

I found a few mistakes in spelling etc. which I will list below;
Page 4, 4th line from bottom, date should be 1993.
Page 38, part 1, 3rd line, theses should be these.
Page 52, 2nd line of text, reccommendation is misspelled.
Page 75, need comma between Adrian and Michigan.

Hope this helps.

Joe Costello

FROM: Mason, Robert W.

TO: Hill, Denise

DATE: 12-12-94

TIME: 07:58

CC:

SUBJECT: NIOSH priorities

PRIORITY:

ATTACHMENTS: Forwarded-> niopri4

print

FORWARDED FROM: Mason, Robert W.

FROM: Ahlers, Heinz W.

TO: Niemeier, Richard W.

DATE: 12-09-94

TIME: 14:59

CC: Mason, Robert W.

Reed, Laurence D.

Stayner, Leslie T.

Whalen, John J.

Zumwalde, Ralph D.

SUBJECT: NIOSH priorities

PRIORITY: R

ATTACHMENTS: niopri4

Attached are the composite recommendations for Greg Wagner from Control
95-015 on NIOSH priority recommendations to OSHA.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Draft - Do Not Cite

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Abritti et al. [1989]	lead	See above	Pb-B	Mean Pb-B = 107 ug/l in children whose families are occupationally exposed to lead (vs. 83 ug/l in control population); mean Pb concentrations in house dust are 2.7 and 4.7 mg/m ² where inhabitants are exposed to Pb in factories and where workshops are adjacent to houses, respectively (vs. 0.8 mg/m ² in controls).	Followup to above study; found decline in Pb-B by greater than 50% from previous study; but no explanation offered.
Beegle and Forslund [1990]	Asbestos & Lead	Plans for cleaning homes with asbestos containing materials or with lead contamination from reclamation of used batteries.	Air sampling is included in both plans; Pb-B monitoring of residents of Pb contaminated homes.	NA	(Report is in a letter to USEPA R-3 and somewhat confusing.) Report is plan to clean ACM and lead dust from residences.

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Bohne and Cohen [1985]	Beryllium	Beryllium production	One aspect of investigation looked at re-suspension of dust from work clothing. Analysis via ICP-AES.	Personal monitors mounted on fabric had increased concentrations of Be as compared to "controls."	<ol style="list-style-type: none"> 1. Conclusions regarding exposures of family members to Be via contaminated work clothes cannot be drawn from this study. 2. Research supported in part via NIOSH grant.
Brockhaus et al. [1988]	Lead & Cadmium	Urban/industrial vs. rural environments; and smelters.	<p>Biological samples of blood, urine & shed deciduous teeth in children.</p> <p>Data on Pb & Cd in air were obtained from the State Agency for Immission Control.</p>	<ol style="list-style-type: none"> 1. The annual means of Pb & Cd vary between 0.2 & 0.5 Pb ug/m³ and 1 & 5 Cd ng/m³, respectively, and do not differ much among studied areas. However, significantly increased levels were measured near smelters. 2. Children from lead worker families had significantly higher Pb-B, Pb-U and Cd-U levels than children from non-lead worker families. 	<p>The study results indicate that father employed in the lead smelter is one of the highly significant predictors of Pb-B. The other predictors were foreign family and lead fallout around the child's dwelling place.</p>
Cannell et al. [1987]	NA	NA	NA	NA	Follow-up to previous report; reports amounts of contamination by types of footwear and surface material.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Clapp et al. [1985]	4,4'-methylenebis(2-chloroaniline) also called MBOCA	Urethane casting	<ol style="list-style-type: none"> 1. Air samples 2. Surface wipes. 3. Hand contact monitors. 4. Urine samples. 	<ol style="list-style-type: none"> 1. Air samples = $< 2.9 \text{ ug/m}^3$ (all samples less than detection limit). 2. Surface wipes = $< 5.3 \text{ ug/wipe}$ (most surfaces). 3. Hand monitors = $< 5.3/\text{hand monitor}$ (all samples less than detectable limit). 4. Two surface wipes had $> 5.3 \text{ ug/wipe}$. Both were collected on MBOCA melting pots where it is expected to be found. 5. Urine samples for 6 workers ranged from 2 to 36 ug/L MBOCA. 	<ol style="list-style-type: none"> 1. No home measurements were made. 2. Although MBOCA was detected in the urine samples, but the concentrations were below the 50 ug/L and the 100 ug/L limits enforced by Michigan and California, respectively. 3. Study investigators recommended: <ol style="list-style-type: none"> a. Clothing not be taken home. b. Shower before leaving work.
Davies and Erros [1980]	Pesticides	Agriculture	Urinary excretion of 6-beta-hydroxycortisol in migrant children.	Significantly high levels of 6-beta-hydroxycortisol were found in urines of migrant children with high serum DDE levels.	Based on a reference reviewed by the author, these results were reported anecdotally in the article. It is not known whether the children's exposures were occupational or from materials brought back to the home.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Danziger [1973]	Mercury (hg)	Scientific glassware mfg, calibration of glassware.	<ol style="list-style-type: none"> 1. Study of 75 workers in 13 plants. 2. Hg in air was measured with vapor detector. 3. Urine spot samples (not 24 hr). 4. A questionnaire was used. 5. Engineering controls were evaluated. 	<ol style="list-style-type: none"> 1. One subject had objective tremor. 2. Hg in urine range = 0.000 to 2.220 mg/l. 3. Hg in air range = 0.00 to 0.30 mg/m³. 	Although clothing contamination was not a part of the study, the authors recommended that workers not wear knitted clothing because Hg can be trapped in the interstices of the fabric. This possibility may have implication on the subject of take-home toxins.
Driscoll and Elliott [1990]	Lead Asbestos Solvents	Mfg. of asbestos brake linings; production of adhesives, sealers and paints.	<ol style="list-style-type: none"> 1. Bulk dust - TEM for asbestos (plant). 2. PBZ air samples - PCM for asbestos. 3. Vacuumed samples: <ol style="list-style-type: none"> a) work clothes, b) car seats, via PCM & TEM. 4. Medical monitoring: <ol style="list-style-type: none"> a) chest X-ray, b) PFT, c) quest., d) Pb-B, e) ZPP. 	<ol style="list-style-type: none"> 1. Bulk = 1 to 50% asbestos. 2. PBZ (n=53) 0.02 to 1.11 f/cc (8-hr TWA). 3. Vacuum Samples: all clothing (n=13) was contaminated with asbestos, 11 of 13 samples from car seats (workers cars) were contaminated. 4. Medical results were extensive in text, n=28, 1 Pb-B was > 40 ug/dl. 	It is postulated that much of the family members risk is a result of workers bringing contaminated clothing home for washing, but this aspect was not a part of this study. The finding of asbestos contaminated work clothes in this study strengthens the postulate.

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Fish et al. [1964]	particulate	experimental re-dispersion of settled particulates	light-scattering particle size analyzer	Re-dispersion of settled particulates was dependent upon room activity.	<ol style="list-style-type: none"> 1. Taken from proceedings from a tech. symposium. 2. Experimental tests were non-contaminant specific.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Garrettson [1984]	Environmental toxicity	pesticides, lead & other toxins	literature review	<ol style="list-style-type: none"> 1. Due to incomplete organ development in children, there is potential for effects on maturation that are not seen in adults. 2. Children between 9 mo. and 3 yrs. old account for more than 50% of poison center calls; between 10% & 20% poison deaths in children are due to pesticides. 3. Asymptomatic lead poisoning is a significant problem in the U.S. today. 4. Children who work as tobacco pickers show symptoms of nicotine poisoning. 	Article discusses home poisons as well as take-home toxins.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Giarelli et al. [1992]	Asbestos	A variety of work performed by shipyard workers, dock workers and sailors.	Review of 170 clinical cases in which necropsies were performed.	<ol style="list-style-type: none"> 1. Mesothelioma in 106 cases. 2. Occupational exposures to asbestos in 150 cases. 3. Five cases had domestic exposures to asbestos in cleaning the work clothes of their husbands, who were employed in shipyards. 	Implication of take-home contamination in the five non-occupational cases.
Gibbs et al. [1989]	asbestos	occupational and nonoccupational exposures	mineral content of the lungs of 84 fatal cases of pleural mesothelioma was estimated through electron microscopy and energy dispersive X-ray analysis.	Lung burdens for chrysotile and amphiboles were estimated. The amounts of chrysotile were similar for both mesothelioma and control populations while the amounts of amphiboles in the former group are higher than those of latter.	Study supports findings that amphiboles are more important than chrysotile in the causation of malignant mesothelioma.

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Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Goldman and Peters [1981]	methylene chloride, fluoropolymer, benzidine dyes, naphthylamine, TDI	various occupations	Review of literature for anecdotal cases of occupational diseases	<p>Recommendations for clinical physicians:</p> <ol style="list-style-type: none"> 1. Survey patient. 2. ID potential sources of exposure, including chemicals brought into the home from contaminated work clothes. 3. ID types of toxic substances used. 4. Follow-up & resolution. 	Article provides sequence of steps to facilitate physician recognition of occupationally related diseases.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Grandjean and Bach [1986]	Lead, asbestos, beryllium, uv radiation, etc.	welding ship building cottage industries other industries	Literature review on indirect exposures	Cited cases of housewives indirectly exposed to asbestos from husband's works. Cases of elevated Pb-B in children of lead workers; house dust containing > 1000 ppm Pb. Cases of chronic pulmonary granulomatosis in wives of beryllium workers; airborne concentrations of Be in homes 125 to 1200 ug/m ³ . Cases of chloracne in women whose husbands worked were exposed to PCBs.	The author emphasize laundering of contaminated work clothes as an important mode of exposure.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Gunter et al. [1987]	lead	Fire assay procedures	<ol style="list-style-type: none"> 1. Pb-B 2. FEPs 3. physicals & questionnaires 4. air sampling for Pb dust & fume 	<ol style="list-style-type: none"> 1. Of 10 workers sampled, all were within OSHA limit of 50 ug/dl for Pb-B; however, 3 were over the 40 ug/dl back-to-work level. 2. 3 FEP conc. exceeded "normal" levels of 50 ug/dl. 3. Physicals and questionnaires revealed no positive physical exam findings of excess lead exposures. 4. Air sampling: GA - 0.1 to 0.6 mg/m³ BZ - 9/14 BZ samples exceeded eval. criteria (range - 0.01 - 0.49 mg/m³) 	The HHE report recommended that the workers should shower and change clothes before leaving the workplace to prevent exposure of family members to lead contaminated work clothes.
Hardy [1965]	Beryllium	Fluorescent lamp making	Study of records of 210 fluorescent lampworkers with beryllium disease	Data are inadequate to assess intensity of exposures to Be.	The author also mentioned the nonoccupational cases of beryllium disease found in the same Registry, and speculated that contaminated work clothes were an important factor in these cases.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Hartle [1987]	PCB	Maintenance workers working in PCB-contaminated repair building in a rail yard	<p>GA air samples using 150 mg dual-section florissil tubes at 0.6-1.0 L/M</p> <p>Wipe samples w/hexane moistened gauze pads</p>	<p>1. Air Samples: - 27 below LOQ - 18 above LOQ w/mean = 0.5 ug/m**3.</p> <p>2. Wipe samples from bottom of maint. pit averaged 90,000 ug/m**2 of PCB.</p> <p>3. Other wipe samples indicated PCB contamination on floors of lunch room, locker rooms, supply room, and foreman's office.</p>	<p>1. NIOSH HHE</p> <p>2. HHE investigators were not allowed to perform personal interviews, BZ sampling, or wipe sampling of clothes and worker-owned tools. The workers might have also contaminated their own homes from clothes, shoes and personal tools taken home with them.</p> <p>3. All air results were below NIOSH REL of 1.0 ug/m**3.</p>
Hartle al. [1987]	PCB	Aluminum extrusion using PCB contaminated hydraulic fluids	<p>Air samples (BZ & GA)</p> <p>Wipe samples</p> <p>Serum PCBs</p>	<p>BZ results up to 2 ug/m³</p> <p>wipe sample results up to 900 ug/m²</p> <p>Serum PCBs were not elevated.</p>	<p>1. NIOSH BZ REL is 1 ug/m³</p> <p>2. NIOSH wipe sample proposed limit of 50-100 ug/m².</p> <p>3. Change room & company laundered coveralls were recommended.</p>

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Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Hasan and Hamayoun [1974]	Beryllium	aviation industry; manufacturing of gyroscopes & nuclear reactors.	Beryllium Case Registry record reviews: X-rays, biopsy, autopsy & PFT	Most of the 76 cases studied had abnormal radiographic patterns, pulmonary functions or Be contents in tissues.	There was a comparison of "neighborhood cases" before and after 1949. The number of these cases had dwindled sharply after 1949, the year in which the fluorescent lamp industry discontinued the use of Be.
Hatch [1990]	mercury	gold ore extraction in a home	Investigation of a mercury poisoning case involving a woman. Hg vapor concentrations measured with a direct-reading instrument.	Only 3 of 26 measurements in the home were significant (0.004, 0.019, 0.053 mg/m ³), and these 3 were taken at source locations for Hg storage (i.e., storage bag, mixing pot, and dispensing ladle).	<ol style="list-style-type: none"> 1. Hobby-related exposures. 2. Patient twice diagnosed with Hg poisoning.
Hofstetter et al. [1990]	lead cadmium	lead smelter	Pb-B Blood Cad. Levels	Pb-B ranged 2.6 - 15.5 ug/dl (mean = 6.3 ug/dl) Cd Blood Levels ranged <0.1 - 0.5 ug/l (mean = 0.14 ug/l)	<ol style="list-style-type: none"> 1. 229 children in study 2. Environmental pollution

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

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Hess [1988]	Dioxin	Environmental clean-up of roads and adjacent structures contaminated with dioxin from waste oil used in dust suppression	TCDD-soil TCDD-Hi-vol air filters	soil: 36 ppb air samples: BDL	Contamination was found in homes and a tavern next to the roads treated with dust suppression. Very large environmental restoration project began in 1983 not yet completed as of article's writing.
Hung [1980]	Lead	Battery processing in home	Case history of Pb poisoning in 2 families in Taiwan	lead encephalopathy in 2 children 16 mo. old child: Pb-B 100 ug/dl 2.5 yr old: Pb-B 86 ug/dl 3yr-8mo old: Pb-B 124 ug/dl	No exposure or environmental data
Joshua et al. [1971]	Lead	Cottage industry: extracting gold & silver from jewelers waste	Medical histories, x-rays, and blood & urine tests were examined for a family of 18 extending 3 generations.	All members of a family living in India, 9 adults (15-19 yrs old) & 9 children (3 weeks to 10 yrs old), showed evidence of lead poisoning. Three of the children died.	This is a case of take-home toxin affecting family members not occupationally exposed. The author notes that the family refused to recognize the hazard and did not take any corrective action.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Jung [1984]	Lead	self employed painter	Pb-B monitoring	Painter's Pb-B level was 29.9 ug/dL; his two children were found to have Pb-B levels of 16-19 ug/dL.	The painter, a cigarette smoker, did not use protective equipment on the job. He complained of nausea and dizziness, and was hospitalized during one summer as a psychiatric admission. At the time, a heavy metals workup was not performed.
Katagiri et al. [1983]	Lead	Pottery mfg in factories and homes in Japan.	Medial monitoring (Pb-U, CPU and ALAU): Three groups of children, whose either or both parents were: 1) home pottery workers (Group A); 2) factory pottery workers (Group B); 3) nonpottery workers. Exposed & non-exposed mothers were also compared.	Groups A & B had greater mean Pb-U levels than Group C and the control group. The children of Groups A & B had much greater mean Pb-U levels than the exposed mothers. Among the other parameters, there were only slight differences among all groups.	The results appear to support previous studies indicating a much greater absorption of ingested Pb for young children than for adults.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Kawai [1983]	Lead	Cottage industries in Japan: quench-hardening & type-printing.	Pb-B, Pb-U, CPU & ALAU levels of 3 groups were compared: (I) adults, (II) children older than 14, and (III) children younger than 12. Air & surface sampling of dust. Pb identified via AAS.	Group III showed a much greater mean value and a higher frequency of abnormally high levels compared with Group II, for Pb-U, CPU and ALAU. Air: 2 to 50 ug/m ³ Surface: 260 to 20,386 ppm of Pb in total dust.	Young children are especially at risk of Pb exposure in homes contaminated with Pb dust from cottage industries involving the use of Pb.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Kaye et al. [1987]	Lead	Electronics components plant making ceramic-coated capacitors & resistors.	<p>Pb-B tests were given to family members of exposed and unexposed workers.</p> <p>Dust samples were taken from vacuum cleaners of both worker and nonworker homes, and were analyzed for Pb content.</p>	<p>The mean Pb-B level (10.2 ug/dl) in family members of exposed workers was significantly higher than that (6.2 ug/dl) in family members of unexposed workers.</p> <p>Children under 6 years of age (exposed group) had the highest mean Pb-B level (13.4 ug/dl).</p> <p>Lead was detected in 10 of 11 dust samples from worker homes, ranging from ND to 3400 ppm, and 2 of 9 samples from nonworker homes, ranging from ND to 320 ppm.</p>	No protective clothing or worksite showers were used to prevent dust from being taken home from the plant.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Kiefer [1994]	Lead & solvents	Renovation of an antique residence.	Bulk paint analysis for Pb. Surface wipes for Pb dust. Personal & area air sampling for Pb, NMP & formic acid.	Paint contained 0.19% to 0.28% Pb. Surface levels ranged from 47 to 158 ug/ft ² . Sampling results did not indicate overexposures to Pb, NMP and formic acid.	This is a renovation situation where exposures will depend on whether or not occupants are in the residence during renovation, and on the effectiveness of cleaning procedures used following renovation. The authors recommended precautions be taken to prevent lead poisoning in the occupants, especially children.
Kilburn et al. [1985]	Asbestos	Shipyard workers	Chest X-rays of shipyard workers and their wives, sons and daughters.	Asbestosis was present in 64.2% of 288 male shipyard workers and 21.1% of 71 female shipyard workers. Asbestosis was found in 11.3% of 274 wives, 7.6% of 79 sons and 2.1% of 140 daughters. These numbers are higher than those in comparison populations.	The authors are concerned with secondary exposures in the homes.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Kilburn et al. [1986]	Asbestos	Shipyard workers	Chest X-rays, PFT (for Whites only) & questionnaires were administered to families of 338 male and 81 female shipyard workers (SYWs), including 280 wives, 144 daughters & 81 sons.	Although they were not occupationally exposed to asbestos, some wives, daughters & sons of SYWs, had asbestosis.	This study is the first showing asbestosis in household contacts of workers who are themselves bystanders of asbestos use in shipyards.
Klemmer et al. [1975]	Arsenic	Homes treated with pesticides against termite infestations, and homes with pretreated lumber.	Concentration of As in household dust from vacuums after filtering through a 0.246 mm size sieve. Analyzed via spectrophotometry.	1.1 to 1,080 ug As/g of sieved dust. Study compared "treated" and "untreated" homes. The results indicated that "treated" homes tended to have significantly higher levels of As in dust than levels in "untreated" homes. However, in some instances of extremely high levels, > 100 ug As/g dust, in both "treated" & "untreated" homes, the homeowners were occupationally tied to pesticide use or production.	In some cases, As may have been brought home on work clothing.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Klorfin and Bartine [1956]	Stilbestrol	Pharmaceutical factory producing diethylstilbestrol.	Medical tests	Six or 7 cases of stilbestrol intoxication identified, 2 of which were workers' children. One 8-yr old boy's mother (also a case) worked in a pharmaceutical factory. Second child was 10-yr old boy who's father was a pharmacist in a pharmaceutical factory.	The authors mentioned that the workers did not wear aprons, did not change their clothes, and did not wash their hands before eating or smoking. The children's exposures could have been from contaminated work clothes that were brought into the homes. No environmental samples were collected.
Lehmann [1905]	Chlorine-tar derivatives (unconfirmed)	Electrolytic decomposition of saturated salt solution for lime chloride prod in German plant.	Clinical observations of chloracne in workers and their family members.	The cases were described. Some family members who were not occupationally exposed had the disease.	The workers were required to bathe and change clothes before leaving the factory, but negligence in compliance was possible. The more mildly diseased workers, in contrast to the more severely afflicted, are known to be clean, neat, and carefully observant of instructions. One worker whose family members had the disease was a notoriously unclean person who had repeatedly failed to follow instructions.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Lewis [1994]	Pesticides	Pesticide use in nine homes	Measuring residual pesticides in indoor air, carpet dust, outdoor soil, and on children's hands; collecting information on household characteristics, pesticides used and stored at the homes, and children's activities.	Twenty-three of 30 target pesticides were detected in this study. With the exception of one home, at least one pesticide was detected in all matrices sampled at each house. Carpet dust contained the greatest number of pesticides and the highest concentrations.	The study did not address the issue of take-home toxins. Exposures were from commercial home treatments or household uses.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Lindbohm et al. [1991]	Lead	No specific process	<p>Pb-B levels were monitored in fathers who were occupationally exposed to Pb, and the results were compared to cases of spontaneous abortions in the families.</p> <p>Exposures were estimated using questionnaires and historical Pb-B levels.</p>	<p>The findings suggest that there may be an association between paternal Pb exposure and the risk of spontaneous abortion.</p>	<p>The study was to determine whether paternal exposure to inorganic Pb during the period of spermatogenesis in question is associated with clinical spontaneous abortion. However, the authors mentioned the possibility of secondary maternal exposure by contact with Pb-contaminated clothes.</p>
Litzistorf et al. [1985]	Fibers	N/A	<p>Study of human activities affecting airborne fiber concentrations in paraoccupational environments in: 1) a classroom, 2) a walk-through area in an asbestos insulated building.</p>	<p>High fiber levels found during vacuuming and heavy foot traffics.</p>	<p>The authors conclude that the results of long-time sampling can be misleading, and proposes that the influence of different parameters of the indoor environment on the fiber level be evaluated.</p>

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Lundquist [1980]	Lead	Manufacturing of lead batteries.	N/A	N/A	The author describes how contamination can be carried on the clothes and shoes from the workplace to the home.
Martin [1974]	Lead	Lead works in the United Kingdom	Pb-B in children; air, surface & soil samples.	Average airborne Pb concentrations 3.0 ug/m ³ with maximum 28 ug/m ³ approx. 100 meters from factory chimney; surface samples up to 392 mg/m ² Pb; soil concentrations 0.15 to 4.9%. Three children with highest Pb-B levels (75, 74, & 65 ug/dl) lived close to the factory (two of whom also had fathers working at the factory).	Widespread contamination of air & soil near lead works. The principal cause of the raised Pb-B levels was presumably either emissions to the atmosphere from the factory, windborne dusts, or dusts from vehicles entering and leaving the factory, or Pb taken home on the person or clothing of a parent working in the factory.
May [1973]	Tetrachlorodibenzo dioxin (dioxin)	Production of 2,4,5-trichlorophenol in which dioxin was produced and released accidentally.	Clinical tests and observations	Seventy-nine cases of chloracne were recorded following the re-opening of the plant after the accident. The building was later decontaminated, and no new case occurred.	The author anecdotically related a similar experience in another plant where more severe cases resulting from exposures to dioxin had occurred. In this case many of the workers' wives, children and pets also developed chloracne.

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Mentrath et al. [1993]	Lead	Mining	Dust samples collected from the cars & homes of both miners & non-miners in the same community.	<p>Mean Pb concentrations in dust = 3909 ppm in miners cars vs. 917 ppm in non-miners cars.</p> <p>Pb loadings on car floors = 3539 ug/ft² miners vs. 565 ug/ft² non-miners.</p> <p>Pb loadings in homes were similar for both groups, approx 56 ug/ft².</p> <p>Concentration of Pb in house dust was higher for miners.</p>	<p>Authors state: "The data suggests that worker carry-home is not a major area of concern at the present time but is an area where some vigilance is warranted."</p>
Molina-Ballesteros [1979]	Lead	Pottery making using lead monoxide	Analyses for Pb in the blood (Pb-B), hemoglobin (Hb), hematocrit (Ht), and urinary delta-aminolevulinic acid (ALAU); included children, adolescents and adults of both sexes.	<p>In the exposed group, abnormally high Pb-B and ALAU levels were found in all ages and both sexes, which were higher than those in the non-exposed group. The Hb and Ht fell within normal limits for both exposed and non-exposed groups.</p>	<p>The author speculates that the high levels of Pb-B and ALAU found in children ages 0-9 years in the exposed group were due to the lack of precautions taken in the family ceramic shops to prevent children from coming into contact with Pb.</p>

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Nelson and Cliff [1992]	Lead	Foundry	Samples collected from homes of foundry & non-foundry workers in a rural town.	Pb contamination detected in all homes.	The authors speculate that airborne emissions from a lead smelter, the presence of four ferrous foundries, and the mobile nature of the work force were the causes of Pb contamination in all the sampled homes.
Nicholson et al. [1980]	Asbestos	Chrysotile mining operations	Air samples collected in the houses of asbestos mine and mill employees	Thirteen samples contained chrysotile in concentrations greater than 50 ng/m ³ but less than 5000 ng/m ³ (8 of these samples > 100 ng/m ³). Three samples taken in houses of non-miners had concentrations of 32, 45 & 65 ng/m ³ .	Shower facilities and change rooms were not available to the mine workers. Asbestos fibers were occasionally visible in the living areas of households sampled.
Pacynski and Robaczynski [1968]	Stilbestrol	Stilbestrol production	Clinical observations	Female workers and their children showed signs of hyperestrogenism attributable to stilbestrol exposures.	The authors stated: "The disregard for the principles of labor hygiene by mothers and the carrying of the stilbestrol powder home were the cause of the constant and long-term effect of estrogen on their children."

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Pasanen [1989]	Fungi	Farming	Air sampling with impactor; cultivation; SEM	In farm homes: viable spore counts 10^3 to 10^4 cfu/m ³ ; total spores 10^4 to 10^5 spores/m ³ . In comparison, several orders of magnitude lower concentrations in urban homes.	The authors stated: "This finding suggests that fungal spores were carried on clothes from cow barns to farmers' homes."
Piacitelli [1993]	Lead	Lead soldering in radiator repair shops	Air & wipe sampling	TWA exposures: average 15.2 ug/m ³ , range 0.9 to 157 ug/m ³ Wipe samples: up to 500,000 ug/m ² .	Exposures were below OSHA PEL 50 ug/m ³ in the two shops that had local exhaust ventilation (LEV). In the one shop that did not have LEV, exposures frequently exceeded the PEL. Pb contamination was found on work surfaces, lunch areas, and workers' hands, faces, shoes and cars.
Piacitelli et al. [1994]	Lead	Bridge work	Wipe & vacuum samples taken in automobiles of abrasive blasters and other lead-exposed workers.	Pb contamination was found on surfaces (floor, seats & arm rests) in all 27 automobiles. The mean dust loading was lower in abrasive blasters' cars than in other workers' cars (369 ug/m ² vs. 1030 ug/m ² , respectively).	Abrasive blasters regularly changed out of work clothing and showered before entering their cars, whereas the other workers did not.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Piccinini[1986]	Lead	Tile workers	Pb-B & Pb-H levels in children of: A) tile workers in Pb areas; B) tile workers in non-Pb areas; and C) non-tile workers (controls).	Significantly higher Pb-B levels in Group-A than Group-C children, but no significant difference between Group-A & Group B children. Significant difference in Pb-H levels between Groups A & C only.	The authors recommended that work clothes not be taken home by the workers.
Price [1972]	PCBs	General population	Human tissue analyses using GC & TLC Human Monitoring Survey	PCB were found in human tissues during autopsies. Somewhat related to this study was the analyses of house dust from homes of workers occupationally exposed to PCBs; several samples contained up to 180 ppm PCBs.	The authors did not draw any conclusion about the PCBs found in house dust.
Que Hee [1985]	Lead	N/A	Method development for sampling & analysis of house dust, and other media for Pb.	N/A	The method may have applications in studies of take-home toxins.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Quinn [1985]	Lead	General population	Pb-B levels	In most areas, the Pb-B levels in children of leadworkers were higher than those in children living near the leadworks.	The author indicates that measures taken to improve hygiene and reduce emissions at leadworks have had a substantial effect on Pb-B concentrations.
Schneider et al. [1989]	Non-specific dust	N/A	Surface sampling method using sticky gelatin foil	Practical applications include assessment of the effectiveness of cleaning programs and characterization of surface contamination patterns in buildings.	
Schneider [1986]	Man made mineral fibers (MMMf) and non-MMMf fibers	N/A	Air & surface sampling	It was found that air sampling would not likely to detect fibers with diameters greater than 50 um due to settling. It was found that surface sampling with sticky tape was useful in evaluating surface accumulations of settled dust.	The author concludes that measurements of surface concentrations of MMMf must supplement measurements of airborne fibers. This study has implication in preventing irritation of the skin and eyes via hands that have touched contaminated surfaces.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Schreiber[1993]	Tetrachloroeth lene (PCE)	Dry cleaning	Literature review of occupational & non- occupational exposures to PCE. Development of pharmacokinetics model for predicting concentrations of PCE in breastmilk.	The author cited geometric mean TWA occupational exposures ranged from 20 to 150 mg/m ³ . Using the model, the predicted breastmilk PCE concentrations for women occupationally exposed to PCE ranged from 857-8440 ug/L (compared to 1.5 ug/L for non- occupationally exposed women).	The model has yet to be validated by monitoring.
Seixas [1986]	Asbestos	Brake shoe mfg.	Chest X-rays; air & clothing samples for asbestos.	Of the 20 x-ray films examined, seven showed radiographic changes consistent with asbestos exposure, and two cases had lung cancer. TWA exposures ranged from 0.06 to 1.56 f/cc. Vacuum samples from work clothes were contained asbestos fibers.	Potential for home contamination via clothes brought home by the workers.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Sherlock [1985]	Lead	UK population - children	<p>Pb-B levels measured in three groups of children:</p> <p>1) Asians, vegetarian; 2) Asians, non-vegetarian; 3) Caucasians.</p> <p>Factors studied: ethnic origins, vegetarianism, dietary Pb intakes, hand washing, parents' smoking habits, and water Pb concentrations.</p>	<p>No significant differences in Pb-B levels among 3 groups, but children who washed hands before eating had lower Pb-B levels than children who did not.</p>	<p>The authors conclude that personal hygiene is a factor in the Pb-B level.</p>

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Silvany-Neto et al. [1989]	Lead	Lead smelting	Pb-B & Zinc protoporphyrin (ZPP) levels in children living near a lead smelter were studied, before and after the smelter made changes to reduce pollution.	Pb-B & ZPP levels were slightly reduced after the smelter had made improvements in environmental controls, but the highly contaminated soil remained a long-lasting risk factor. Children of lead workers had higher geometric mean ZPP level than those of non-lead workers (1.71 vs. 1.20 micromole/l, respectively).	The authors concludes that children of lead workers are at high risk from lead poisoning.
Simonson and Mecham [1983]	Lead	Smelter	Evaluation of controls for lead removal from clothing: airshowers & automatic shoe cleaners.	Airshower removed 5 % to 72 % of lead from clothing. No data reported for shoe cleaners; only observations.	The study did not include home contamination.
Stewart [1967]	Particulates	N/A	Literature review: Study of the dynamics in the resuspension of particulates from surfaces.	Resuspension is affected by particle size, wind speed, and other factors. In the indoor environment, resuspension is also affected by the efficiency of the ventilation system.	The article does not specifically address the subject take-home toxins, but it shows possible applications.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Venables and Newman-Taylor [1989]	1. Rat-borne allergens 2. Platinum salts	1. Animal handling in laboratory. 2. Use of platinum salts in industrial laboratory.	Two case studies.	In both cases, one spouse was allergic to the allergens brought home from the other spouse.	The symptoms were relieved after both workplaces implemented change-and-shower policy.
Venable et al. [1993]	Lead	Cable splicing in a utility company	Air & wipe sampling Pb-B & ZPP	TWA exposures, 0.22 to 17 ug/m ³ , below OSHA PEL (50 ug/m ³). Wipe samples: non-detectable to 9.3 mg/sample Pb-B levels: Two employees (out of 43) exceeded OSHA's 40 ug/dL trigger level for additional testing. ZPP levels: 12 to 72 ug/dL	Most of the workers showered, and changed their clothes and shoes before leaving work.
Wang et al. [1989]	Lead	Pb soldering	Pb-B in umbilical cords of newborns whose either or both parents were occupationally exposed to Pb.	The number of hours working at lead soldering by newborn's mother and paternal exposure are significantly associated with newborn's Pb-B levels.	Father's work clothes that were washed with clothes of other household members were some of the contributors to elevated Pb-B levels in newborn cords.

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Weeks [1976]	N/A	Method development-- chemical spot tests (visualization & uv detection)	The spot tests can detect low levels (ng) on surfaces (metal, paint, concrete).	This article does not address the topic of take-home toxins.
Whitwell et al. [1977]	Occupations in asbestos factories, shipyards, sack-repair factories, gas-mask factories, and others.	Examination of asbestos-fiber contents of 100 pleural mesothelioma specimens (ie., patients). The results were compared to those of 100 "control lungs" and 100 lungs with lung cancer of non-industrial origins.	Eighty-eight of the 100 pleural mesothelioma patients had been exposed to asbestos, and in 73 of these (83%), the lung tissue contained over 100,000 asbestos fibers per gram (f/g) of dried lung. Seventy-one per cent of control lungs, and 80% of lungs with lung cancer of non-industrial origins, contained less than 20,000 f/g.	Seven pleural mesothelioma patients with no credible history of asbestos exposure were 3 housewives, a farmer, a fireman, a clerk, and a crankshaft fitter. All had under 40,000 asbestos f/g, six being less than 20,000 f/g, and no fibers were seen in two cases. Possible take-home-toxin cases?

INDUSTRIAL HYGIENE REVIEW OF TAKE-HOME TOXIN LITERATURE

Author (year)	Contaminant	Process	Sampling Method	Results/ Concentrations	Comments
Wiehrdt [1994]	Lead	Various Pb related industries	Case reports	<ol style="list-style-type: none"> 1. Two children were hospitalized and underwent chelation therapy. Father brought lead home on his clothing. 2. Five related employees brought lead home on their clothing. One child had Pb-B of 50 ug/100g, and underwent chelation. 3. Children of 3 employees had elevated Pb-B levels. Wipe samples of homes showed Pb contaminations. 	These cases were brought to OSHA's attention by local health departments.
<p>Notes: * Results of other tests (hematocrit, total erythrocytal porphyrins, aminolevulinic acid, etc.) reported in interim paper.</p>					
<p>Abbreviations & acronyms: PB-B = Blood Lead, Pb-U = Lead in Urine, Pb-H = Lead in hair, ECD = Electron Capture Detector, GC = Gas Chromatography, FID = Flame Ionization Detector</p>					