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Lead:

An Interdisciplinary Annotated Bibliography

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Lead: An Interdisciplinary Annotated Bibliography

Blando, J., et al. (2013). "Variability and trend of multiple blood lead measures among construction and manufacturing workers." Occup Environ Med 70(11): 774-781.

Objectives: This study evaluated multiple blood lead measures collected over time and assessed differences arising from exposure and testing variability. Methods: Blood lead data was used to compare individuals from manufacturing and construction occupational cohorts. Trends of blood lead levels (BLLs) over time were analysed using mixed model analysis. Random selection of BLL values was used to determine the improvement in the precision of mean BLL estimates as the number of tests increased. Results: From 2003-2007, there were 619 manufacturing and 657 construction workers with more than one blood lead test reported. Construction workers had much more variability in their blood lead trends. They also tended to have less frequent follow-up blood tests compared with manufacturing workers. Both occupational cohorts had persistent BLLs that resulted in many workers with chronically high blood lead values (>25 mg/dL). Approximately 11.2% of construction workers and 34.8% of manufacturing workers with an initial blood lead test above 25 mg/dL remained above this blood level through the study period. The precision in the mean BLL estimates increased more substantially for construction workers when compared with manufacturing workers as the number of blood lead tests per worker increased. Conclusions: This study confirmed differences in the pattern of blood lead tests and the resulting trends for manufacturing compared with construction workers. It also suggested that the number of blood lead tests performed on a worker is an important consideration in the assessment of a worker' s mean blood lead estimate, and this is particularly true for workers with highly variable exposures.

Buchanan, S. N., et al. (2008). "Street corner hazard surveillance and health intervention among Chicago day laborers." Arch Environ Occup Health 63(1): 9-12.

Day laborers in Chicago are often hired for hazardous jobs and have little access to basic health care. In this study, the researchers offered tetanus vaccinations and blood lead tests to workers waiting on street corners, who then completed a survey on hazardous job tasks (N = 92). All participants were male, 97% were foreign-born, and 93% had performed demolition and rehabilitation, window removal and installation, or paint removal in the previous month. Most were not current with tetanus immunization. The geometric mean blood lead level was 3.8 mug/dL. Nonparametric statistical analysis showed a significant association ($p < .05$) between blood lead level and country of origin. The results demonstrate the feasibility of hazard surveillance and health intervention at street corner hiring sites.

Buzzetti, A. J., et al. (2005). "Impact of a lead-safe training program on workers conducting renovation, painting, and maintenance activities." Public Health Rep 120(1): 25-30.

OBJECTIVE: An important source of lead exposure is lead-based paint that is disturbed when unsafe work practices are used during renovation, remodeling, and maintenance activities. This study explores the success of a pilot lead-safe skills training program for home improvement contractors and their employees (including renovators, remodelers, and painters) and small property owners. METHODS: The study evaluates whether attendees at eight-hour lead-safe work practices training courses learned and retained information about lead exposure; developed and retained positive attitudes toward lead-safe work practices; and developed lasting, positive behavioral intentions to use lead-safe work practice skills and techniques. A

questionnaire was administered immediately before, immediately following, and several months following the training program. Coded data from the questionnaires were analyzed using SPSS software. RESULTS: Respondents showed statistically significant changes from before to after the training program, and the changes were maintained over time. Knowledge improved, and attitudes and behavioral intentions changed in a favorable direction. CONCLUSION: These results suggest that lead-safe training can be successful and can create lasting changes in lead-safe knowledge, attitudes, and behaviors.

Ceballos, D. M., et al. (2022). "Metals dust in workers' homes and potential for take home in the Greater Boston area: Pilot study." Environ Res 209: 112893.

Toxic metals such as lead, cadmium, arsenic, are present at construction worksites. From work, metals can easily, unintentionally be transported to homes of workers, contaminating living spaces and affecting others including children, known as "take-home exposure." Focus has been given to minimizing lead take-home exposure but less is known about other metals. This pilot study aims to better understand the sources and predictors of metals in the home primarily of construction workers (n = 21), but also explore other workers potentially exposed [janitorial (n = 4) and auto repair (n = 2) jobs]. Greater Boston workers were recruited in 2018-2019 through collaboration with community-based organizations and worker unions serving low-income/immigrant workers. During a home visit, a dust vacuum sample was collected, a worker questionnaire was administered, and home observations were performed to determine factors that could affect home metals concentration. Thirty elements were analyzed in the dust via inductively coupled plasma coupled to atomic emission and mass spectrometry. We performed univariable and multivariable models, potential predictive factors, and multivariable mixed-effect regression analyses combining metals. Arsenic, chromium, copper, lead, manganese, nickel, and tin, commonly found in construction, were higher in construction workers' home dust compared to other workers, although not statistically significant. Sociodemographic/work/home-related variables affected home metals dust concentrations. Various work-related factors were associated with higher metal dust levels, for example: no work locker vs. locker (nickel ratio of means or ROM = 4.2, $p < 0.05$); mixing vs. no mixing work/personal items (nickel ROM = 1.6, $p < 0.05$); dusty vs. no dusty at work (copper ROM = 3.1, $p < 0.05$); not washing vs. washing hands after work (manganese ROM = 1.4, $p < 0.05$); not changing vs. changing clothes after work (cadmium ROM = 6.9, $p < 0.05$; copper ROM = 3.6, $p < 0.05$). Mixed effect regression confirmed statistical significance, which suggests a likelihood of metal mixtures carrying a "take-home" potential. Lead home interventions should evaluate other metals exposure reduction.

Ceballos, D. M., et al. (2021). "Factors affecting lead dust in construction workers' homes in the Greater Boston Area." Environ Res 195: 110510.

Lead is a known reproductive, developmental, and neurological toxicant. Workers with a high likelihood of being exposed to lead at work may inadvertently transport lead home from work, known as "take-home exposure." This is concerning for many workers for whom a workplace intervention is not feasible because their worksites and employers often change, rendering centralized strategies insufficient. This study aimed to better understand the connection between lead in the home of workers living with children and work in construction (n = 23), while other occupations were used as a comparison group (janitorial n = 5, autobody n = 2). Thirty workers living in disadvantaged communities in the Greater Boston area were

recruited in 2018-2019 through collaboration with non-profits and worker unions with expertise working with low-income or immigrant workers. Construction workers that performed renovations, bridge constructions, welding, metal work, and demolitions were prioritized during recruitment. During a visit to their residences, a worker questionnaire was administered, and observations and a dust vacuumed sample of the home were collected. Factors predicting lead in home dust were explored by a bivariate analysis and a multivariable regression model. We found lead in homes' dust in the range of 20-8,310 ppm. Homes of construction workers generally had higher and more variable lead dust concentrations (mean 775, max 8,300 ppm) than autobody and janitor worker homes combined (mean 296, max 579 ppm). Five of the construction workers' home lead dust concentrations exceeded US guidelines for yard soil in children's play areas of 400 ppm, and were similar to other studies of homes near lead smelters, superfund sites, or in the Boston area in the early 1990s, pointing to disparities relating to work. Results from the multivariable regression model suggest that lead dust in homes of workers was associated with sociodemographic-, home-, and work-related factors, and pointed to overlapping vulnerabilities; however, a larger sample size is needed to verify findings. Results provide evidence that work-related factors are important to consider when assessing home exposures, and that take-home exposures for workers in lead high-risk jobs such as construction may be an important source of exposure in the home prime for public health intervention at work, home, and community levels.

Fiedler, N., et al. (2003). "Cognitive effects of chronic exposure to lead and solvents." Am J Ind Med 44(4): 413-423.

Background: Occupational exposure to lead and solvents has declined steadily over the past 20 years, however, construction workers continue to be exposed to these neurotoxicants. The purpose of this study was to investigate the cognitive effects of chronic occupational exposure to lead and solvents. Method: Based on K-XRF of tibial bone lead and occupational history of solvent exposure, subjects were classified into four exposure groups: lead (N = 40), solvent (N = 39), lead/ solvent (N = 45), and control (N = 33). All subjects completed tests to assess concentration, motor skills, memory, and mood. Results: Relative to controls, the lead, solvent, and lead/solvent groups performed significantly more poorly on a test of verbal memory, while the lead and lead/solvent groups were slower than the solvent and control groups on a task of processing speed. Bone lead was a significant predictor of information processing speed and latency of response while solvent exposure was a significant predictor of verbal learning and memory. Conclusions: Bone lead was associated with slower speed of processing while exposure to lead and/or solvents reduced efficiency of verbal learning.

Flynn, M. R. and P. Susi (2004). "A review of engineering control technology for exposures generated during abrasive blasting operations." J Occup Environ Hyg 1(10): 680-687.

This literature review presents information on measures for controlling worker exposure to toxic airborne contaminants generated during abrasive blasting operations occurring primarily in the construction industry. The exposures of concern include respirable crystalline silica, lead, chromates, and other toxic metals. Unfortunately, silica sand continues to be widely used in the United States as an abrasive blasting medium, resulting in high exposures to operators and surrounding personnel. Recently, several alternative abrasives have emerged as potential substitutes for sand, but they seem to be underused Some of these abrasives may pose

additional metal exposure hazards. In addition, several new and improved technologies offer promise for reducing or eliminating exposures; these include wet abrasive blasting, high-pressure water jetting, vacuum blasting, and automated/robotic systems. More research, particularly field studies, is needed to evaluate control interventions in this important and hazardous operation.

Frounfelker, R. L. (2006). "SPATTER! SPATTER! SPATTER! Workers' health and the spray machine debate." Am J Public Health 96(2): 214-221.

A conflict between industrialization and worker health developed in the painting industry during the early 1900s with the introduction of the spray machine. This technological innovation allowed the application of paint at greater speed and lower cost than hand painting and increased the rate at which painters were exposed to lead and other toxins contained in paint. From roughly 1919 to 1931, the painters' trade union clashed with employers, paint manufacturers, and legislatures over the impact of the spray machine on the health of workers and the need to enact legislation to regulate its use. While painters made gains on local, state, and national levels during the 1920s to prevent the use of the spray machine, their efforts ultimately failed.

Guth, K., et al. (2020). "Assessment of lead exposure controls on bridge painting projects using worker blood lead levels." Regul Toxicol Pharmacol 115: 104698.

A retrospective analysis of worker blood lead levels (BLL) was conducted using blood lead data collected by four bridge painting contractors before and after lead exposure. The objective of the study was to evaluate the effectiveness of exposure controls in preventing elevated blood lead levels (>25 mug/dl) during bridge painting projects. The contractors selected for the study submitted BLL data for 289 workers representing ten work tasks and 11 bridge painting projects. In total, 713 blood lead levels results were evaluated. The mean blood lead level for all work classifications combined was 10.9 mug/dl at baseline compared with 14.9 mug/dl after two months of exposure and 15.0 mug/dl after four months of exposure. Two months after initial exposure, 29% of the painters and 35% of the laborers had a 10 mug/dl incremental increase or greater in blood lead level. Likewise, 18% of the painters and 26% of the laborers had a blood lead level greater than 25 mug/dl during the same time. The blood lead levels that exceeded the 25 mug/dL threshold ranged from 30mug/dL-63 mug/dL for painters and 26 mug-56 mug/dL for laborers. All work tasks with high-intensity exposure (abrasive blaster/painter, abrasive blaster, painter & laborer) experienced an average blood lead level increase that ranged from 0.2 mug/dl to 8.9 mug/dl two months after initial exposure. Blood lead testing conducted after modified exposure controls (two months after the initial follow-up blood testing) were implemented showed a decrease in average blood lead levels (range -0.14 mug/dl to -2.7 mug/dl) for two high-intensity exposure work tasks. In comparison, the other two high-intensity work tasks had moderate increases (range 1 mug/dl to 2.4 mug/dl). The modified exposure controls included an increase in the air velocity inside of the work containment and an administrative control in the form of additional worker training on lead exposure prevention. The reduction in the 95th percentile (point estimate) BLL exposure profile for each exposure group at the 4-month follow-up blood testing period is associated with modified exposure controls. Ineffective exposure controls were identified through the analysis of worker BLLs. We found two exposure groups (laborer and painter) whose 95th percentile (point estimate) exposure profile was greater than the OSHA construction lead standard's

targeted BLL goal (25 mug/dl) during the first two months of exposure. Our research findings provide support for monthly blood lead testing after baseline until blood lead levels are controlled to an acceptable concentration.

Henn, S. A., et al. (2011). "Characterization of lead in US workplaces using data from OSHA's integrated management information system." Am J Ind Med 54(5): 356-365.

BACKGROUND: Lead hazards continue to be encountered in the workplace. OSHA's Integrated Management Information System (IMIS) is the largest available database containing sampling results in US workplaces. METHODS: Personal airborne lead sampling results in IMIS were extracted for years 1979-2008. Descriptive analyses, geographical mapping, and regression modeling of results were performed. RESULTS: Seventy-nine percent of lead samples were in the manufacturing sector. Lead sample results were highest in the construction sector (median = 0.03 mg/m(3)). NORA sector, year, OSHA region, number of employees at the worksite, federal/state OSHA plan, unionization, advance notification, and presence of an employee representative were statistically associated with having a lead sample result exceed the PEL. CONCLUSIONS: Lead concentrations within construction have been higher than any other industry. Lead hazards have been most prevalent in the north and northeastern US. IMIS data can be useful as a surveillance tool and for targeting prevention efforts toward hazardous industries.

Johnson, J. C., et al. (2000). "Lead exposure among workers renovating a previously deleaded bridge: comparison of trades, work tasks." AIHA J (Fairfax, Va) 61(6): 815-819.

Airborne and surface lead exposures were evaluated for construction trade groups at a previously deleaded bridge renovation site in the midwestern United States. Although all lead-based paint should have been removed, old layers of leaded paint were still present on some sections of the bridge. Ironworkers performing metal torch cutting had the highest exposures (188 microg/m3), followed by workers engaged in clean-up operations and paint removal ($p < 0.001$). Respirators were most frequently worn by workers with the greatest lead exposures; however, laborers performing clean-up operations had exposures to lead dust of 43 microg/m3 and often wore no respiratory protection. Wipe samples revealed that almost all contractor vehicles were contaminated with lead. Heavy equipment operators with low airborne lead exposure had the highest levels of surface contamination in personal vehicles (3,600 microg/m2). Laborers cleaning structural steel with compressed air and ironworkers exposed to lead fumes from cutting had the highest concentrations of lead dust on clothing (mean 4,766 microg/m2). Handwashing facilities were provided, but were infrequently used. No separate clothes changing facility was available at the site. The potential for "take-home" contamination was high, even though this site was thought to be relatively free of lead. Construction contractors and their workers need to be aware that previous deleading of a site may not preclude exposure to significant amounts of lead.

Landrigan, P. J., et al. (2004). "Health and environmental consequences of the world trade center disaster." Environ Health Perspect 112(6): 731-739.

The attack on the World Trade Center (WTC) created an acute environmental disaster of enormous magnitude. This study characterizes the environmental exposures resulting from destruction of the WTC and assesses their effects on health. Methods include ambient air sampling; analyses of outdoor and indoor settled dust; high-altitude imaging and modeling of

the atmospheric plume; inhalation studies of WTC dust in mice; and clinical examinations, community surveys, and prospective epidemiologic studies of exposed populations. WTC dust was found to consist predominantly (95%) of coarse particles and contained pulverized cement, glass fibers, asbestos, lead, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and polychlorinated furans and dioxins. Airborne particulate levels were highest immediately after the attack and declined thereafter. Particulate levels decreased sharply with distance from the WTC. Dust pH was highly alkaline (pH 9.0-11.0). Mice exposed to WTC dust showed only moderate pulmonary inflammation but marked bronchial hyperreactivity. Evaluation of 10,116 firefighters showed exposure-related increases in cough and bronchial hyperreactivity. Evaluation of 183 cleanup workers showed new-onset cough (33%), wheeze (18%), and phlegm production (24%). Increased frequency of new-onset cough, wheeze, and shortness of breath were also observed in community residents. Follow-up of 182 pregnant women who were either inside or near the WTC on 11 September showed a 2-fold increase in small-for-gestational-age (SGA) infants. In summary, environmental exposures after the WTC disaster were associated with significant adverse effects on health. The high alkalinity of WTC dust produced bronchial hyperreactivity, persistent cough, and increased risk of asthma. Plausible causes of the observed increase in SGA infants include maternal exposures to PAH and particulates. Future risk of mesothelioma may be increased, particularly among workers and volunteers exposed occupationally to asbestos. Continuing follow-up of all exposed populations is required to document the long-term consequences of the disaster.

Okun, A., et al. (2004). "Trends in occupational lead exposure since the 1978 OSHA lead standard." Am J Ind Med 45(6): 558-572.

BACKGROUND: The purpose of the study was to evaluate trends in occupational lead exposures throughout U.S. industry after the establishment of the general industry lead standard in 1978 and the construction industry standard in 1993. METHODS: Lead exposure measurements collected by the Occupational Safety and Health Administration (OSHA) under their compliance and consultation programs were analyzed. Time trends in the distributions of exposure levels were evaluated graphically. Trends in the proportion of exposures above the OSHA permissible exposure limit (PEL) were analyzed using logistic regression models. RESULTS: The distribution of lead exposure levels declined over the study time period for general industry, but not for construction. The median exposure levels for general industry facilities decreased five- to tenfold. Logistic regression models reveal statistically significant declines in the odds of a lead exposure exceeding the PEL. CONCLUSIONS: This study provides evidence for relatively large decreases in lead exposure levels in general industry facilities over time. The study does not provide similar evidence for the construction industry. Given the limited number of years of data available since the implementation of the revised construction standard for lead, re-analysis of lead exposure levels within this industry would be worthwhile when more data become available.

Rodrigues, E. G., et al. (2010). "Personal exposure, behavior, and work site conditions as determinants of blood lead among bridge painters." J Occup Environ Hyg 7(2): 80-87.

Bridge painters are exposed to lead during several job tasks performed during the workday, such as sanding, scraping, and blasting. After the Occupational Safety and Health Administration standard was passed in 1993 to control lead exposures among construction workers including bridge painters, this study was conducted among 84 bridge painters in the

New England area to determine the significant predictors of blood lead levels. Lead was measured in personal air and hand wipe samples that were collected during the 2-week study period and in blood samples that were collected at the beginning and at the end of the study period. The personal air and hand wipe data as well as personal behaviors (i.e., smoking, washing, wearing a respirator) and work site conditions were analyzed as potential determinants of blood lead levels using linear mixed effects models. Our results show that the mean air lead levels over the 2-week period were the most predictive exposure measure of blood lead levels. Other individual-level significant predictors of blood lead levels included months worked on bridge painting crews, education, and personal hygiene index. Of the site-level variables investigated, having a containment facility on site was a significant predictor of blood lead levels. Our results also indicate that hand wipe lead levels were significantly associated with higher blood lead levels at the end of the study period compared with the beginning of the study period. Similarly, smoking on site and respirator fit testing were significantly associated with higher blood lead levels at the end of the study period. This study shows that several individual-level and site-level factors are associated with blood lead levels among bridge painters, including lead exposure through inhalation and possible hand-to-mouth contact, personal behaviors such as smoking on site, respirator fit testing, and work site conditions such as the use of better containment facilities. Accordingly, reduction in blood lead levels among bridge painters can be achieved by improving these workplace practices.

Sinyai, C. and S. Choi (2020). "Fifteen years of American construction occupational safety and health research." Safety science 131: 104915.

The researchers reviewed construction occupational safety and health research published in high-impact, peer-reviewed academic journals between 2002 and 2016 to assess whether research in the field is efficiently targeted to produce evidence-based interventions addressing the industry's most serious occupational hazards. Unlike most previous surveys of the field, this interdisciplinary literature search captured research published in the construction management and engineering literature as well as that in public health and medicine journals. The researchers found 741 articles by US-based lead authors, with falls the most-studied safety hazard (89 articles) and airborne silica exposure the most-studied health hazard (51), both among the deadliest current hazards in construction occupational safety and health, but much asbestos research was sponsored by companies involved in litigation, generating few findings useful for protecting today's workers. The review described important trends in the literature, including increased attention to noise and hearing loss, a growing number of intervention studies, and greater concern for populations at disproportionate risk (e.g., small/residential, Latino/immigrant, younger/older workers, & women working in construction). The National Institute for Occupational Safety and Health (NIOSH) directly or indirectly funded a majority of the published research. Policymakers should understand that most occupational safety and health research depends on NIOSH funding.

Tak, S., et al. (2008). "Characteristics of US workers whose blood lead levels trigger the medical removal protection provision, and conformity with biological monitoring requirements, 2003-2005." Am J Ind Med 51(9): 691-700.

BACKGROUND: Workers with blood lead levels (BLL) > or =60 microg/dl (50 microg/dl for construction workers) or with three or more consecutive BLLs over at least 6 months that average 50 microg/dl or greater are required to be removed from work involving

lead exposure that exceeds the OSHA action level. This study estimates the proportion of workers with BLLs that trigger the medical removal provision by industry sector, and examines whether workers received appropriate follow-up blood lead testing. METHODS: Three years (2003-2005) of data from the Adult Blood Lead Epidemiology and Surveillance program were analyzed to identify those industries with a high percentage of workers with BLLs that trigger the medical removal provision. Adjusted rate ratios (RR) of adults with such BLLs were estimated by industry sector compared to the battery manufacturing industry using Poisson regression models. RESULTS: Out of 13,724 adults with BLLs > or =25 microg/dl, a total of 533 adults had BLLs that triggered the medical removal provision. RRs of adults with BLLs triggering medical removal were highest for "painting and wall covering contractors" (RR = 22.1) followed by "highway, street and bridge construction" (RR = 14.7), "amusement, gambling, and recreation" (RR = 11.4), and "glass product manufacturing" (RR = 10.1). Overall, 29% of adults with BLLs triggering medical removal received appropriate follow-up blood lead tests and met the eligibility to return to lead work. CONCLUSIONS: These findings suggest that additional efforts are needed to prevent occupational overexposure to lead in adults, and to ensure proper medical management of those workers who meet medical removal criteria.

Tumpowsky, C. M., et al. (2000). "Elevated blood lead levels among adults in Massachusetts, 1991-1995." Public Health Rep 115(4): 364-369.

Objective. Lead poisoning, the oldest recognized occupational disease, remains a danger for children and adults. Data collected for 664 cases reported to the Massachusetts Occupational Lead Registry in 1991-1995 were summarized in a 1998 state report. Here, the authors present some of the key findings from that report for a wider audience. Methods. The authors summarize key findings of the 1998 state report. Findings. Construction workers, in particular licensed deleaders and house painters, accounted for almost 70% of occupational cases involving blood lead levels ≥ 40 micrograms of lead per deciliter (mcg/dl) of blood. Among 100 workers with the highest blood lead levels (≥ 60 mcg/dl), 29% were house painters. Hispanic workers were over-represented in the Registry. A small proportion of cases were non-occupational, typically associated with recreational use of firing ranges or do-it-yourself home renovations. Conclusion. Lead poisoning is a preventable disease, yet these data indicate that additional prevention efforts are warranted.

Virji, M. A., et al. (2009). "Skin and surface lead contamination, hygiene programs, and work practices of bridge surface preparation and painting contractors." J Occup Environ Hyg 6(2): 131-142.

A 2005 regulatory review of the lead in construction standard by the Occupational Safety and Health Administration (OSHA) noted that alternative pathways of exposure can be as significant as inhalation exposure and that noncompliance with the standard pertaining to hygiene facilities and practices was the second most commonly violated section of the standard. Noncompliance with provisions of the standard and unhealthy work and hygiene practices likely increase the likelihood of take-home lead via contaminated clothing, automobiles, and skin, thus contributing to elevated blood lead levels (BLL) among construction workers and their family members. We performed a cross-sectional study of bridge painters working for small contractors in Massachusetts to investigate causes of persistent elevated BLLs and to assess lead exposures. Thirteen work sites were evaluated for a 2-week period during which

surface and skin wipe samples were collected and qualitative information was obtained on personal hygiene practices, decontamination and hand wash facilities, and respiratory protection programs. Results showed lead contamination on workers' skin, respirators, personal automobiles, and the decontamination unit, indicating a significant potential for take-home lead exposure. Overall, the geometric mean (GM) skin lead levels ranged from 373 microg on workers' faces at end of shift to 814 microg on hands at break time. The overall GM lead level inside respirators was 143 microg before work and 286 microg after work. Lead contamination was also present inside workers' personal vehicles as well as on surfaces inside the clean side of the decontamination unit. Review of the respiratory protection programs, work site decontamination and hand wash facilities, and personal hygiene practices indicated that these factors had significant impact on skin and surface contamination levels and identified significant opportunities for improving work site facilities and personal practices. Elevated lead exposure and BLL can be minimized by strict adherence to the OSHA provisions for functioning decontamination and hygiene facilities and healthy personal hygiene practices.

Virji, M. A., et al. (2009). "Task-based lead exposures and work site characteristics of bridge surface preparation and painting contractors." J Occup Environ Hyg 6(2): 99-112.

This study of bridge painters working for small contractors in Massachusetts investigated the causes of elevated blood lead levels and assessed their exposure to lead. Bridge work sites were evaluated for a 2-week period during which personal and area air samples and information on work site characteristics and lead abatement methods were gathered. Short-duration personal inhalable samples collected from 18 tasks had geometric means (GM) of 3 microg/m(3) to 7286 microg/m(3). Full-shift, time-weighted average (TWA) inhalable samples (>or=6 hours) collected from selected workers and work sites had GMs of 2 microg/m(3) to 15,704 microg/m(3); 80% of samples exceeded the permissible exposure limit (PEL) of 50 microg/m(3), on average by a factor of 30. Area inhalable samples collected from three locations ranged from 2 microg/m(3) to 40,866 microg/m(3) from inside the containment, 2 microg/m(3) to 471 microug/m(3) from a distance of <6 meters, and 2 microg/m(3) to 121 microg/m(3) from >6 meters from the containment. Seventy nine percent of the area samples from inside the containment exceeded the PEL on average by a factor of 140. Through observations of work site characteristics, opportunities for improving work methods were identified, particularly the institution of engineering controls (which were only occasionally present) and improvement in the design and construction of the containment structure. The high levels of airborne lead exposures indicate a potential for serious exposure hazard for workers and environmental contamination, which can be mitigated through administrative and engineering controls. Although these data were collected over 10 years ago, a 2005 regulatory review by the Occupational Safety and Health Administration (OSHA) of its lead in construction standard reported that elevated lead exposures and blood lead levels, high occurrence of noncompliance with the lead standard, and nonimplementation of newer technology especially among small painting firms employing <10 workers are still widespread. As a result, the findings of this study are still quite germane even a decade after the introduction of the new OSHA standard.

Vork, K. L., et al. (2001). "Prevention of lead poisoning in construction workers: a new public health approach." Am J Ind Med 39(3): 243-253.

BACKGROUND: In 1990, Yale University, the Connecticut Departments of Health Services and of Transportation, the Connecticut Construction Industries Association, and the state's construction trade unions created the Connecticut Road Industry Surveillance Project (CRISP). METHODS: Data from 90 bridge projects from 1991 to 1995 and approximately 2,000 workers were evaluated. The distribution of peak lead concentrations in the blood for CRISP workers classified into five groups were compared to that from workers outside of Connecticut. RESULTS: This demonstration project was instrumental in lowering bridge worker blood lead levels. After 1992, only the painting contract employees experienced peak blood lead levels with < or = 2% exceeding 50 microg/dl. Compared to similar workers in other states, Connecticut workers had significantly lower peak blood lead levels. CONCLUSIONS: Two thousand workers and over 120 contractors benefited directly from CRISP. Two key features of the CRISP model differed from the 1993 OSHA standard: a contract-specified lead health protection program and a centralized system of medical monitoring. These differences may account for the improved protection observed between the CRISP and non-Connecticut cohorts.

Weisskopf, M. G., et al. (2004). "Cognitive deficits and magnetic resonance spectroscopy in adult monozygotic twins with lead poisoning." Environ Health Perspect 112(5): 620-625.

Seventy-one-year-old identical twin brothers with chronic lead poisoning were identified from an occupational medicine clinic roster. Both were retired painters, but one brother (J.G.) primarily removed paint and had a history of higher chronic lead exposure. Patella and tibia bone lead concentrations measured by K-X-ray fluorescence in each brother were 5-10 times those of the general population and about 2.5 times higher in J.G. than in his brother (E.G.). Magnetic resonance spectroscopy (MRS) studies examined N-acetylaspartate:creatine ratios, a marker of neuronal density. Ratios were lower in J.G. than in his brother. Scores on neurocognitive tests that assess working memory/executive function were below expectation in both twins. Short-term memory function was dramatically worse in J.G. than in his brother. These results demonstrate some of the more subtle long-term neurologic effects of chronic lead poisoning in adults. In particular, they suggest the presence of frontal lobe dysfunction in both twins, but more dramatic hippocampal dysfunction in the brother with higher lead exposure. The MRS findings are consistent with the hypothesis that chronic lead exposure caused neuronal loss, which may contribute to the impairment in cognitive function. Although a causal relation cannot be inferred, the brothers were genetically identical, with similar life experiences. Although these results are promising, further study is necessary to determine whether MRS findings correlate both with markers of lead exposure and tests of cognitive function. Nevertheless, the results point to the potential utility of MRS in determining mechanisms of neurotoxicity not only for lead but also for other neurotoxicants as well.

Zhu, J., et al. (2012). "Worker lead poisoning during renovation of a historic hotel reveals limitations of the OSHA lead in construction standard." J Occup Environ Hyg 9(9): D167-171.

Worker lead poisoning during renovation of a historic hotel reveals limitations of the OSHA lead in construction standard. Short duration tasks can escape triggers for action, because exposures are not reported until after the task is complete.

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