Pathological Anatomy of Trieste 1967-1980 1 was due to probable domestic exposure. Necropsy findings available in 63 cases. Remaining 7 cases were diagnosed at thoracotomy. Of the cases, 43 employed in shipyards, most prior to 1940. Intervals between first exposure and death ranged from 28 to 61 years. Asbestos bodies found in 48 of 61 cases.
Bianchi et al. [1987] Italy	Asbestos (shipyard, sodium carbonate factory)	Hyaline pleural plaques	59 cases were attributed to domestic exposure (laundering asbestos-contaminated work clothes of family members). 9 cases with occupational and domestic exposure.	Not stated	74 women with hyaline pleural plaques found at necropsy. 2 cases with occupational exposure. Sufficient exposure data could not be obtained on 4 cases. Pleural malignant mesothelioma was noted in 2 cases with a history of household exposure.
Bianchi et al. [1990] Italy	Shipyard, sodium carbonate factory, textile, artisans, domestic maids)	Hyaline pleural plaques	Pleural plaques at necropsy were found in 55% of 121 women with history of domestic exposure.		1,620 necropsies (1,040 men, 580 women) were performed from Oct 1979 to Dec. 1987 in Monfalcone, Italy. 121 women with history of domestic exposure were compared to 57 women with no history of domestic exposure. Pleural plaques were significantly more prevalent in those women with domestic exposure ($p<0.001$). The prevalence of hyaline plaques was higher in every occupational category for women with domestic exposure than for women without domestic exposure.
Bianchi et al. [1991] Italy	Shipbuilding, sodium carbonate factory	Asbestos bodies Hyaline pleural plaques	1,765 necropsies (1,127 men; 638 women). In women, cleaning of work clothes polluted with asbestos was the main source of exposure. Domestic exposure resulted in pleural plaques in about half the necropsies on female patients.		Prevalence of pleural plaques and asbestos bodies varied by occupation in men; the highest prevalence was in those who had worked in the sodium carbonate factory. Only 21 of the 638 necropsies on females had a history of occupational exposure.

Table 6. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH EXPOSURE	COMMENTS/ ISSUES
Bianchi et al. [1993] Italy	Asbestos (shipyard, sodium carbonate factor)	Mesothelioma	6 women had history of domestic exposure (laundering asbestos-contaminated clothing of family members).		92 malignant mesotheliomas were diagnosed between Oct. 1979 and April 1992 at Monfalcone Hospital. 6.5% of these were associated with domestic exposure. 75 cases had occupational history of exposure to asbestos. One case had a history of probable environmental exposure.
Lander and Viskum [1985] Denmark	Asbestos work	Pleural plaques, Pleural calcification, Pulmonary fibrosis, Asbestosis	Of 63 women (spouses of workers exposed to asbestos) with indirect (non-occupational) exposure to asbestos, 9 (17%) had radiological changes characteristic of exposure to asbestos. Exposure consisted of laundering asbestos-contaminated work clothes.	Adult women	The researchers attempted to enroll 125 spouses of asbestos-exposed workers. 90 participated in the study. 20 were excluded due to lack of exposure (X-rays were normal). 5 were excluded due to occupational exposure (one had pleural plaques). 2 were excluded for other pulmonary diseases.
Gibbs et al. [1989] Wales	Asbestos	Pleural mesothelioma	1 male and 12 females with non-occupational exposure (Zielhuis group II, e.g., the wives of asbestos workers) included in the study.	47-72	84 cases diagnosed 1979-1986 chosen because the history of asbestos exposure was absent, indirect, or ill-defined. 3 purposes of study were: 1. correlate lung mineral count with Zielhuis (1977) occupational exposure groupings; 2. determine whether any mesotheliomas were unrelated to asbestos exposure; and 3. compare the role of amphiboles and chrysotile in causation. Conclude that: 1. Zielhius method too complex; 2. mesotheliomas may develop in absence of asbestos exposure; and 3. amphiboles are more important than chrysotile. Electron microscope mineral fiber analysis data provided by exposure group.

Table 6. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH EXPOSURE	COMMENTS/ ISSUES
Gibbs et al. [1990] Wales	Asbestos (shipyard work, lagging, building, ordnance)	Malignant pleural mesothelioma	10 cases in family members, 9 of whom were spouses of asbestos workers and 1 was daughter of a man who died of asbestosis.	Age range: 47 to 72.	This was a comparison of types of lung fibers and size distribution in a series of non-occupational cases of mesothelioma with a series of known occupational exposure in female gas mask workers. The non-occupational group fiber exposure was variable; 6 showed high crocidolite; 7 showed high amosite; 1 high chrysotile; and 2 showed normal for all fiber (several showed more than 1 high fiber group).
Konetzke et al. [1990] Germany	Asbestos	Asbestosis Mesothelioma	48 non-occupational registry cases of mesothelioma and 19 cases of asbestosis (11 male; 56 female). 10 of these lived near an asbestos plant.		Confirmed reports that even in the non-occupational area, asbestos represents a non-negligible risk for diseases of the lung. Non-occupational risk factors identified in this study included: laundering (46%); use of asbestos containing materials in the house (21%); and leisure activities (15%).
Kiviluoto [1965] Finland	Asbestos	Pleural plaques, Pleural adhesions, Pulmonary fibrosis, Mesothelioma.	4 cases of asbestoses in 4 sisters whose father had been occupationally exposed to mixed dusts.		The father 50 years earlier had been occupationally exposed to mixed dusts and presumably brought them home on his clothes.
Martensson et al. [1984a]	Asbestos work	Mesothelioma	Woman who had been exposed to asbestos during childhood via her father's work clothes.		Analysis of 32 cases of malignant mesothelioma. All but one case was occupational.
Sider et al. [1987] U.S.A.	Insulation work	Radiographic pleural changes (plaques, calcification, thickening)	18 (19.4%) wives of asbestos-exposed insulation workers screened had radiographic abnormalities.		117 wives of asbestos-exposed insulation workers were screened with X-rays and pulmonary function tests. None of the 24 women under age 40 had any X-ray abnormalities. Exposure for all of them was less than 8 years. These 24 were excluded. 18 (19.4%) of the remaining 93 had radiographic abnormalities.

Table 6. (Continued) Health Effects of Take-Home Asbestos Exposure (Case Series)

AUTHOR(S) YEAR COUNTRY	INDUSTRY	HEALTH EFFECT	#/RELATIONSHIP	AGE AT DEATH *EXPOSURE*	COMMENTS/ *ISSUES*
Giarelli et al. [1992] Italy	Asbestos (shipyard)	Mesothelioma	5 women with a history of domestic exposure to asbestos (laundering the asbestos-contaminated clothing of family members).	Age at death of all cases 33 to 92 years (median 70 years).	170 pleural mesotheliomas examined at necropsy between 1968-1987 (Trieste University). Occupational histories consistent with asbestos exposure in 150 cases. 5 had no asbestos exposure history but lung sections showed asbestos bodies. 5 women had a history of domestic exposure to asbestos (laundering the asbestos-contaminated clothing of family members).

Table 7. Health Effects of Take-Home Lead Exposure (Cohort Studies)

Author (year)	Location	Industry	Study Design	Results	Comments
Baker et al. [1977] CDC [1976]	Tennessee, USA	Lead smelting	Cohort 20 Exposed children 17 Neighborhood controls	Mean BLL significantly higher in exposed children; some of whom had BLL > 80 μg/dL. Higher dust lead levels in exposed houses (2,687 vs. 404 ppm); children's BLLs correlated with dust levels.	Matched on neighborhood and measured lead content in paint by X-ray fluorescence. 7 children had erythrocyte protoporphyrin > 190 μg/100 mL which necessitated immediate medical attention.
Elwood et al. [1977]	England	Battery plant	Cohort 192 Exposed children 273 Children from birth registry	Workers' children had significantly higher BLLs than registry children (mean 33 vs. 27 μg/dL).	Used capillary sampling; 3-year-olds had highest BLLs. No health effects reported.
Koplan et al. [1977]	Barbados	Pottery	Cohort 12 Potters 19 Family members 24 Controls	Mean BLL of potters' family members (35 μg/dL) was significantly higher than that of controls (17-19 μg/dL).	Homes were adjacent to potteries. An adult female member of potters' family had decreased deep tendon reflexes in ankles bilaterally; BLL of 54 and erythrocyte protoporphyrin of 209 mg/100 mL.
Watson et al. [1978] CDC [1977a]	Vermont, USA	Battery plant	Cohort 27 Exposed children 32 Neighborhood controls	56% of exposed vs. 12.5% of controls had BLL ≥ 30 μg/dL; higher mean dust lead levels in exposed houses (2,239 ppm) vs. controls (718 ppm).	Used capillary sampling. Significantly elevated erythrocyte protoporphyrin.
Millar [1978]	England	Lead smelting/refining	Cohort 71 Children of workers 191 Community children (living near plant)	Difference in BLLs between workers' children (21.1 μg/dL) and community children (18.2 μg/dL) was statistically significant for children age ≤ 10.	No deviation from normal health were found by careful study.
Rice et al. [1978]	USA (city unspecified)	Secondary lead smelter	Cohort 33 Exposed homes 19 Neighborhood homes	7 exposed children had zinc protoporphyrins over 50 μg/dL compared to 1 control child. Significantly higher lead levels were found in wipe and dust samples from exposed homes compared to control homes.	No BLLs were measured. Other health effects not reported.
Abbritti et al. [1979]	Italy	Ceramics	Cohort 40 Children of ceramic workers 47 Children of ceramic workers who work at home 89 Unexposed children in community	Mean BLLs for the three groups: 25.1, 27.5, 23.0 (p-value for difference between the latter two < 0.001).	Many of the pottery factories were home-operated. No significant difference in hematocrit.

Table 7. (Continued) Health Effects of Take-Home Lead Exposure (Cohort Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Landrigan et al. [1980]	Georgia, USA	Stained glass	Cohort 12 Workers 5 Hobbyists 4 Workers' family members	Mean BLLs were 20.7 μg/dL for workers, 11.6 μg/dL for hobbyists and 11.3 μg/dL for family members of workers. BLL was associated with duration of work and percentage of work involving lead.	No health effects reported.
Molina-Ballesteros et al. [1980]	Mexico	Pottery	Cohort 198 Workers and their families 187 Controls and their families	Children aged < 9 years of exposed workers had a mean BLL of 81 μg/100g compared to control children of same age who had a mean BLL of 19.5 μg/100g.	No association between clinical symptomology and lead poisoning could be established because of socioeconomic conditions.
Morton et al. [1982]	Oklahoma, USA	Battery factory	Cohort 34 Exposed children (age < 7) 34 Age-matched neighborhood control children	Significantly different BLLs were found between groups $p<0.001$). BLL > 30 μg/dL (maximum 72 μg/dL) in 53% of exposed children versus 0% in controls. Statistically significant differences found in children's BLL between good and poor worker hygiene practices.	Used capillary sampling. No health effects reported.
Milar and Mushak [1982]	North Carolina, USA	Battery factory	Cohort 17 Exposed children (age < 5) 30 Control children (age < 5)	Average BLL of exposed children was 44 μg/dL and of control children, 18 μg/dL.	No health effects reported.
Ramakrishna et al. [1982]	Sri Lanka	Gold and silver recovery	Cohort 33 Members of exposed families 21 Neighborhood controls	Mean BLL in exposed families was 33 μg/dL versus 12 μg/dL in control families. Very high BLLs were found in two children aged 12 years (42 and 56 μg/dL).	The youngest child tested was 9 years old. No health effects reported.
Molina-Ballesteros et al. [1983]	Mexico	Pottery manufacturing	Cohort 153 Children (age 5-15) from pottery-making families 80 Control children from local schools	Exposed children had significantly higher mean BLL (39.5 μg/dL) than controls (24.8 μg/dL). Over 40% of exposed children had BLLs over 40 μg/dL compared to none of control children.	No cases of acute lead poisoning were found. Hemoglobin and hematocrits were within the lower limits of normal.

Table 7. (Continued) Health Effects of Take-Home Lead Exposure (Cohort Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Katagiri et al. [1983]	Japan	Pottery manufacturing	Cohort 89 3-yr olds from homes where pottery was made 70 3-yr olds from homes where parent works in pottery factory 947 3-yr olds from homes where no one works in pottery 768 3-yr old controls	Children in groups 1 and 2 had significantly higher urinary lead levels (15.8 and 13.6 μg/dL) compared to control children (10.6 μg/dL) and compared to their mothers (10.8 μg/dL).	Urine samples are questionable in evaluating lead exposure. δ-aminolevulinic acid in urine was not different between groups. Coproporphyrin in urine was slightly elevated in home pottery children.
Richter et al. [1985]	Israel	Battery factory	Cohort 18 Exposed children 729 Control children	Among exposed children > 10 years old, zinc protoporphyrin > 40 μg/dL was 4.1 times higher and among exposed children < 10, zinc protoporphyrin > 40 μg/dL was 2.9 times higher than controls.	No BLLs were measured. Elevated zinc protoporphyrin can also be influenced by iron deficiency. Other health effects not reported.
Piccinini et al. [1986]	Italy	Ceramic tile	Cohort 22 Children of tile workers exposed to lead 27 Children of tile workers not exposed to lead 24 Control children	Children in group 1 had a mean BLL of 13.5 μg/dL compared with group 2 mean of 12.2 and group 3 mean of 10.7. Hair lead levels for the 3 groups were 17.0, 9.8 and 7.8 respectively.	Used capillary sampling. No sex differences found. No health effects reported.
Kaye et al. [1987] CDC [1985]	Colorado, USA	Electrical components plant	Cohort 89 Exposed family members 62 Clinic controls	Exposed family members had significantly higher mean BLL (10.2 μg/dL) compared to unexposed (6.2 μg/dL).	No significant differences between groups in hemoglobin levels.
Abbritti et al. [1988]	Italy	Ceramic pottery factories	Cohort 136 Exposed children 199 Community children	Exposed children had higher mean BLL (10.7 μg/dL) compared to community children (9 μg/dL) ($p<0.05$).	Many of the pottery factories were home-operated. No differences found by age or sex of child. No health effects reported.
Wang et al. [1989]	Taiwan	Multiple	Cohort 105 Newborns of lead workers 102 Non-exposed newborns	Mean cord BLL of exposed newborns was significantly higher (8.8 μg/dL) than mean cord BLL of unexposed newborns (6.9 μg/dL). Birth weights and gestational age not effected.	Paternal contribution to cord BLL appears to be through either working at home (n=12 fathers) or bringing lead dust home and exposing mother.

Table 7. (Continued) Health Effects of Take-Home Lead Exposure (Cohort Series)

Author (year)	Location	Industry	Study Design	Results	Comments
Matte et al. [1989] Matte and Burr [1989]	Jamaica	Battery repair	Cohort 24 Exposed households (112 workers and family members) 18 Neighborhood control households (74 family members)	Geometric mean BLLs were significantly higher among exposed households compared to controls. 43% of exposed children aged < 12 years had BLL greater than 70 μg/dL.	These were "backyard" battery repair shops. No health effects reported.
CDC [1989a]	Jamaica	Battery repair	Cohort 17 Exposed households 18 Neighborhood controls	All exposed children aged 0-5 had BLLs $\geq$ 25 μg/dL.	No health effects reported.
Gittleman et al. [1994] Gittleman et al. [1991] CDC [1992b]	Alabama, USA	Battery reclamation	Cohort 16 Children and 11 adults of 11 workers 7 Neighborhood control families (5 children age 6-17, 11 adults)	Exposed children had higher mean BLLs (mean 22.4 μg/dL, max 42 μg/dL) compared to controls (9.8 μg/dL). 75% of workers' children had BLLs $\geq$ 10 μg/dL compared with 40% of control children. Adult family members of workers BLLs (mean 8.9 μg/dL, max 21 μg/dL).	No health effects reported.

Table 8. Health Effects of Take-Home Lead Exposure (Community Studies)

Author (year)	Location	Industry	Study Design	Results	Comments
Martin et al. [1974]	England	Lead factory	Community screening 39 Children < age 5 living within 400 m of factory 80 Children living 400-500 m from factory 252 Children at local schools	Of 4 children < age 5 with highest BLLs, 3 with levels of 75, 74, and 65 μg/mL were living close to factory and 2 of these had fathers working at factory. Five of 10 surveys in vicinity of other lead works found elevated BLLs in families of workers (no other data available).	No clinical symptoms of lead poisoning. Not clear whether these four were examined.
Landrigan and Baker [1981]	Texas, USA	Ore smelting	Community survey 3 Households in survey include smelter workers	No children in worker households had BLL ≥40 μg/dL.	No health effects reported.
Ewers et al. [1982]	Germany	Lead smelting	Community survey 302 Exposed children 86 Children in control area	Children of lead workers had higher BLLs than other children (geometric mean = 19.7 vs. 14.2 μg/dL; $p < .05$). Higher tooth lead levels were associated with father's occupational exposure to lead.	Capillary sampling; blood samples were collected from only a sample of children (n=83). No health effects reported.
Carvalho et al. [1984]	Brazil	Lead smelting	Community survey 104 Children (age 1-9) of lead workers 357 Children (age 1-9) of non-lead workers	Exposed children had a significantly higher mean BLL (67.5 μg/dL) than unexposed children (56.6 μg/dL). Variation in hemoglobin levels was not associated with BLLs.	Results originally reported in an unpublished thesis by Carvalho (1982).
Chenard et al. [1987]	Canada	Copper smelting	Community survey 128 Children Group 1 (35) exposed through residence and father's work Group 2 (63) exposed through residence only Group 3 (30) exposed through father's work only 189 control children from nearby community	All exposed children had significantly higher BLLs than control children. BLL ratios of exposed groups 1, 2, and 3 to non-exposed were 1.83, 1.79, and 1.23 respectively. All BLLs in workers' children < 30 μg/dL.	Additional sources of lead exposure such as hobbies and home assessment not measured. Free erythrocyte protoporphyrin is not significantly different between exposed and control.
Brockhaus et al. [1988]	Germany	Lead smelter	Community survey 9 Children of lead workers (age 4-5) 195 Control children (age 4-5)	Children of lead workers had significantly higher mean BLL (18.4 μg/dL) than controls (10.4 μg/dL).	No health effects reported.

Table 8. (Continued) Health Effects of Take-Home Lead Exposure (Community Studies)

Author (year)	Location	Industry	Study Design	Results	Comments
Silvany-Neto et al. [1989]	Brazil	Lead smelting	Community surveys 1980 Survey 131 Children of lead workers 457 Community children 1985 Survey 108 Children of lead workers 142 Community children	Children of lead workers had a significantly higher mean ZPP level than controls both in the 1980 survey (35.4 vs. 24.9 μg/dL) and in the 1985 survey (26.3 vs. 22.8 μg/dL).	Other health effects in workers children not presented.
Maravelias et al. [1989]	Greece	Lead smelting	Community survey 514 Children living in smelting town	The mean BLL for the children of unskilled workers (many of whom worked at the smelter) was 23.3 μg/dL. This was significantly higher than the mean BLL of children of other workers.	No health effects reported.
Hoffstetter et al. [1990]	Germany	Lead and other metal smelting	Community screening 229 Children ages 6-7	Mean BLL 6.3 μg/dL (range 2.6-15.5 μg/dL). Factors significantly associated with higher BLL were: living in urban area, second-hand smoke, living in a family of foreigners or with a lead worker.	BLLs significantly lower in 1989 than in previous test years (back to 1974). No health effects reported.
ATSDR [1991a]	Pennsylvania, USA	Lead plant	Community survey 736 Study participants	Children (age 0-5) whose parents had a job with "definite" lead exposure had a mean BLL of 12.7 μg/dL compared with children whose parents were unexposed (9.0 μg/dL).	Poor response rate (27.7%); numbers very small; no results statistically significant. Erythrocyte protoporphyrin levels for workers' family not reported separately.
Miesen [1991]	Germany	Metallurgical plant	Community screening 491 Exposed (19 children < age 6)	Of schoolchildren living with lead-exposed family members, 16.7% had BLLs over 25 μg/dL.	No effects on red blood cells, hemoglobin, hemotocrit and porphyrin.
Lyngbye et al. [1991]	Denmark	Multiple lead industries	Community survey 101 First grade children with high dentine lead concentrations (above 18.7 μg/g). 99 Control children with low dental lead (below 5 μg/g).	A positive association (4-fold relative risk) was found between dental lead and parental employment as a shipyard worker, welder, auto mechanic or car painter.	Only half of eligible children contributed a tooth for analysis. No health effects reported.

Table 8. (Continued) Health Effects of Take-Home Lead Exposure (Community Studies)

Author (year)	Location	Industry	Study Design	Results	Comments
Schuhmacher et al. [1991]	Spain	Multiple lead industries	Community survey 478 Exposed children	Mean hair lead for children whose fathers worked in lead-related occupations was 12.7 μg/g compared to 8.4 μg/g among children of workers not in lead occupations.	No data on blood lead levels. No health effects reported.
Cook et al. [1993]	Colorado, USA	Smelting and mining	Community screening 150 Children < age 6	Mean BLL 10.1 μg/dL (range 0.5-30.1 μg/dL). Parental occupation as a miner was an independent predictor of BLL.	No health effects reported.