

Table 18. Regulations of Federal Agencies Relevant to Workers' Family Protection

RULE/CFR NO.	AGENCY	DESCRIPTION OF RELEVANT ELEMENTS
<p><b>Inorganic arsenic</b>                      [29 CFR 1910.1000] (general industry)                      [29 CFR 1915.1018] (shipyards)                      [29 CFR 1926.1118] (construction)</p>	<p>OSHA</p>	<p>The PEL is 10 <math>\mu\text{g}/\text{m}^3</math> as an 8-hr. average. Where employees work in areas where exposure concentrations exceed 10 <math>\mu\text{g}/\text{m}^3</math> or where the possibility of skin or eye irritation from inorganic arsenic exists, the employer must provide clean protective work clothing weekly (daily if exposure levels exceed 100 <math>\mu\text{g}/\text{m}^3</math>). Protective clothing must be removed in change rooms and placed in a closed container prior to removal for cleaning, laundering or disposal. The container must be labeled and the launderer informed of the hazards. When exposures exceed 10 <math>\mu\text{g}/\text{m}^3</math>, the employer must provide showers and separate storage facilities for street and work clothes.</p>
<p><b>Asbestos</b>                      [29 CFR 1910.1001] (general industry)</p> <p>[29 CFR 1915.1001] (shipyards)                      [29 CFR 1926.1101] (construction)</p>	<p>OSHA</p>	<p>PEL is 0.1 fiber/cc as an 8-hr. average. Excursion Limit (EL) is 1 fiber/cc as a 30-min. average. Where employees are exposed above these limits, or where the possibility of eye irritation exists, the employer must provide, and ensure: that the employee wears appropriate protective work clothing; that contaminated clothing is removed only in change rooms; that no employee takes contaminated work clothing out of the change room (except those authorized to do so for purposes of laundry, maintenance and disposal); that containers for contaminated clothing are labeled; that laundering is done in a way that will minimize release of fibers to the air; that the launderer be informed of the hazards; and that contaminated clothing be transported in sealed containers. The employer must provide facilities to assure that street clothes do not become contaminated if the employees' exposures exceed the PEL, that such employees shower at the end of the work shift and that they do not leave the workplace with any clothing or equipment worn during the work shift.</p> <p>In addition to the requirements for general industry, clothes of workers who work in certain regulated areas where the decontamination area and the shower cannot be located next to the regulated area, must be vacuumed with a HEPA vacuum cleaner before proceeding to the shower, or the employee must remove contaminated clothing in the equipment room and don clean work suits before proceeding to the shower. For other regulated areas, work clothing must be vacuumed before it is removed, but showering is not required.</p>
<p><b>Cadmium</b>                      [29 CFR 1910.1027] (general industry)                      [29 CFR 1915.1027] (shipyards)                      [29 CFR 1926.1127] (construction)</p>	<p>OSHA</p>	<p>The PEL is 5 <math>\mu\text{g}/\text{m}^3</math> as an 8-hr. average. If an employee is exposed above the PEL or where skin or eye irritation is associated with cadmium at any level, the employer must provide clothing and equipment that prevents contamination of the employee and the employee's garments. Contaminated clothing must be removed at the end of the work shift in change rooms which have separate storage facilities for street clothes and work clothes. The facilities must be designed to prevent contamination of the street clothes. The employer must assure that employees exposed above the PEL shower during the end of the work shift. The employer must assure that no employee takes contaminated protective clothing from the workplace, except when authorized to do so for laundry, cleaning, maintenance or disposal at an appropriate location or facility. Contaminated clothing must be stored in a closed container, and labeled. Launderers and cleaners must be informed of hazards.</p>
<p><b>Hazard Communication</b>                      [29 CFR 1910.1200] (general industry)                      [29 CFR 1915.1200] (shipyards)                      [29 CFR 1926.59] (construction)</p>	<p>OSHA</p>	<p>These standards have elements that could be used for preventing workers' home contamination. These elements include: the written hazard communication which employers must prepare; the requirements that all containers of hazardous chemicals be labeled; the requirement for preparation of material safety data sheets containing information on applicable precautions for safe handling and use, including appropriate hygiene practices, work practices, or personal protective equipment; the requirement for employee information and training.</p>
<p><b>Hazardous Waste Operations and Emergency Response</b>                      [29 CFR 1910.120] (general industry)                      [29 CFR 1926.65] (construction)</p>	<p>OSHA</p>	<p>These standards require a written safety and health program for employees involved in hazardous waste operations. Among the requirements are: use of appropriate protective equipment for each hazardous waste site; appropriate decontamination of all employees and contaminated clothing and equipment before leaving the area; location of the decontamination procedures to minimize cross-contamination; removal of protective clothing or equipment from the site only by authorized employees; advising laundries and cleaning establishments of the hazards of contaminated clothing; and provision of showers and change rooms outside of the contaminated area, when the need is indicated.</p>

Table 18. (Continued) Regulations of Federal Agencies Relevant to Workers' Family Protection

RULE/CFR NO.	AGENCY	DESCRIPTION OF RELEVANT ELEMENTS
<p><b>Lead</b>                      [29 CFR 1910.1025] (general industry)                      [29 CFR 1915.1025] (shipyards)</p> <p>[29 CFR 1926.62] (construction)</p>	OSHA	<p>The PEL is <math>50 \mu\text{g}/\text{m}^3</math> as an 8-hr. average. Where employees are exposed above <math>50 \mu\text{g}/\text{m}^3</math> the employer must: provide clean protective clothing at least weekly (daily if exposures exceed <math>200 \mu\text{g}/\text{m}^3</math>); provide clean change rooms equipped with separate storage facilities for work and street clothes which prevent cross-contamination; provide showers and ensure that employees shower at the end of the work shift; and ensure that employees required to shower do not leave the workplace wearing any clothing or equipment worn during the work shift. Appendix B to these standards advises the worker of the benefits imparted to the family by these requirements.</p> <p>In addition to the requirements for general industry and shipyards, for many construction operations, until the employer has demonstrated that exposures are not above the PEL (<math>50 \mu\text{g}/\text{m}^3</math>), the employer must provide the protective clothing and showering requirements discussed above for general industry and shipyards.</p>
<p><b>Mandatory Health Standards - Surface Coal Mines and Surface Work Areas of Underground Coal Mines</b>                      [30 CFR 71.400-71.404]</p>	MSHA	<p>Requires each operator of a surface coal mine to provide bathing facilities and clothing change rooms in a convenient location with individual storage container or lockers for miners' clothing during and between shifts.</p>
<p><b>Mandatory Safety Standards - Underground Coal Mines</b>                      [30 CFR 75.1712]</p>	MSHA	<p>Requires each operator of an underground coal mine to provide bathing facilities (showers with both hot and cold water) and change rooms with individual storage containers or lockers and sufficient room to permit the use of the facilities by all miners changing clothes prior to and after each shift.</p>
<p><b>Labeling Requirements for Pesticides and Devices</b>                      [40 CFR 156.10]                      [40 CFR 156.20]</p>	EPA	<p>Among the several requirements for labels are: a child hazard warning "keep out of reach of children" must appear on every pesticide product label, with few exceptions; clearly stated directions for use, including worker protection statements required by the worker protection standard; specific directions for storage and disposal of the pesticide and its container. Worker protection statements required on pesticide labels for products to be used in the production of agricultural plants on any agricultural establishment include statements on: restricted entry; worker notification; and personal protective equipment.</p>
<p><b>Packaging Requirements for Pesticides and Devices</b>                      [40 CFR 157]</p>	EPA	<p>This rule requires child-resistant packaging for pesticide products and devices, however a product restricted to use by or under the supervision of a certified applicator is exempt from this requirement unless EPA determines that the product poses a risk of serious accidental injury or illness which child-resistant packaging would reduce. Certain products packaged in large-sized containers are also exempt unless EPA determines that it is to be sold to homeowners or other members of the general public.</p>
<p><b>Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticide Containers</b>                      [40 CFR 165]</p>	EPA	<p>Procedures for storage and disposal of pesticides and pesticide containers are recommended, but are mandatory only for EPA in carrying out its disposal and storage operations. Recommendations for disposal of small quantities include rinsing empty containers three times, adding the rinse liquids to spray mixtures in the field, burning, where permissible, in open fields, or buried singly in open fields by the user.</p>

Table 18. (Continued) Regulations of Federal Agencies Relevant to Workers' Family Protection

RULE/CFR NO.	AGENCY	DESCRIPTION OF RELEVANT ELEMENTS
<b>Worker Protection Standard</b> [40 CFR 170]	EPA	This standard generally applies to the use of pesticides on agricultural establishments for the production of plants for commercial purposes. The owners of agricultural establishments need not assure that the protective measures are provided to themselves and members of their immediate family while they are performing tasks related to production of agricultural plants on their own agricultural establishment, although they are encouraged to do so. The standard delineates restrictions on entering areas treated with pesticides; defines protective clothing, and its use and decontamination; storage requirements for clean protective clothing; a requirement that contaminated clothing be stored and washed separately from other clothing or laundry; a requirement that persons cleaning or laundering protective clothing be informed of the contamination and correct ways to handle and clean it; a requirement that all clean personal protective equipment be stored separately from personal clothing and apart from contaminated areas. The agricultural employer must not allow or direct any worker to wear home or take home personal protective equipment contaminated with pesticides.
<b>Certification of Pesticide Applicators</b> [40 CFR 171]	EPA	This standard generally requires that applicators be competent in the use and handling of pesticides they use, that they can read and understand the label and instructions for use, storage, and disposal of the pesticides and containers.
<b>National Oil and Hazardous Substances Pollution Contingency Plan</b> [40 CFR 300]	EPA	The purpose of the plan is to provide organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, and contaminants. The plan defines size classes of releases, includes the National Priorities List of hazardous waste sites, provides for worker protection in responding to releases and working at hazardous waste sites, and community right-to-know provisions.
<b>Designation, Reportable Quantities, and Notification</b> [40 CFR 302]	EPA	Lists hazardous substances and their reportable release quantities.
<b>Worker Protection</b> [40 CFR 311]	EPA	Applies 29 CFR 1910.120 to State and local government employees engaged in hazardous waste operations in States that do not have an OSHA approved State occupational safety and health plan.
<b>Asbestos</b> [40 CFR 763]	EPA	Extends worker protection of the OSHA asbestos standard for construction to employees of local education agencies who perform operations, maintenance repair activities involving Asbestos-Containing Materials (ACM). Extends construction standard to employees of State and local governments not covered by OSHA, an approved OSHA State plan, or State asbestos regulation which EPA determines is comparable to or more protective than this standard (40 CFR 763). Appendix C to Subpart E (Asbestos-Containing Materials in Schools) entitled "Asbestos Model Accreditation Plan for States" requires asbestos workers training to include information on "potential exposures, such as family exposures."

Table 19. Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
<p>Occupational Safety and Health Administration (OSHA) Austin, Texas [Nicholas 1994; Natarajan 1994]</p> <p>OSHA Wichita, Kansas [Goldberg 1994]</p> <p>OSHA Hawaii [Goo 1994]</p> <p>OSHA Chicago, Illinois (regional office) [Wiehrdt 1994]</p>	<p>The OSHA office in Austin, Texas investigated a referral from the Texas State Health Department concerning a child with a high BLL. The father's BLL was also high and his workplace had high lead levels. OSHA did not inspect the home but made recommendations to prevent further contamination. The State has a hazard training standard where employers must inform employees of hazardous substances. See Natarajan [1994] in Table 9 for details.</p> <p>The OSHA office of Wichita, Kansas had no data on home contamination and stated that its jurisdiction is the workplace only. However, based on feedback from chemical workers, home contamination was a common occurrence. Where applicable, the OSHA standards requiring showers, protective clothing, and employee training are used to prevent home contamination.</p> <p>The author pointed out that there are no provisions to ensure that contamination is removed from a worker's clothing if an over exposure cannot be proven.</p> <p>The health department in Kankakee, Illinois referred a case of home contamination to OSHA. Resulting in an OSHA inspection of the father's workplace. In another case the Indiana OSHA referred a case of home contamination to a Marion County health agency which then found an elevated BLL in a child. Yet in another case the Cleveland area OSHA office discovered during a workplace inspection some of the employees' children had elevated BLLs. OSHA made measurements of home contamination and referred the case to the Ohio Department of Health. See Wiehrdt [1994] in Tables 9 and 15.</p>
<p>Mine Safety and Health Administration (MSHA)</p> <p>Zalesak [1994]</p>	<p>MSHA submitted two reports of workers' home contamination by mercury.</p>
<p>Department of the Interior [Heine 1994]</p>	<p>Reported that home contamination has not been a problem at the National Fisheries Contamination Research Center. Personal protective equipment is used and Center has hygiene plan.</p>
<p>Department of Energy [Boyle 1994]</p>	<p>Sixteen reports of cases including 3 incidents of home contamination were extracted from DOE's Occurrence Reporting and Processing System (ORPS) reporting system for review by NIOSH. The Department takes follow-up action such as major revisions in facility decontamination procedures.</p>
<p>Nuclear Regulatory Commission [Brockman 1993]</p>	<p>NRC has two databases, one for reactor related events and the other for non-reactor related events. A NRC search of these two databases found 34 incidents of off-site contamination in the reactor related file of which several had potential for worker home contamination. In the non-reactor events database they found 80 off-site contamination events of which 6 had potential for worker home contamination.</p>

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
<p>Agency for Toxic Substances and Disease Registry (ATSDR)</p>	
<p>[Alabama Department of Public Health 1991]</p>	<p>The Alabama Department of Health conducted an exposure study of children living near a lead reclamation factory in Alabama. Although the investigators recognized the potential for workers' home contamination, households of employees of the factory did not participate. Possible reasons for non-participation are discussed in the report.</p>
<p>ATSDR [1989b]</p>	<p>A study in Michigan to determine the extent of trackout from the workplace was reported of the homes of workers exposed to MOCA while manufacturing plastics. See ATSDR [1989b] in Tables 12 and 15.</p>
<p>ATSDR [1990a]</p>	<p>ATSDR and EPA acting under CERCLA provided technical assistance to the Tennessee Department of Health investigating contamination of workers' homes with mercury and subsequent decontamination. See ATSDR [1990a] in Tables 13 and 15.</p>
<p>ATSDR [1993a]</p>	<p>In this study of a North Carolina hazardous waste incinerator, EPA conducted site evaluations, NIOSH conducted neurotoxicity studies on workers, and ATSDR studied the health of area residents. ATSDR was to do study of workers' families and homes, but was unable to get sufficient volunteers.</p>
<p>ATSDR [1991a]</p>	<p>In this Philadelphia neighborhood lead study, exposure of children was evaluated; children of lead workers were included. See ATSDR [1991a] in Table 8.</p>
<p>ATSDR [1989a; 1990b; 1993b]</p>	<p>Anderson Development Company, Adrian, Michigan manufactured MOCA. Detectable levels of MOCA were found in urine of workers' families. Professional cleaning of homes was reported (carpets, baseboards, hard covered floors) after lab tests (dryer lint, furnace filters, vacuum bags, urine of family members) showed home contamination. Currently conducting a study for bladder cancer of workers and workers' families. See also ATSDR [1989a, 1990b] in Table 12.</p>
<p>ATSDR [1991b]</p>	<p>At the Bofors - Nobel, Inc. chemical manufacturing site in Michigan. 3,3'-Dichlorobenzidene was found in homes of some workers (vacuum cleaner bags) and in the urine of some workers and family members. See ATSDR [1991b] in Tables 12 and 15.</p>

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
Environmental Protection Agency (EPA)	
ERM-Southeast, Inc. [1989]	This report contains a protocol developed by an EPA contractor for monitoring and cleaning homes contaminated with mercury.
Beegle and Forslund [1990]	This report contains a protocol for cleaning homes contaminated with lead and asbestos.
Fisher [1991]	In this text of EPA answers to follow-up questions from the Senate hearing on Lead in the Environment, EPA's recognition of home contamination with lead from the workplace as a serious problem is stated. EPA is working cooperatively with OSHA and Labor groups to develop a research agenda for this tissue. Although EPA's role is to identify research to minimize home exposure, EPA does not generally respond to specific home contamination incidents.
Ramsey [1987]	In this report of a Superfund site in Missouri, complete removal of dioxin contaminated soil and materials around homes and clean-up of home interiors is described.
Hess [1988]	In this report of a Missouri Superfund site, removal and replacement of dioxin contaminated roads and decontamination of houses and businesses is described. See Hess [1988] in Table 15.
MacDonald [1988]	In this report of a Missouri Superfund site, cleanup of mobile home park, including decontamination of mobile homes, contaminated with dioxin is described.
Price and Welch [1972]	In this report on EPA supported testing of human adipose tissue samples for PCBs, the authors also reported on PCBs in the house dust of workers homes. See Table 15.
Doherty [1984]	In this report of a Missouri Superfund site, removal and replacement of a dioxin-contaminated roadway and decontamination of houses is described. See Table 15.

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
Centers for Disease Control and Prevention (CDC)	
NIOSH [1971]	A series of tests were conducted on a woman's coat containing asbestos (8%) to determine magnitude of exposure associated with wearing, brushing, or cleaning the coat. Found transfer to companion clothing during laundry.
Donaldson and Johnson [1972]	Survey of Diamond Shamrock Company in Redwood City, California, to determine exposure of workers to bis (chlordimethyl) ether. The employees paid half the cost of the work clothes and although the company paid for laundering, they could take their work clothes home.
Lemen [1972]	Proctor and Gamble in Blue Ash, Ohio. This was a study of asbestos exposure in workers involved in spraying fireproof insulation at new building site. Workers were covered with insulation material, did not have respirators, and took clothing home at end of day. Recommended supply of respirators and clothing and laundry by contractor.
Marceleno et al.[1974]	Grace Bleachery, Lancaster, North Carolina (textile facility). This was a study to determine the presence and extent of exposure to bis-chloromethyl ether. Workers did not shower or change work clothes before leaving for home and were seen eating in production areas at work.
Finklea [1976]	Testimony of John F. Finklea to Congress. RE: exposure to kepone at Life Science Products plant in Virginia. Found that Kepone contaminated work clothes were often worn home.
Wagoner [1976]	Joseph K. Wagoner's testimony to the subcommittee of House committee on Interstate and Foreign Commerce pointed out that wives, children, and relatives of asbestos workers have died from disease related to asbestos exposure from worker's clothing brought home.
Bierbaum [1993]	NIOSH participated in an incident of diethylstilbestrol poisoning in farm children.
Todd and Timbie [1979]	Survey of wood preservative treatment facility (Creosote) at Koppers Company, Inc., Florence, South Carolina. Some employees had work uniforms, but others brought work clothing from home. Most employees changed clothes before leaving work, but not all employees showered, although shower facilities were provided.
Belanger et al. [1979]	Kentile Floors, Inc. in Chicago, Illinois. Investigation of worker exposure to asbestos and other chemicals. Manufacturer of vinyl floors and and asbestos floor covering. Workers required to wear coveralls, respirators, and safety shoes, and can shower, but not required to do so.
Landrigan et al. [1980]	Published paper of stained glass workers - hobbyist, professionals and families, BLLs were related to lead in workplaces and workers' homes. Recommended that contaminated work clothes not be worn home and be laundered separately.
Apol and Singal [1980]	Alaskan Battery Enterprises, Fairbanks, Alaska. Evaluated lead exposure among workers manufacturing lead-acid storage batteries. Looked at worker BLLs. Owner and family lived above the plant and 4 employees were children. Home entered through hallway that opened into plant. Recommended shower and change room, good housekeeping and redesign of entry to house.

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
Bridbord [1980]	Book Chapter - Lead exposure. The author points out that lead adversely affects sperm, and the fetus; that lead can be brought home as dust on shoes, clothing, and body; and that elevated blood levels have been found in children of workers exposed to lead (e.g. battery manufacturing).
Clapp et al. [1985]	Steinmetz & Sons, Moscow, Pennsylvania. Workers in this factory were exposed to MOCA. It was recommended that workers get clothing from company that is laundered daily and not worn home, use shoe covers, and shower before leaving work.
Aw et al. [1985]	Manufacturing Chemists, Inc., Indiana. An animal growth promoter (estrogenic) was found in worker's clothing which were laundered at home. Extensive recommendations were made to prevent home contamination.
Seixas and Ordín [1986]	Friction Division Products, Trenton, New Jersey. In this plant in which auto and truck brake shoes were manufactured, samples from workers' clothing as they left the plant showed asbestos, raising potential for home contamination.
Eisenbud and Lisson [1983]	Update of Beryllium cases - Up to 1983 no new cases of berylliosis had been reported since 1950.
Placitelli and Rice [1993]	Measured lead levels in radiator repair shop workers' clothes, and vehicles.
CDC [1992a]	CDC's MMWR report on lead exposures among lead burners. Wipe samples were taken from changing room, toe of workboot, and floor under auto gas pedal. BLLs of family members of 2 workers were measured. The company implemented additional hygiene practices.
Knishkowsky and Baker [1986]	Journal article. Contamination routes between work and home, types of illnesses that resulted, and preventive measures are discussed.
Hartle et al. [1987]	Aluminum Company of America, Lafayette, Indiana. Investigation of exposure to PCBs. It was recommended that exposed personnel be provided with protective equipment, including company-laundered coveralls, change rooms, and showers.
Ehrenberg et al. [1986]	Staco, Inc., Poultney, Vermont. Thermometer manufacturing plant. NIOSH trailer where tests were given became contaminated with mercury, suggesting possible home contamination.
Godbey et al. [1987]	Evaluation of brake drum service controls at Postal Service in Nashville, Tennessee. Some workers took asbestos-soiled clothes home to wash. Only 1/4 of workers used shower facilities regularly, and 2/8 did not change out of work clothes before going home. Recommended education about personal hygiene.
Gunter et al. [1987]	Bondar-Clegg, Lakewood, Colorado & Spark's, Nevada. Lead exposure in five-assay labs. Recommended showering and changing clothes and shoes before leaving work.



Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
Hartle [1987]	This was a joint request to NIOSH from EPA and ATSDR for technical assistance in connection with a PCB contaminated Amtrak railyard. NIOSH recommendations to prevent contamination of workers' cars and homes included shoe covers, personal protective equipment, and leaving tools onsite.
Driscoll and Elliott [1990]	Chrysler Chemical Division, Trenton, Maine. Exposure to asbestos, solvents and lead. Found asbestos contamination of workers' clothing, autos, and on workers leaving for home. Recommended change facilities, showers, and company provision of work clothing.
Matte and Burr [1989]	Jamaican Ministry of Health, Kingston, Jamaica. Backyard battery repair shop - measured lead in houses and blood levels of family members. Found significant contamination and recommended that there should be separate entrances for shops and houses, that dust in workplaces be controlled, that work clothing, laundry facilities, and showers be provided.
Gittleman et al. [1991]	G.T. Jones Tire and Battery Distributing, Inc., Birmingham, Alabama. Lead exposure from battery recycling. Took samples from workers' autos. Found lead in autos, which was not consistent with reports that most of workforce showered before leaving and maintained good hand-washing hygiene. Observed that only 20% of workers showered before leaving work and 1/3 did not change work clothes at end of day. Recommended good personal hygiene (showers, clothing changes, hand-washing).
Venable et al. [1993]	Boston Edison Company, Boston, Massachusetts. Work in underground utility vaults. Wipe samples for lead from work surfaces, service vehicles, employee clothing, and hands. Recommended hand-washing procedures, showering, and changing into non-contaminated clothing at the end of day.
McCammon et al. [1991]	New England Lead Burning Company, Salt Lake City, Utah. Wipe samples showed contaminated clothing, shoes (which wore home) and lead in workers' cars. Opportunity for lead exposure probably increased by lack of showering and practice of wearing work clothes home. Made recommendation to prevent home contamination.
Donovan [1994a,b]	Kessler Studios, Loveland, Ohio. Home-based stained glass window studio. Did not appear that lead was migrating into house - results indicated that ventilation and hygiene practices employed by the artists minimize their exposure and the contamination of their house with lead.
Kominsky and Singal [1987]	Firefighters in Groveport, Ohio. PCB contamination. Recommended disposable protective clothing to ultimately reduce problems of decontaminating equipment.
Kominsky [1984c]	Fabric samples from protective clothing of 3 firefighters were analyzed for malathion and diazinon. Laundry decontamination procedures were recommended.
Kominsky [1984b]	PCB contaminated firefighters clothes - Decontamination procedures for clothing were insufficient.
Seligman [1984]	Follow-up. Evaluated health complaints of firefighters.
Kominsky [1987b]	Close out in 1987. Restated contents of previous 2 memos.
Kominsky [1984a]	Measured PCB concentrations in firefighters' clothing worn at a fire. Clothing was replaced.
Orris and Kominsky [1984]	Maplewood, Minnesota. PCBs in high school. Made recommendation about laundering clothing to remove PCBs.
Kominsky [1987a]	Jacksonville, Florida. Firefighter suits contaminated with PCBs from fire at transformer oil reclamation facility. Recommendations made for decontaminating garments, based on study of two different laundry methods.
Kiefer [1994]	Atlanta, Georgia. Lead abatement recommendations for renovation of antique building-concern for workers and for occupants of house.

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
Other CDC Centers Baker et al. [1977]	A joint study by CDC, the Tennessee Department of Public Health, and the Memphis-Shelby County Health Department of a lead smelter in Memphis, Tennessee found workers' houses had significantly higher concentrations of lead dust than controls. Children's BLLs were significantly higher than control children's and correlated with the concentrations of lead in dust.
Baker et al. [1980]	PCBs in sewage sludge. Serum PCB levels were higher in worker's families than in other community residents.
Cannon et al. [1978]	Joint study by CDC and EPA, Virginia State Department of Health and NIOSH of Kepone poisoning in wives of kepone workers. It is stated that the kepone episode has stimulated the development of an active, OSHA-approved occupational safety and health plan and has stimulated the passage through the State Legislature of the Virginia Toxic Substances Information Act.
Dolcourt et al. [1981]	Joint study by CDC, North Carolina Department of Human Resources, and Cabarrus County Health Department of auto battery recycling. Two families in cottage industries had high BLLs.
Dolcourt et al. [1978]	Joint study by CDC and the Wake County Health Department of lead poisoning in children of battery workers. Dust samples were collected in homes and BLLs of children were determined. Carpeting, clothes, and closets showed especially large amounts of contamination. Took measurements to reduce workers' exposure and home contamination and to decontaminate homes. Molar and Mushak [1982] studied decontamination of these homes of in a study supported by NIEHS Grants.
Falk et al. [1981]	Girl with angiosarcoma was exposed to arsenic in soil, water, and dust on father's work clothes and boots. NCI and NIEHS were also involved in this study.
Kaye et al. [1987]	Study of family members of workers exposed to lead. Children and family members had elevated BLLs compared to a non-exposed group. Lead levels from dust samples were significantly higher in workers' homes.
Landrigan [1976]	In this review of lead exposure in children, workers' home contamination is cited as a source of exposure.
Landrigan and Baker [1981]	In a study of children exposed to heavy metals from smelters, a relation between house dust levels and BLLs of children was found in El Paso, Texas.
Matte et al. [1991]	Several Centers and NIOSH studied household dust and soil around houses and BLL contamination in households near both conventional and cottage lead smelters. Significant increase in BLLs in children and residents near cottage smelters were found.
Matte et al. [1989]	Study of battery repair shops in Jamaica. Also reported in [CDC 1989a].
Novotny et al. [1987]	Joint study by CDC and the Colorado Department of Health of employees of a firing range and their wives.
Watson et al. [1978]	This joint study by CDC, EPA, and the Vermont State Health Department found elevated BLLs of children of workers manufacturing lead storage batteries. Even though workers showered and changed clothes at work, clothes were washed at home.
Wolfe et al. [1961]	Recommended that if discarded pesticide drums can't be destroyed, they should be rinsed with water at least twice, so as to be less likely to have toxic residues that can affect children. Also made recommendations for decontamination of pesticide applicators' clothing.

Table 19. (Continued) Federal Agency Involvement in Incidents of Workers' Home Contamination and Related Activities

FEDERAL AGENCY	RESPONSE
<p>U.S. Air Force U.S. Atomic Energy Commission and U.S. Weather Bureau</p> <p>Eisenbud et al. [1949]</p>	<p>Non-occupational Beryllium poisoning. Measured concentrations of beryllium generated during laundry, folding of clothes, etc.</p>
<p>U.S. Atomic Energy Commission</p> <p>Stern &amp; Eisenbud [1951]</p>	<p>Epidemiology of Beryllium intoxication. The literature on concentrations of beryllium related to development of diseases was reviewed, and related to "hygiene" measures. Exposure levels for workers, and for air in vicinity of beryllium plant and recommended laundering of workers' clothing to prevent contamination of workers' homes.</p>

Table 20. How State Agencies Respond to Incidents of Workers' Home Contamination - States that Have Their Own OSHA Program

STATE	AGENCY	INFORMATION PROVIDED TO NIOSH
Alaska	Department of Environmental Conservation	The Department reported that it does not evaluate contaminated homes of workers [Ballentine 1994].
	Department of Labor	The Department reported that it has no jurisdiction to inspect homes and has no tracking mechanism [Study 1994].
Arizona	Department of Health	The Department reported cases of childhood lead poisoning where take-home lead was probably the cause. The State has a blood lead reporting law which also covers pesticides. The Department had no referrals from the State OSHA for take-home cases. Childhood pesticide exposure from workers storing pesticides in beverage bottles had occurred; the Arizona Department of Agriculture now includes training on storing pesticides. The Department of Health also submitted a case study of home extraction of gold with mercury, and provided a detailed description of its occupational lead poisoning program [Fowler 1994a,b; Hatch 1990].
California	Department of Health Services	The California Department of Health reported that it has a surveillance system for BLLs. This information is collected from all clinical labs for children under 16. Notification letters are sent to local health departments where children with high BLLs are found. Forms for case management follow-up include information on potential take-home exposures. Local health departments are notified to investigate take-home exposures. Of cases with elevated BLLs, 10% had a potential take-home cause. Case studies were submitted to NIOSH. The Department also reported that California law requires physicians to report pesticide-related illnesses to the Pesticide Illness Surveillance Program by notifying local health departments. One report was submitted to NIOSH on childhood exposure to pesticides where farmworker children had elevated exposures. Recommendations are made for changing, storing, and laundering contaminated clothing [Osorio 1994].
	Environmental Protection Agency	The Department of Pesticide Regulation provided a report on childhood poisoning by pesticides [Griffin and O'Malley 1992].
Connecticut	Department of Public Health and Addiction Services	The Connecticut Department of Health investigated one case of possible contamination of worker's home by lead carried home - two children were exposed [Jung 1994].
Indiana	Department of Health	The Indiana Department of Health reported that it has no laws or rules on contamination of workers' homes, but were aware of a report [Baker et al. 1980] on a study conducted by CDC of persons in Indiana exposed to PCBs from contaminated sewage sludge [Ruyack 1994; Steele 1994].
	Department of Labor	The Department found one case of lead poisoning in a child whose father was exposed to lead. The company provided for washing the worker's car and socks [Molovich 1991].
Iowa	Department of Employment Services	The Department reported that the Bureau of Labor had investigated a plant where exposures to lead exceeded the standard and one child was identified with lead poisoning [Hooper 1991].
Kentucky	Department of Health Services	The Department of Health reported that it has no formal reporting system for home contamination incidents, they are handled on a case-by-case basis [Auslander 1994].
	Labor Cabinet	The Agency reported that it has no rules, regulations, or reports related to contamination of workers' homes [Palmore 1984].
Maryland	Department of the Environment	The Department has investigated cases of lead exposure of children and provided NIOSH with copies of the case reports. Maryland has a childhood lead registry and an adult lead registry which report overlapping cases to each other (cross-matches) [de Silva 1994]. See also: Table 9.

Table 20. (Continued) How State Agencies Respond to Incidents of Workers' Home Contamination – States that Have Their Own OSHA Program

STATE	AGENCY	INFORMATION PROVIDED TO NIOSH
Michigan	Department of Natural Resources	The Department reported that the Michigan Environmental Response Act has a section dealing with identification, priority evaluations, and remediation of environmental sites of contamination. The Department has no information about workers transporting chemicals to homes [Oakwood 1994].
New York	Department of Environmental Conservation	The Department reported that it follows OSHA regulations and provides protective equipment for workers. It was not aware of any take-home exposure cases [Edouard 1994].
	Department of Health	The Department of health reported that it has studied exposures resulting from dry cleaning - occupationally exposed nursing mothers and other populations [London 1994; Schreiber et al. 1993; Stasiuk 1993].
	Department of Labor	The Department of Labor reported that it has not conducted any investigations involving contamination in workers' homes [Colavito 1994].
Oregon	Department of Health	The Department of Health reported that it maintains surveillance programs for blood lead and pesticide exposure. Information on workers' contamination of homes, such as two case histories submitted to NIOSH can be obtained from these sources. There are no Oregon rules or laws dealing specifically with home contamination [Barnett 1994].
	Department of Labor	The Department reported that Oregon OSHA has many regulations that help to prevent home contamination via work practice controls and work hygiene [Schuster 1994].
Puerto Rico	Department of Labor and Human Resources	Puerto Rico reported that it has no reports or regulations on home contamination [Valdes 1994].
Utah	Department of Health	The Department of Health submitted a report of a study to NIOSH about a take-home incident among lead burners conducted by the Utah Department of Health and NIOSH [Beaudoin 1994; CDC 1992a].
Virginia	Department of Labor and Industry	The Virginia OSHA identified 3 cases of workers' home contamination by lead and submitted summaries of the inspection reports to NIOSH [Amato 1994].
	Department of Health	The Department of Health reported that it had investigated two cases of lead poisoning of children whose parents were exposed in the workplace [Wasti 1994; Anonymous 1992; Pitts 1986].
Wyoming	Department of Health	The Department of Health reported that it has no program in place to measure hazardous chemicals and substances carried home by workers [Sabes 1994].

Table 21. How State Agencies Respond to Incidents of Workers' Home Contamination – States that Do Not Have Their Own OSHA Program

STATE	AGENCY	INFORMATION PROVIDED TO NIOSH
Alabama	Department of Health	The Department of Health submitted two case histories where site visits found increased BLLs, a final report to ATSDR on lead exposure of children, and a report on tire and battery plants conducted by the regional OSHA office [Williamson 1994; State of Alabama 1992; Mangum 1994; Alabama Department of Health 1991].
Arkansas	University of Arkansas College of Agriculture and Home Economics and Cooperative extension Service	The College reported that it has no reports of take-home toxins, and that the States worker protection standard applies to agriculture. The Department submitted reports to NIOSH on educational literature with segments addressing home contamination from workers [Huitink 1994; Lavy 1994].
Delaware	Department of Natural Resources and Environmental Control	The Department reported that it had no information on any take-home cases [Mohrman 1994].
Florida	Department of Labor and Employment Security Department of Agriculture	The Department of Labor reported that it has no mechanism in place to monitor worker transportation of chemicals, etc. [Koehler 1994]. The Department of Agriculture has published a brochure in English and Spanish on washing clothing contaminated by pesticides which was provided to NIOSH [Anonymous 1994].
Idaho	Department of Health	The Department of Health reported that it has no jurisdiction over private sector or other agencies. It does have a health and safety program for its own employees with specific procedures involving contamination and written procedures to comply with OSHA for lab safety and hazardous waste. It has practices and procedures in place to make sure decontamination occurs at the workplace. It has an elevated blood lead registry and conducts follow-up studies on children that are reported. Employers of adults reported to the registry are identified to see if there is an occupationally related cause of exposure [Schultz 1994; Stokes 1994].
Louisiana		No responses to requests for information were received; however, the Agriculture Experiment Station provided reports on pesticide workers' clothing contamination and laundering when contacted by telephone [Finley et al. 1977; no date].
Maine	Department of Environmental Protection	The Department of Environment reported that it has an emergency response group that responds to oil and hazardous chemical incidents. The group follows decontamination procedures and has decontamination areas for workers. All the workers are in a health monitoring program [Marriott 1994].
Mississippi	State Department of Health	The Department reported on an investigation of two cases of lead poisoning [Pollock 1994].
Montana	Department of Health and Environmental Sciences	The Department reported that it has no system of tracking home-contamination cases, any complaints of hazardous sites are referred to county health officials [Cleverly 1994].
Nebraska	Department of Labor	The Department of Labor reported that it has no statutes or regulations about home contamination. It uses applicable OSHA standards [Calcaterra 1994]. The Agriculture Experiment has been active in studying laundering of pesticide workers' clothing and informing farm families of appropriate laundering procedures [Laughlin and Gold 1988, 1989c].
New Jersey	Department of Labor Department of Health	Federal Occupational Safety and Health Standards are applied to public sector employees [Katz 1994] The Department of Health submitted a report on a pilot project on exposure of children to take-home lead [Stanbury 1994; Czachur et al. 1995].

**Table 21. (Continued) How State Agencies Respond to Incidents of Workers' Home Contamination – States that Do Not Have Their Own OSHA Program**

STATE	AGENCY	INFORMATION PROVIDED TO NIOSH
Oklahoma	Department of Health and Department of Environmental Quality	These Departments reported that they have no data or regulations on home contamination [Coleman 1994].
Pennsylvania	Department of Labor and Industry	The Department of Labor reported that it collects information on hazardous chemicals in the workplace from employers. It provided NIOSH with copies of the State's: Employer/Worker Community Right to Know Act; List of chemicals subject to reporting (EPA); Manual for employer compliance with Hazardous Materials Act [Tinney 1994].
South Dakota	Department of Health	The Department of Health reported that it has been conducting residential indoor air quality studies since 1990, and has initiated a simple data collection system for surveillance of hazards in the home; however, it has no reports of take-home cases [Forsch 1994].
West Virginia	Department of Health and Human Resources	The Department of Health reported that it has no reports or data on workers' home contamination and submitted the State's Asbestos Licensure Law [Wallace 1994; Pinnell 1994].
Wisconsin	Department of Natural Resources (DNR)	The Department of Natural Resources reported that it has no evidence of wastewater staff taking home contaminants. There is a possibility of home contamination by forest firefighters, since the firefighters wash their clothing at home. DNR does not systematically collect information on home contamination; it focuses on environmental protection, rather than public or environmental health [Kavanaugh 1994].

**Table 22. Responses of State Agencies to Incidents of Workers' Home Contamination – Publication in the Literature from State Agencies**

STATE AGENCY	REFERENCE	FINDINGS
Alabama Department of Public Health	CDC [1992b]	1991 - Battery reclamation workers had elevated BLLs and BLLs of some of the workers' children were high. Workers had inadequate hygiene practices; wore work clothes home, didn't shower at work. Closed plant.
California	West and Lim [1968] Anonymous [1968] West [1959]	1968 - Mercury workers contaminated their homes with mercury from boots and work clothing. 1968 - Agencies developed a document on how to prevent mercury poisoning, including showering before leaving work and company laundering of clothes. A child whose father was a crop sprayer was poisoned when his father wore contaminated shoes home.
Colorado Department of Health	Cook et al. [1993] CDC [1985; Kaye et al 1987] CDC [1989b]	1993 - Assessed BLLs of children living in mining and smelting communities. Found that the sources of exposure to lead were lead brought home on clothes and contaminated soil in yards. Electrical component manufacturer. High BLLs in workers who wore work clothes home and exposed children, significantly higher BLLs in workers' children. Elevated BLLs in workers who manufactured lead belt buckles. Wives and childrens' BLLs were elevated. Noted the importance of getting occupational histories from patients admitted for treatment of lead poisoning.
Minnesota Department of Health	Winegar et al. [1977] Lussenhop et al. [1989]	1977 - Lead smelter workers and families - BLLs and house dust concentrations of lead were measured. BLLs up to 44 mg were found. Also found elevated house dust lead levels in workers' homes and lead on workers and their clothing. 1989 - Some radiator repair workers had elevated BLLs. Screened 16 children - BLLs were normal.
New Jersey Department of Health	Czachur [1995]	1994 - Conducted a pilot study on children of workers with elevated BLLs and found lead contaminated clothing to be a source of elevated BLLs in the children.
New York Department of Health	Nunez et al. [1993] Vianna and Polan [1978]	1993 - Radiator repair - study of workers' children and workers (67% of auto radiator repair workers in 89% of shops in city). None of children's BLLs were in excess of current guidelines. 1978 - Non-occupational exposure to asbestos in females (8 women with domestic exposures because of husbands' occupation had malignant mesothelioma).
North Carolina Wake County Department of Health	CDC [1977b]	1977 - Take-home lead from battery plant employees, 72% of children of plant employees had increased BLLs. High concentrations of lead were found in cars and in closets where shoes and work clothes were stored.
Oklahoma Department of Health	Morton et al. [1982]	1982 - Studies of children of workers in lead related industries - assessed exposure and measured BLLs and personal hygiene practices of workers. Only good personal hygiene before leaving work was effective for lead containment (showering, washing hair, changing clothes).
Pennsylvania Department of Health	Lieben and Williams [1969]	1969 - Respiratory diseases associated with beryllium refining in alloy fabrication - 95 workers and "contact" cases, some of whom were relatives of workers.



Table 22. (Continued) Responses of State Agencies to Incidents of Workers' Home Contamination – Publication in the Literature from State Agencies

STATE AGENCY	REFERENCE	FINDINGS
Pennsylvania Department of Labor and Industry	Fulton and Matthews [1936]	1936 - Report on effects of exposure to naphthalene and chlorodiphenyl (dermatological and systemic effects) - case of dermatitis in child whose father had worked at plant and wore soiled clothes home. The father played with child without changing clothes. The wife also had dermatitis, as did an 11-month-old infant.
Tennessee Department of Public Health	CDC [1976]	1976 - Children of workers in secondary lead smelters. Children of workers had elevated BLLs, supposedly because of parents' contaminated clothing.
Vermont State Department of Health	Zirschy and Witherall [1987]	1987 - Study of mercury from clinical thermometer plant being carried home on workers' clothing. Found increased air mercury levels in some of workers' homes and increased urine mercury levels in some children's urine. Plant was closed and company was required to clean up workers' homes. Subsequently hired consultant, who developed protocol describing all cleaning procedures, disposition of waste, personnel to be used and procedures to determine the success of the decontamination. Paper describes contents of this protocol.
	Hudson et al. [1985, 1987]	1985 - Study of the children of the thermometer plant workers. Mercury was found in urine of workers' children.
	Watson et al. [1978]	Children of workers exposed to lead at a battery plant had high BLLs and their homes had elevated lead levels in house dust.
Virginia Commonwealth University	Garrettson [1988]	1987 - This is a report of a study of a radiator mechanics' child with lead poisoning.

Table 23. Responses of Industry to Incidents of Workers' Home Contamination

Source	Industry	Problem	Industry Action
Barnett [1994]	Wood treating	Chloropicrin brought home in company truck. The pesticide spilled in worker's driveway, neighbors became ill.	Company changed policy - no company vehicles can be taken home, better storage procedures for pesticides in transport.
Barnett [1994]	Bronze foundry	Lead determined to be brought into workers homes on their clothing. Two children identified with elevated BLLs.	Employee homes and workplace were cleaned. Lower lead content stock was substituted. OSHA Lead Standard was complied with.
Gunter et al. [1987]	Assay laboratory	Workers were exposed to high lead levels and some had elevated BLLs.	Company requested NIOSH Health Hazard Evaluation.
Donovan [1994a,b; 1994b]	Stained glass	Work involves use of lead, residence attached to workplace.	Operator of studio requested a NIOSH Health Hazard Evaluation. NIOSH found that exemplary industrial hygiene practices being used effectively prevented home contamination.
Versen & Bunn [1989]	Mining, processing, and packaging of diatomaceous earth	Possible exposure to silica when laundering workers' clothes.	Company-conducted study indicated that laundering did not produce silica dust levels higher than ambient.
Hudson et al. [1985, 1987]	Thermometer manufacture	Workers and children of workers had high levels of mercury in their blood	Plant voluntarily closed. Part of plant re-opened when controls were put into effect.
de Silva [1994]	Sandblasting	In a routine annual check-up, a pediatrician found an elevated BLL in a 2-year-old. The pediatrician determined that the child's father was working in a lead related occupation. The father's BLL was 35 µg/dL.	"Preventive actions at the worksite were implemented."
Lundquist [1980]	Battery manufacturing	Take-home lead contamination	The reference is an informational/educational article in a trade magazine. Covers mechanisms of home contamination and ways to prevent it.
Lead Industries Association [1989, 1991, 1993a,b; 1994a,b]	Multiple industries and hobbies, users of lead	Potential take-home contamination	Industry association has produced a series of fliers, brochures, and industry/hobby specific videotapes that make reference to preventing home contamination.