: 4510-26-P

DEPARTMENT OF LABOR

29 CFR Parts 1910 and 1926

Docket No. OSHA-2018-0004

RIN 1218-AD10

Advance Notice of Proposed Rule Making (ANPRM) – Blood Lead Level for Medical Removal

AGENCY: Occupational Safety and Health Administration (OSHA), Labor

ACTION: Advance Notice of Proposed Rulemaking (ANPRM).

SUMMARY: OSHA is considering rulemaking to revise its standards for occupational exposure to lead based on medical findings since the issuance of OSHA's lead standards that adverse health effects in adults can occur at Blood Lead Levels (BLLs) lower than the medical removal level (≥ 60 µg/dL in general industry, ≥ 50 µg/dL in construction) and lower than the level required under current standards for an employee to return to their former job status (< 40 µg/dL).[1] The agency is seeking input on reducing the current BLL triggers in the medical surveillance and medical removal protection provisions of the general industry and construction standards for lead. The agency is also seeking input about how current ancillary provisions in the lead standards can be modified to reduce worker BLLs.

DATES: Submit comments on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

[1] OSHA's standard for lead in general industry expresses blood lead in units of µg/100g of whole blood. The standard for lead in construction expresses blood lead in units of µg/dL, which the agency explained is essentially equivalent to µg/100g of whole blood (29 CFR 1926.62, Appendix A, II.B.3: *Health Protection Goals of the Standard).* For simplicity, this ANPRM expresses blood lead in units of µg/dL throughout.

ADDRESSES: You may submit comments and attachments, identified by Docket No. OSHA-2018-0004, electronically at *www.regulations.gov*, which is the Federal e-Rulemaking Portal. Follow the instructions online for making electronic submissions.

Instructions: All submissions must include the agency's name and the docket number for this ANPRM (Docket No. OSHA-2018-0004). When uploading multiple attachments into Regulations.gov, please number all of your attachments because *www.regulations.gov* will not automatically number the attachments. For example, Attachment 1 - title of your document, Attachment 2 - title of your document, Attachment 3 - title of your document, etc. When submitting comments or recommendations on the issues that are raised in this ANPRM, commenters should explain their rationale and, if possible, provide data and information to support their comments or recommendations. Wherever possible, please indicate the title of the person providing the information and the type and number of employees at your worksite.

All comments, including any personal information you provide, will be placed in the public docket without change and will be publicly available online at *www.regulations.gov*. Therefore, OSHA cautions commenters about submitting information they do not want to be made available to the public or submitting materials that contain personal information (either about themselves or others) such as Social Security Numbers and birthdates.

Docket: To read or download comments or other material in the docket, go to Docket No. OSHA-2018-0004 at *www.regulations.gov.* All comments and submissions are listed in the *www.regulations.gov* index; however, some information (e.g., copyrighted material) is not publicly available to read or download through that website. All submissions, including copyrighted material, are available for inspection at the OSHA Docket Office. Documents submitted to the docket by OSHA or stakeholders are assigned document identification numbers (Document ID) for easy identification and

retrieval. The full Document ID is the docket number plus a unique four-digit code. OSHA is identifying supporting information in this ANPRM by author name and publication year, when appropriate. This information can be used to search for a supporting document in the docket at *https://www.regulations.gov.* Contact the OSHA Docket Office at 202-693-2350 (TTY number: 877-889-5627) for assistance in locating docket submissions.

FOR FURTHER INFORMATION CONTACT:

Press Inquiries: Contact Frank Meilinger, Director, Office of Communications, U.S. Department of Labor; telephone (202) 693-1999; email *meilinger.francis2@dol.gov*.

General and technical information: Contact Andrew Levinson, Acting Director, Directorate of Standards and Guidance, U.S. Department of Labor; telephone (202) 693-1950; email *Levinson.andrew@dol.gov*.

SUPPLEMENTARY INFORMATION: The Supplementary Information section follows this outline:

Table of Contents

I. Background
- A. Events Leading to this Action
- B. Industry Profile Information
- C. Health Effects of Lead Exposure

II. Request for Input
- A. Blood Lead Triggers for Medical Removal Protection
- B. Medical Surveillance Provisions
- C. Permissible Exposure Limit (PEL)
- D. Personal Protective Equipment (PPE), Hygiene, and Training
- E. Safe Harbor Compliance Protocols
- F. Environmental Effects
- G. Duplicative, Overlapping, or Conflicting Rules
- H. Questions for Employers on Current Practices

I. Background

A. Events Leading to this Action

OSHA's lead standard for general industry (29 CFR 1910.1025), adopted in 1978, established a permissible exposure limit (PEL) airborne concentration of 50 $\mu g/m^3$ averaged over an 8-hour period and was based on consideration of health effects,

feasibility issues, and the goal to keep BLLs below 40 µg/dL for the majority of workers occupationally exposed to lead (43 FR 54191). During approximately the same time-frame, the United States Congress enacted a law to provide Federal financial assistance to help cities and communities eliminate the causes of lead-based paint poisoning and detect and treat incidences of lead poisoning (Pub. L., 91-695; 42 USC Ch. 63). Additionally, the Consumer Products Safety Commission (CPSC) implemented regulations prohibiting lead from most consumer products and banned lead from residential paint (16 CFR 1303). The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD) enacted rules to reduce human and environmental exposure to lead (24 CFR 35; 40 CFR 80; 40 CFR 745).

In 1992, OSHA promulgated an interim final rule for lead exposure in construction (29 CFR 1926.62) as required by Title X of the Housing and Community Development Act of 1992 (102 Pub. L. 550). This rule amended Subpart D of 29 CFR part 1926 by adding a new section, 1926.62, that lowered the existing lead PEL in construction to 50 µg/m^3 and included ancillary provisions similar to those in the general industry lead standard. OSHA's general industry and construction standards contain medical removal provisions for workers whose BLLs exceed a certain level: in general industry, when a periodic and a follow-up blood test result show BLL ≥ 60 µg/dL, or an average of the last three blood lead tests show BLL ≥50 µg/dL; and in construction, when a periodic and a follow-up blood test result show BLL ≥ 50 µg/dL. These workers must be temporarily removed to a job with exposures at or below the action level (58 FR 26590).

In 1992, the U.S. Congress passed the Workers' Family Protection Act (29 U.S.C. 671a). The Act required the National Institute for Occupational Safety and Health (NIOSH) to report on take-home contamination from workplace chemicals and

substances, including lead.[2] NIOSH found take-home exposure to be a widespread problem (NIOSH, 1995). The report identified workplace measures that are effective in reducing take-home exposure such as changing clothes before going home and leaving soiled clothing at work for laundering, storing street clothes in areas separate from work clothes, showering before leaving work, and prohibiting removal of toxic substances or contaminated items from the workplace, in addition to citing the importance of primary prevention by limiting exposure in the workplace. NIOSH noted that preventing take-home exposure is critical because decontaminating homes and vehicles is not always effective.

In 1996, OSHA implemented a Special Emphasis Program (SEP) for lead in construction (CPL 2.105) in response to documented elevated BLLs in construction workers. The SEP established a mechanism for programmed health inspections of construction sites where lead may be present. In 2001, OSHA implemented a National Emphasis Program (NEP) for lead (CPL 2-0.130). The NEP was implemented to direct OSHA's field inspection efforts to reduce occupational exposures to lead. This ongoing NEP includes general industry, construction, longshoring, and marine terminals. OSHA updated its NEP for lead in 2008 and expanded its targeting in 2013 to include indoor and outdoor firing ranges and recycling industries (OSHA, 2008; OSHA, 2013). In 2007, OSHA completed a Regulatory Flexibility Act Section 610 review and Executive Order 12866 lookback review of 29 CFR 1926.62 Lead in Construction (OSHA, 2007). The agency found that for the hazards associated with lead in the construction industry, a mandatory standard remains necessary to adequately protect employees. The lookback study also concluded that the lead in construction standard has not had negative economic

[2] Take-home lead contamination occurs when lead dust is transferred from the workplace on employees' skin, clothing, shoes, and other personal items to their vehicle and home. Take-home lead can be a chronic source of exposure for workers and exposures to household members (NIOSH 1995).

impacts on business, including small businesses, and therefore remains economically feasible.

Exposure to lead is associated with adverse health effects, including but not limited to effects on the reproductive, cardiovascular, neurological, respiratory, and immune systems. Since promulgation of OSHA's lead standards, extensive research has been published indicating adverse health effects in adults at lower levels than had been previously documented (see, e.g., AOEC 2007; NTP 2012; ATSDR 2020; ACGIH 2013; EPA 2013). A variety of public health and government organizations have developed recommendations or revisions to standards to more stringently limit occupational exposures to lead and manage the effects of exposure in exposed workers. In 2007, the Association of Occupational and Environmental Clinics (AOEC) published guidelines for medical management of lead exposed adults (with special emphasis on those exposed to lead at work). The recommendations included: clinical assessment with detailed medical, occupational, and environmental history, physical exam, BLL determination, and other labs (CBC, BUN, Creatinine, Urine Analysis, EP); medical surveillance with follow-up BLL; and medical management with evaluation of exposures and risk factors, family and social context, and consideration for potential removal from exposure (AOEC, 2007). In 2016, the American College of Occupational and Environmental Medicine (ACOEM) released a Position Statement on Workplace Lead Exposure recommending revisions to OSHA's AL and PEL; workplace hygiene requirements; medical surveillance and medical removal protection provisions; and introduction of surface lead dust requirements (ACOEM 2016, p. e371). The Department of Defense (DOD) commissioned the National Research Council (NRC) to conduct a study to determine whether current OSHA exposure standards used on firing ranges are protective. The committee concluded that the current OSHA standard of a BLL of under 40 μg/dL is not sufficiently protective of personnel who have repeated lead exposures on firing ranges

(NRC, 2013). DOD subsequently lowered the medical removal triggers for BLLs in military and civilian DOD personnel. DOD's medical removal is based on BLLs at or greater than 20 µg/dl, and employee return to work when BLL is at or below 15 µg/dL (DOD, 2018, p. 55; Table C4.T2, pp. 57-61). In 2018, NIOSH published a Request for Information (RFI) indicating NIOSH's intent to update its recommended exposure limit (REL) for inorganic lead and to develop updated recommendations for handling of inorganic lead and medical surveillance in the workplace (NIOSH 2018).

Several states have initiated updates to their occupational lead standards. In 2018 Michigan OSHA's State Plan (MIOSHA) in the Michigan Department of Licensing & Regulatory Affairs revised its lead standards for general industry and construction. The revisions included changing the BLL at which an employee is required to be removed from lead exposure, previously 50 µg/dL, to 30 µg/dL for both standards. In addition, the BLL at which an employee may be returned to work involving lead exposure was changed from < 40 µg/dL to 15 µg/dL in both standards. MIOSHA also removed a previous requirement to analyze for the zinc protoporphyrin (ZPP) level. MIOSHA's revisions followed recommendations developed by a group of stakeholders over the course of meetings held in 2017 and 2018. The group's proposed revisions to the occupational standards were the subject of public hearings in August 2018 and became effective in December 2018 (MOEMA 2019, p. 8). Michigan's revisions did not alter the PEL for lead.

The California Department of Public Health (CDPH) Occupational Lead Poisoning Prevention Program made recommendations for revisions to the California OSHA (Cal/OSHA) lead standards for general industry in 2010 and construction in 2011, including recommendations to lower the BLLs for medical removal and return to former job status; require more frequent BLL testing; broaden the provision and notification processes for BLL testing for exposed workers; and lower the 8-hour time-weighted

average (TWA) PEL (CDPH, 2010; CDPH, 2011). CDPH's recommendation for lowering the PEL was based on a report produced by the California Environmental Protection Agency (Cal/EPA, Office of Environmental Health Hazard Assessment (OEHHA)) that used an updated physiologically-based pharmacokinetic (PBPK) model to characterize the relationship between air lead levels and BLLs (OEHHA, 2014).

Cal/OSHA has held advisory meetings to discuss potential changes to its lead standards and has published a discussion draft of possible amendments to the existing regulations in general industry and construction operations. California's most recent discussion draft includes a medical removal level of 30 μg/dL for a single test result; or when the last two monthly blood lead tests are ≥ 20 μg/dL; or when the average of the results of all blood lead tests conducted in the last 6 months is at or above 20 μg/dL of whole blood. The discussion draft includes a return to former job status when two consecutive blood lead tests are ≤ 15 μg/dL. The discussion draft also includes a reduction in the PEL from 50 $\mu g/m^3$ to 10 $\mu g/m^3$ and the AL from 30 $\mu g/m^3$ to 2 $\mu g/m^3$, among other changes. The discussion draft and related documents are available at https://www.dir.ca.gov/dosh/DoshReg/5198Meetings.htm.

Washington State Department of Labor & Industries, Division of Occupational Safety and Health (Washington DOSH), is also developing a variety of updates to Washington State's occupational lead standards. In 2012, Public Health - Seattle and King County (PHSKC) petitioned the Washington State Department of Labor & Industries to update the occupational lead standards, including the BLLs for medical removal and return to former job status; the AL and PEL; and provisions for protective clothing, hygiene, medical surveillance, training, and education. Washington DOSH has proposed lowering its medical removal BLL to ≥ 30 μg/dL for a single test result, ≥ 20 μg/dL for multi-test results, and a return to former work status BLL of < 15 μg/dL. Washington DOSH has also proposed a reduction in the PEL from 50 $\mu g/m^3$ to 20 $\mu g/m^3$,

among other changes to the lead standard. Washington DOSH's stakeholder review draft (2019) and other information related to its stakeholder meetings on the lead rule revision process are available at *https://lni.wa.gov/safety-health/safety-rules/rulemaking-stakeholder-information/sh-rules-stakeholder-lead*.

OSHA is also considering revisions to its lead standards. Through this ANPRM, OSHA seeks input on the BLL triggers used for medical removal and return to work status. The agency also requests information on other potential changes to the current standards to reduce the risk of adverse health effects from occupational lead exposure.

B. Industry Profile Information

In accordance with OSHA's intent to assess the potential impacts of revising blood lead triggers for medical removal protection, the agency made preliminary estimates of the annual number of firms, by industry, expected to have workers with elevated BLLs. For these estimates, OSHA used the reporting levels in CDC's Adult Blood Lead Epidemiology and Surveillance (ABLES) dataset of 5 µg/dL, 10 µg/dL, and 25 µg/dL, and OSHA's lead standards' medical removal levels (50 µg/dL for construction and 60 µg/dL for general industry).

OSHA identified the industry sectors associated with lead exposure as those found in the ABLES dataset. This dataset shows that the national prevalence rate of BLLs ≥10 µg/dL for adults declined from 26.6 adults per 100,000 employed in 2010 (among 37 reporting states) to 15.8 in 2016 (among 26 reporting states). For context, the geometric mean BLL for all adults in the US (including workers) was 0.855 µg /dL in 2018 (HHS, 2022). Historically, in the U.S., most lead exposures among adults have been occupational. Among the 11,695 adults with known lead exposures at BLL of ≥10 µg/dL in 2016, 90.3% had occupational exposures. The majority of these adults were employed

in four main industry sectors: manufacturing, construction, services, and mining (NIOSH, 2016).

To help inform the rulemaking process, OSHA contracted with Abt Associates to generate preliminary estimates of the number of establishments and cases across all states at the ABLES reporting levels of 5 µg/dL, 10 µg/dL, 25 µg/dL, and the lead standards' medical removal levels (50 µg/dL for construction and 60 µg/dL for general industry). The first step was to identify industry sectors associated with lead exposure by 4-digit NAICS that were identified in a 2017 CDPH report (Payne, 2017), industries identified by OSHA in the personal sampling data reported by the OSHA Information System (OIS) (OSHA, 2020a), and industries with violations of lead exposure medical surveillance requirements in the last 10 years of OSHA inspections and violations (OSHA, 2020b; OSHA, 2020c). To estimate the number of workers with BLLs at or above each ABLES reporting level and the OSHA standards' medical removal levels by NAICS, BLL data from the ABLES program and the CDPH Occupational Blood Lead Registry for the years 2012-2014 and 2015-2018 (Payne, 2017; CDPH, 2020a; CDPH, 2020b) were pooled. Because ABLES data are limited to those states that report testing results to ABLES, the next step was to use U.S. Census data to extrapolate a preliminary estimate of the national number of cases from the ABLES state data. The method and results are described in full in the memorandum entitled *Estimated Number of Work-Related BLL Cases and Firms* (Abt Associates, 2021). This memorandum includes a table that provides the number of firms with preliminary BLL estimates at or above the relevant levels (the ABLES reporting levels and the OSHA standards' medical removal levels) and a table that provides the number of workers with preliminary BLL estimates at or above the relevant levels; the preliminary BLL estimates are presented by industry. In Appendix A at the end of this ANPRM, Table 1 "Summary of Annual Number of Firms with BLL Tests and Cases" presents the estimated number of firms where employees

received test results that were at or above each ABLES reporting level and the OSHA standards' medical removal levels.

Of 44,144 firms where employee BLLs are tested, 8,611 firms were estimated to have recorded BLLs equal to or above 5 μg/dL, while 2,087, were estimated to have recorded BLLs at or above 25 μg/dL; only 137 firms were estimated to have baseline BLL cases annually resulting in medical removal protection under OSHA's existing requirements (BLLs greater than or equal to 50 and 60 μg/dL for construction and general industry, respectively).

This preliminary analysis shows that, among all affected employers, approximately 44 percent of firms where employee BLL is tested are in five industry groups: NAICS 7139: Other Amusement and Recreation Industries (6,656 firms); NAICS 3272: Glass and Glass Product Manufacturing (5,156 firms); NAICS 8111: Automotive Repair and Maintenance (3,333 firms); NAICS 2383: Building Finishing Contractors (2,746 firms); and NAICS 5629: Remediation and Other Waste Management Services (1,663 firms). OSHA requests public input on the agency's preliminary profile of affected industries, in particular the list of affected NAICS industries and the estimated number of firms that have workers with BLLs at or above the selected thresholds.

C. Health Effects of Lead Exposure

Exposure to lead is associated with adverse health effects, including but not limited to effects on the reproductive, cardiovascular, neurological, respiratory, and immune systems. As highlighted by a National Research Council report (NRC, 2013), lead has been shown to have both acute and chronic toxic effects, affecting virtually every organ and system in the body (ATSDR, 2020). Since OSHA's lead standard for general industry was promulgated, BLLs in the general adult population have declined from an overall mean blood-lead level of 15.8 μg/dL (1976-1980) to 0.855 μg/dL in

2018, primarily reflecting the decrease in lead used in gasoline production, as well as the removal of lead from consumer paint (CDC, 1982; HHS, 2022, p. 212; ATSDR, 2020, p. 2). However, extensive research has emerged indicating that adverse health effects can occur in adults with lower BLLs than was previously recognized (ATSDR, 2020; ACGIH, 2013; CDPH, 2009 and 2013; EPA, 2013; NTP, 2012). For example, BLLs as low as 5 µg/dL have been associated with impaired kidney and reproductive function, high blood pressure, and cognitive effects attributed to prenatal exposure. Poorer performance on neurocognitive and neuropsychologic assessments were observed in adults with BLLs as low as 5-19 µg/dL compared with adults with BLLs below 5 µg/dL (Kosnett, 2007, pp. 464, 466; EPA, 2013, pp. 4-311 – 4-313, 2013; NTP, 2012, pp. 19-42). While there is also evidence of adverse health effects in adults with BLLs below 5 µg/dL, those are not discussed in OSHA's literature review (please see ATSDR, 2020). Table 1 provides an overview of the adverse health effects associated with adult lead exposure, including the effects of exposure on pregnant workers and their developing fetuses, and longer-term effects on children/adolescents exposed in utero to lead.

Table 1: Overview of Adverse Health Effects Associated with Exposure to Lead in Adults

Health Effect	**Descriptive Detail of Health Effect**	
Reproductive and Developmental[3]	Reduced fertility, low sperm mobility, increased risk of miscarriage. Effects on developing fetus due to lead exposure in utero - decreased birth size, adverse effects on developing brain, kidney, nervous system, cognitive and learning disabilities, decreased child growth, delayed onset puberty	
Vascular/Cardiovascular	Hypertension	Increased systolic and/or diastolic pressure, stroke, heart disease
	Cerebrovascular	Stroke
	Cardiac/cardiovascular	Heart disease, atherosclerosis, altered cardiac conduction
Hematological	Heme synthesis (interference with iron uptake), anemia, altered levels of plasma erythropoietin	

[3] For more information on pregnancy and lead exposure please see *https://www.cdc.gov/nceh/lead/publications/leadandpregnancy2010.pdf*

Table 1: Overview of Adverse Health Effects Associated with Exposure to Lead in Adults	
Neurological	Reduced performance on neurocognitive and neuropsychological tests, peripheral neuropathy, psychiatric symptoms (depression, panic disorders, anxiety, hostility, anger, schizophrenia) cognitive decrements, lead intoxication, dementia, hearing loss
Renal	Nephrotoxicity (proximal tubular nephropathy, glomerular sclerosis, interstitial fibrosis, tubular necrosis)
Respiratory	Decreased lung function, increased bronchial hyperreactivity, increased risk of asthma and obstructive lung disease
Endocrine (excluding reproductive)	Alteration of serum thyroid levels (T3, T4, TSH), decreased levels of serum vitamin D
Hepatic	Liver enlargement, increased gall bladder wall thickness, increased total cholesterol
Musculoskeletal	Bone loss, increased bone metabolism/turnover, adverse periodontal and dental effects
Gastrointestinal	Constipation, colic, abdominal cramps
Body weight	Decreased body mass index (BMI) in adolescents and adults
Immunological	Decreased complement, changes in indicators of inflammation (monocytes, macrophages, neutrophils) and cell-mediated immunity (T cells, natural killer cells)
Cancer	Lung, stomach, kidney, and brain cancer

Based on information contained in ATSDR, 2020

1. Routes and Kinetics of Lead Exposure.

Lead exposures in adults above background or baseline levels are typically associated with occupational exposures. Background or baseline levels occur from incidental exposures through ambient air, foods, drinking water, soil, and dust and result in an average BLL for adults of 0.855 µg/dL (geometric average) (ATSDR, 2020; HHS, 2022). Occupational exposure to lead can occur through inhalation, oral, and/or dermal routes (EPA, 2013 pp. 7-18; NAS, 2013, pp. 9, 15-17, 47). The Agency for Toxic Substances and Disease Registry (ATSDR) has stated that all the health effects discussed here can result from all three of these routes of exposure (ATSDR, 2020).

Lead accumulates in the body with continued or chronic exposure (ATSDR, 2020; AOEC, 2007; EPA, 2013; NTP, 2012; Shih, 2007). In adults, 90 percent of lead is stored in bone, with only 1 percent in blood (EPA, 2013, pp. 4-324 – 4-326). Lead can be

released from bone to blood and other soft tissues over time. In particular, lead can be mobilized from bone even after removal from occupational exposure; after use of chelation therapy to reduce BLLs; during age-related bone loss, especially menopause and osteoporosis; and during pregnancy and lactation (EPA, 2013; NTP, 2012). Because lead is retained in the bones and can be released into the bloodstream over time, it is difficult to predict individuals' BLLs from their recent external exposures (NAS, 2013; ATSDR, 2020).

Multiple factors can influence the toxico- and pharmacokinetics of lead in the body, including genetic polymorphisms, nutrition and diet, smoking, gender, and age (NAS, 2013). California OEHHA developed a pharmacokinetic model which indicated that when BLLs during the working lifetime (characterized in the model as 40 hours per week over a 40-year working life) are maintained below 20 µg/dL, medical removal is expected to result in a fairly rapid decline to a BLL of 15 µg/dL, which was selected as an acceptable BLL for the purposes of the model (OEHHA, 2014, pp. 3-4). For example, the 95th percentile worker[4] removed after forty years of exposure with a BLL of 20 µg/dL would be expected to decline to 15 µg/dL within ten weeks. If BLLs are allowed to reach the 50 µg/dL currently allowed under OSHA standards, the California OEHHA model estimates that medical removal periods greater than 18 months would be generally necessary to reduce BLLs to 15 µg/dL, even among workers with only one year of occupational exposure (OEHHA, 2014, pp. 3-4).

Table 2 highlights some of the adverse health effects associated with various BLLs. While these findings are based on clinical assessments from comprehensive reviews, they do not necessarily represent strict threshold values as certain health endpoints may manifest at lower or higher levels in some individuals or groups.

[4] The phrase '95th percentile worker' in this context means that ninety five percent of the workers removed from lead exposure after a 40-year work life of lead exposure resulting in a BLL of 20 µg/dL would be expected to take 10 weeks for their BLLs to decline 5 µg/dL to 15 µg/dL.

Table 2: Overview of Health Effects Associated with Elevated BLL in Adults	
BLL (µg/dL)	Health Effects
5-10	Acute decrease in renal function Elevated blood pressure Altered heme synthesis Impaired neurocognitive and neuropsychological assessment Developmental effects (e.g., decreased cognitive and reduced birthweights) – fetuses exposed to lead in utero through pregnant worker lead exposure
10-20	Spontaneous abortion (miscarriage) Hypertension Decreased renal function Decreased platelet count Decreased blood hemoglobin
20-40	Headache Fatigue Anemia Sleep disturbance Anorexia Bowel changes Arthralgia Myalgia Decreased libido Personality changes
40-60	Sperm effects (decreased number and function) Subclinical peripheral neuropathy Altered red blood cell function Renal damage Cognitive dysfunction
60-80	Hemolytic anemia Renal failure Stroke
Above 80	Central Nervous System (CNS) effects Nephropathy Gout Hearing loss Encephalopathy

Adapted from AOEC, 2007. For additional resources please also see: *NTP Monograph on Health Effects of Low-Level Lead*, available at *https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead_newissn_508.pdf*.

2. Medical Surveillance and Management for Elevated Blood Lead.

A comprehensive medical surveillance program can be an invaluable tool in assessing the healthfulness of a workplace. Medical surveillance incorporates a systematic assessment of employees' health through medical monitoring and management practices (NIOSH, 2018). OSHA included a medical surveillance provision

in the 1978 lead standard in part to mitigate some of the most detrimental effects of lead exposure to workers. However, since OSHA promulgated the standard, much more has become known regarding acute and chronic exposures (especially at low levels) and susceptible populations.

Measurement and Management of Blood Lead Levels (BLLs).

OSHA, as well as a number of agencies and public health groups state that the BLL is the best method available to monitor lead exposure (1910.1025, Appendix C; ACOEM 2016, p. e372; AOEC 2007, p. 4; CDPH 2009, p. 4; CSTE 2015, p. 2). OSHA and others have noted that BLL is generally a good indicator of current or recent external lead exposure; however, it is not necessarily correlated with total body burden of lead or cumulative exposure (29 CFR 1910.1025, Appendix C; AOEC 2016, pp. 4-7; CDPH 2009, p. 4; NAS 2013, pp. 48-56). This is because, over time, a high percentage of lead is deposited in bone, and after exposure ends, mobilization from bone occurs very slowly. As a result, a high BLL may represent a high recent exposure without an excess of total body burden, and a low BLL does not necessarily mean that total body burden is low (29 CFR 1910.1025). For long-term, long-latency, or cumulative exposures, lead body burden is generally considered the most adequate method (NAS 2013, p. 64). Lead body burden can be measured using x-ray fluorescence techniques but such methods are currently not widely or readily available (ACOEM 2016, p. e372; CSTE 2015, p. 2).

Medical management guidelines for adult lead exposure were developed by a national expert panel coordinated by the Association of Occupational and Environmental Clinics (AOEC 2007, pp. 5-9, 13), in collaboration with the ABLES program. The authors recommend that maintaining BLLs below 20 µg/dL over a twenty-year period, or under 10 µg/dL over a forty-year period, would be sufficient to prevent chronic effects associated with adult lead exposure. They further recommend maintaining BLLs below 20 µg/dL in order to prevent recognized acute health effects (Schwartz and Hu, 2007).

ACOEM states that the most compelling evidence for adverse health effects occurs at moderate levels of blood lead ranging from 10 to 20 μg/dL (ACOEM 2016, p. 1). In the context of general population screening, the CDC recommends adult BLLs (persons ≥ 16 years of age) from a venous blood specimen of ≥ 5 μg/dL be considered for case classification for the purposes of medical surveillance (CDC 2016, p. 260); ABLES uses 5 μg/dL to indicate an elevated BLL for surveillance purposes (ABLES, 2021). NIOSH additionally provides a reference guide to BLL regulations and recommendations (ABLES, 2021).

The following sections outline the current medical management and monitoring practices required under OSHA's lead standards, in order to contextualize OSHA's later questions regarding possible changes to these requirements in Section II, Request for Input.

Methods for Monitoring Blood Lead Levels in OSHA's Standards.

OSHA's lead standards do not specify a particular method for analyzing BLL but require that the method of sampling and analysis used is accurate to plus or minus 15 percent or 6 μg/100 ml, whichever is greater (to a 95 percent confidence level). The general industry standard once required the analysis to be conducted by a laboratory licensed by the CDC or which has received a satisfactory grade in blood lead proficiency testing from the CDC within the previous 12 months (per 29 CFR 1910.1025(j)(2)(iii)), but now allows testing to be conducted in a CLIA compliant laboratory (OSHA, 2018).[5] The construction standard requires the analysis to be conducted by a laboratory approved by OSHA (29 CFR 1926.62(j)(2)(iii)). The medical surveillance guidelines in Appendix

[5] In a memorandum to OSHA Regional Administrators, the agency specified that in lieu of approval by OSHA or CDC, the agency will accept the use of a blood lead analysis laboratory that has been approved under the U.S. Department of Health and Human Services (HHS), Centers for Medicare and Medicaid Services (CMS), blood lead laboratory monitoring system pursuant to the Clinical Laboratory Improvement Amendments (CLIA) regulations, 42 CFR Part 493 (OSHA 2018).

C of OSHA's lead standards indicate that any method that meets the accuracy specified by the standards can be used to analyze the blood sample.

OSHA's Requirements for Blood Lead and Zinc Protoporphyrin Testing, Worker Notification of Blood Lead Levels, Medical Removal, and Return to Work.

The medical surveillance and medical removal protection provisions in OSHA's lead standards contain BLL triggers for medical removal, return to work status, and employee notification of blood test results. The general industry standard requires employers to institute a medical surveillance program for all employees who are or may be exposed at or above the action level of 30 µg/m^3 for more than 30 days per year (29 CFR 1910.1025(j)). Employers must make biological monitoring in the form of blood lead testing and ZPP levels available to these employees in accordance with the following schedule provided in 29 CFR 1910.1025(j)(2)(i):

- At least every six months to each employee covered under paragraph (j)(1)(i) of the standard;
- At least every two months for each employee whose last blood lead test indicated a BLL at or above 40 µg/dL. This frequency shall continue until two consecutive blood lead tests indicate a BLL below 40 µg/dL; and
- At least monthly during the removal period of each employee removed from exposure to lead due to an elevated BLL.

OSHA's lead standard for construction requires the employer to make blood sampling and analysis for lead and ZPP levels available to employees occupationally exposed on any day to lead at or above the action level (29 CFR 1926.62 (j)(1)(i)). It further requires the employer to institute a medical surveillance program for all employees who are or may be exposed by the employer at or above the action level for more than 30 days in any consecutive 12 months (29 CFR 1926.62 (j)(1)(ii)) and requires employers to provide blood lead testing to employees in the medical surveillance

program at least every two months for the first six months, and every six months thereafter (29 CFR (1926.62 (j)(2)(i)(A)). Furthermore, the employer is required to provide blood lead testing at least every two months for employees covered under (j)(1)(i) or (ii) whose last test indicated a BLL at or above 40 µg/dL, until two consecutive tests show the BLL has declined below 40 µg/dL. And, the standard requires the employer to provide blood lead testing at least monthly during the removal period of each employee removed from exposure to lead due to an elevated BLL (29 CFR 1926.62(j)(2)(i)(C)).

OSHA's general industry standard requires the employer to notify each employee whose BLL is at or above 40 µg/dL within five working days after the receipt of biological monitoring results. OSHA's construction standard requires the employer to notify each employee in writing of their BLL within five working days after the receipt of biological monitoring results, regardless of the BLL detected.

The general industry standard requires an employer to remove an employee from work involving exposure to lead at or above the action level when two consecutive blood lead tests are at or above 60 µg/dL; or when the average of the last three tests (or the average of all tests conducted over the previous six months, whichever period is longer) is at or above 50 µg/dL, with the exception that medical removal is not required if the last test indicates a BLL below 40 µg/dL. It also requires medical removal when a final medical determination concludes that an employee has a medical condition that places the employee at increased risk of material impairment to health from exposure to lead (29 CFR 1910.1025(k)). The construction standard requires an employer to remove an employee from work involving exposure to lead at or above the action level when the employee's BLL is at or above 50 µg/dL for two consecutive tests or a final medical determination concludes that the employee has a medical condition that places the employee at increased risk of material impairment to health from exposure to lead (29

CFR 1926.62(k)). Both standards specify that the employer shall return an employee to the employee's former job status when two consecutive blood sampling tests indicate that the BLL is below 40 µg/dL (29 CFR 1910.1025(k)(1)(iii)(A)(1); 29 CFR 1926.62(k)(1)(iii)(A)(1)).

Zinc Protoporphyrin (ZPP) Testing.

Along with BLLs, ZPP testing is required by OSHA's lead standards as part of its medical surveillance and management plan (29 CFR 1910.1025(j)(2); 29 CFR 1926.62(j)(2)). ZPP is a metabolite found in erythrocytes during hemoglobin synthesis. The zinc in ZPP replaces iron in hemoglobin synthesis during times of iron deficiency. Elevated lead levels in the blood interfere with iron ion transfer, creating a condition similar to iron deficiency, thus elevating zinc in the production of hemoglobin and ZPP.

The clinical utility of ZPP testing to identify elevated BLL is now understood to be limited by several factors:

- *Low sensitivity:* ZPP is generally not elevated until BLLs exceed 25 µg/dL (Kosnett et al 2007, p. 468). Thus, workers may reach harmful BLLs well before the ZPP level registers as abnormal.
- *Low specificity:* ZPP is not specific to lead. In other words, elevated levels of ZPP can be caused by conditions other than blood lead, such as iron deficiency anemia, jaundice, and sickle cell anemia (ATSDR 2020, p. 336). Thus, an elevated ZPP does not always mean that a worker has an elevated BLL.
- *Lag time:* ZPP levels generally lag behind BLLs by two to six weeks (CDPH 2009, p. 4). Thus, a worker may have an elevated BLL while the ZPP level is still within normal range. The reverse is also true; a worker's BLL may begin to decline, while the lagging ZPP level remains elevated (Martin 2004, pp. 589-590). This delay limits the utility of ZPP as a screening or biomonitoring tool.

- *High individual variability:* Individuals with the same BLL can have widely differing ZPP levels (Martin 2004, pp. 588-590). This may be due to differences in individual susceptibility to lead (Grandjean 1991, pp. 111-112) or other factors. However, such variations can complicate interpretation of test results.

Both AOEC and CDPH recommend against routine clinical use of ZPP - unless legally required - for monitoring lead-exposed patients (AOEC, 2007; CDPH 2009, p. 4). Similarly, ATSDR notes that "ZPP is not sufficiently sensitive at lower BLLs and therefore is not as useful a screening test for lead exposure as previously thought" (ATSDR 2007, pp. 232-233). OSHA's enforcement policy currently allows employers to use methods other than the ZPP test for determining lead toxicity. See *www.osha.gov/laws-regs/standardinterpretations/1996-03-04-1*. Due to these issues, OSHA is requesting input on whether to eliminate the requirement for ZPP monitoring (see Section II, Request for Input).

II. Request for Input

This ANPRM seeks input on the following areas: OSHA's triggers for medical removal of workers with elevated BLLs and their return to lead-exposed work; OSHA's requirements for medical surveillance and management of lead-exposed employees; several additional provisions and compliance protocols that are undergoing public review in State Plans' ongoing work to update their occupational lead standards; and the costs and effectiveness of lead exposure identification and control strategies. This Request for Input section includes a series of questions on the OSHA standards' requirements and possible revisions to them, followed by a series of questions on employers' requirements, which may in some cases be more protective than OSHA standards. While the questions pertaining to current requirements are primarily addressed to employers, OSHA will review and consider all information submitted in response to these questions.

This section includes questions about several provisions of OSHA's lead standards that are addressed in recent or proposed changes to State Plan lead standards in Michigan, Washington State, and California. As previously discussed, in January 2019 MIOSHA revised its lead standards for general industry and construction, changing the BLL at which an employee is required to be removed from lead exposure and the BLL at which an employee may be returned to lead exposure. Cal/OSHA has held advisory meetings to discuss a variety of potential changes to its lead standards and has published a draft of possible amendments to the existing regulations in general industry and construction operations.[6,7] Washington DOSH is also developing a variety of updates to DOSH's occupational lead standards.[8] For several lead standard provisions that State Plans have made or proposed changes to, this section describes the changes in the relevant State Plan(s) and requests input on whether similar revisions to federal lead standards should be considered. The State Plan changes and proposals include revisions to state blood lead triggers for medical removal protection and return to work; permissible exposure limits; and several "safe harbor" protocols that employers in certain industries, or who meet specified requirements, may opt to use as alternatives to complying with the main rule.

Several questions in this section also relate to recommendations made by the Association of Occupational and Environmental Clinics (AOEC, 2007) and ACOEM (2016, pp. e371-e372) for updates to OSHA's Lead standards. ACOEM's

---

[6] California's most recent discussion draft and other materials related to the advisory meetings are available at https://www.dir.ca.gov/dosh/DoshReg/5198Meetings.htm.

[7] The California Department of Public Health (CDPH) Occupational Lead Poisoning Prevention Program (OLPPP) made recommendations to Cal/OSHA for revising its General Industry Lead Standard and Construction Industry lead standards for the protection of workers who are exposed to lead on the job, available at https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/LeadStdRecs.aspx.

[8] Washington DOSH's stakeholder review draft (2019) and other information related to its stakeholder meetings on the lead rule revision process are available at https://lni.wa.gov/safety-health/safety-rules/rulemaking-stakeholder-information/sh-rules-stakeholder-lead.

recommendations refer to "significant lead exposure", defined as an airborne or surface lead content known or reasonably anticipated to cause elevated BLL (ACOEM 2016, p. e372, Table 1); and refer to a "lead-exposed worker", defined as "any worker who is handling or disturbing materials with a significant lead content in a manner that could reasonably be expected to cause potentially harmful exposure through lead dust inhalation or ingestion, regardless of airborne lead concentrations or surface contamination levels" (ACOEM 2016, p. e372).

OSHA notes that this ANPRM focuses primarily on medical surveillance/medical removal protection and on state-based innovations. Therefore, it does not request input on every provision OSHA might seek to modernize or otherwise revise in its lead standards through a Notice of Proposed Rulemaking (NPRM) in the future.

When answering the numbered questions below, please label your responses with the number of the question, explain the reasons supporting your views, and identify and provide relevant information on which you rely, including, but not limited to, data, studies, and articles.

A. Blood Lead Triggers for Medical Removal Protection

1. Requirements for Medical Removal.

OSHA's general industry standard for lead requires an employer to remove an employee from work involving exposure to lead at or above the action level (30 μg/m^3) when two consecutive blood lead tests are at or above 60 μg/dL or when the average of the last three tests is at or above 50 μg/dL. OSHA's construction standard requires an employer to remove an employee from work involving exposure to lead at or above the AL when the employee's BLL is at or above 50 μg/dL for two consecutive tests. (See Section I.C, Health Effects of Lead Exposure, for a full description of OSHA's blood lead requirements for Medical Removal Protection (MRP)).

ACOEM has recommended medical removal of workers who have repeat BLLs over 20 μg/dL (measured in four weeks), or if any single BLL exceeds 30 μg/dL (ACOEM 2016, p. e372, Table 1). MIOSHA's 2019 update to Michigan's occupational lead standard changed the BLL at which an employee in general industry or construction is to be removed from lead exposure, previously 50 μg/dL, to 30 μg/dL for both standards. Cal/OSHA's discussion draft includes a medical removal BLL of ≥ 30 μg/dL; when the last two monthly blood lead tests are ≥ 20 μg/dL; or when the average of the results of all blood lead tests conducted in the last six months is at or above 20 μg/dL of whole blood. Washington DOSH's stakeholder review draft would lower its medical removal BLL to ≥ 30 μg/dL for a single test result and ≥ 20 μg/dL for multi-test results for both general industry and construction lead standards. After commissioning the National Research Council (NRC) to conduct a study to determine whether current OSHA exposure standards used on firing ranges are protective (NRC, 2013), DOD lowered the medical removal triggers for BLLs in military and civilian DOD personnel, which previously were aligned with OSHA's standards. DOD's medical removal is now based on BLLs at or greater than 20 μg/dL (DOD, 2018, p. 55; Table C4.T2, pp. 57-61)).

(1) Should OSHA consider changing the BLL at which an employee in general industry or construction is to be removed from lead exposure to match any of the approaches described above? Is there a different BLL trigger for removing a worker from lead-exposed work that you would suggest? Please explain your answer and provide supporting information or data, if available.

2. Requirements for Return to Lead-Exposed Work.

OSHA's lead standards for general industry and construction both specify that the employer shall return an employee to their former job when two consecutive blood-sampling tests indicate that the BLL is below 40 μg/dL.

ACOEM has recommended that return to lead-exposed work should be considered after two BLLs are below 15 µg/dL (ACOEM 2016, p. e372, Table 1). MIOSHA changed the BLL at which an employee may return to lead exposure from below 40 µg/dL to below 15 µg/dL in both general industry and construction. Cal/OSHA's discussion draft would provide that a removed worker may return to former job status when two consecutive blood lead tests are below 15 µg/dL. Washington DOSH's stakeholder review draft similarly includes a return-to-work BLL of below 15 µg/dL for both general industry and construction lead standards. DOD's updated policy provides for employee return to work when BLL is at or below 15 µg/dL (DOD, 2018, p. 55; Table C4.T2, pp. 57-61)).

(2) Should OSHA consider changing the BLL below which an employee shall be returned to lead exposure to 15 µg/dL? Is there a different BLL trigger for returning a worker to lead-exposed work following medical removal that you would suggest? Please explain your answer and provide supporting information or data, if available.

B. Medical Surveillance Provisions

1. Medical Examination and Consultation Requirements.

OSHA's lead standards require employers to make a full medical examination and consultation available to an employee: (1) before the first assignment to an area that has lead at or above the action level; (2) at least once a year for an employee who had a BLL of 40 µg/dL or over at any time during the preceding 12 months; and (3) as soon as possible on notification by an employee that they have developed signs or symptoms of lead intoxication, desire medical advice concerning the effects of lead (past or current) and the ability to procreate a healthy child, or who has difficulty in breathing during respirator fit test or use. In addition, an examination must be made available as medically appropriate for each employee either removed from exposure to lead due to a risk of

sustaining material impairment to health, or whose lead exposure is otherwise limited based on a final medical determination.

For the purposes of the lead standard, a full medical examination includes: (1) a detailed work and medical history; (2) a thorough physical examination; (3) measurement of blood pressure; (4) analysis of BLL, hemoglobin and hematocrit, erythrocyte indexes, peripheral smear morphology, zinc protoporphyrin (ZPP), blood urea nitrogen and creatinine, and urinalysis with microscopic examination; and (5) any other tests that a physician thinks are appropriate, including a pregnancy test or laboratory evaluation of male fertility if requested by the employee.

(3) Are these still appropriate tests or should a full medical examination include any other tests? OSHA is also requesting comment on the appropriateness of including the ZPP given its limitations (see also Section #6, "ZPP", below).

2. Triggers for Routine Blood Lead Monitoring.

OSHA's lead standards require the employer to institute a medical surveillance program, including blood lead testing prior to lead exposure and at regular intervals thereafter, for employees who are or may be exposed to airborne lead at or above 30 $\mu g/m^3$ for more than 30 days per year.

Airborne Lead Exposure Trigger for Blood Lead Monitoring.

The Washington DOSH stakeholder review draft would require employers to provide ongoing blood lead monitoring for employees exposed to lead for more than 10 days per year, including any day with airborne exposure totaling 10 $\mu g/m^3$ as an 8-hour TWA or greater or any day with a task lasting 30 minutes or more that involves exposure above 20 $\mu g/m^3$. Cal/OSHA's discussion draft would require employers to institute a medical surveillance program, including blood lead testing, for employees who are or may be exposed at or above a revised action level of 2 $\mu g/m^3$ for 10 or more days per year.

(4) Should OSHA consider expanding its criteria for blood lead monitoring to resemble the ongoing blood lead monitoring criteria that Washington DOSH and/or Cal/OSHA is considering? Are there different criteria you would suggest? Please explain your answers.

Additional Triggers.

In OSHA's lead standards, worker eligibility for blood lead monitoring is based solely on airborne lead exposure criteria. In contrast, the Washington DOSH stakeholder review draft would require employers to provide ongoing blood lead monitoring for employees exposed at or above any action level for more than 10 days per year, including any day involving a combined total of at least one hour of: (1) activity disturbing or touching metals containing 20 percent or more lead (by weight); (2) activity disturbing non-metals containing 0.5 percent or more lead by weight; (3) creating aerosols or fumes from materials containing 0.1 percent or more lead by weight; or (4) work in areas with surfaces at a "Surface Action Level" of 1000 μg/dm^2 (equivalent to 9290 μg/ft^2).[9]

Cal/OSHA's discussion draft includes a requirement that employers must institute a medical surveillance program, including blood lead testing, for employees who perform a "trigger amount of lead work", defined as altering or disturbing material that is known or reasonably anticipated to contain at least 0.5 percent lead by weight, or torch cutting any scrap metal, for a combined total of at least 8 hours during any 30-day period.

In addition, ACOEM has recommended that BLL be measured routinely for all lead workers, where a "lead-exposed worker" is defined as "any worker who is handling or disturbing materials with a significant lead content in a manner that could reasonably be expected to cause potentially harmful exposure through lead dust inhalation or

[9] See *Surface Sampling and Material Content Requirements* below for percentage and contamination specifications. The Washington DOSH Stakeholder Review Draft states that "work is timed from beginning the contact or disturbance activity to the time when the worker accesses washing facilities where personal protective equipment can be doffed properly and the worker can thoroughly wash off lead contamination."

ingestion, regardless of airborne lead concentrations or surface contamination levels" (ACOEM 2016, p. e372).

(5) Should OSHA consider adding criteria other than airborne lead exposure to its requirements for blood lead testing, such as contact with lead-contaminated surfaces, disturbance of lead-containing materials or direct contact with high-percentage lead materials? In particular, should OSHA consider adopting criteria based on contact with lead-contaminated surfaces, disturbance of lead-containing materials, or contact high lead-content metals, as Washington DOSH's stakeholder review draft and Cal/OSHA's discussion draft contemplate? Please explain your answer.

3. Frequency of Blood Lead Monitoring.

OSHA's lead standard for general industry requires employers to provide blood lead testing to employees in the medical surveillance program at least every six months, with the following exceptions: (1) every two months if a previous BLL was at or above 40 µg/dL of whole blood, until two consecutive results are below 40 µg/dL and (2) at least monthly during the removal period of each employee removed from exposure to lead due to an elevated BLL.

For those employees who are in the medical surveillance program because they are or may be exposed to airborne lead at or above the action level (30 $\mu g/m^3$) for more than 30 days in any consecutive 12 months, OSHA's lead standard for construction requires the employer to provide blood lead testing at least every two months for the first six months, and every six months thereafter. In addition, for employees who were exposed on <u>any</u> day to lead at or above the action level, and for employees who have been exposed to lead at or above the action level for more than 30 days in a 12 month period ***<u>and</u>*** whose last blood sample indicated a BLL at or above 40 ug/dL, the standard requires blood testing at least every two months until two consecutive results indicate a BLL below 40 µg/dL. The standard also requires the employer to provide blood lead

testing at least monthly during the removal period of each employee removed from exposure to lead due to an elevated BLL. (See Section I.C, Health Effects of Lead Exposure, for a full description of OSHA's blood lead requirements for MRP).

ACOEM has recommended that lead workers' BLLs be measured every two months for the first six months of placement, or upon change to tasks resulting in higher exposure, and that BLLs should be measured every six months thereafter (ACOEM 2016, p. e372, Table 1). In addition, ACOEM has recommended BLL measurement every two months for workers with results between 10 and 19 µg/dL and monthly measurement for workers with results of at least 20 µg/dL.[10]

The Washington DOSH stakeholder review draft and Cal/OSHA's discussion draft would require that blood lead testing be made available every two months for a worker's first six months of testing, and every six months after that. In addition, testing would be made available at least every two months if a worker's BLL is greater than 10 µg/dL.

The Washington DOSH stakeholder review draft would require testing to be offered monthly if an employee has been medically removed, until two consecutive tests show the worker's BLL has decreased to below the proposed return-to-work level.[11] Cal/OSHA's discussion draft stipulates testing at least monthly for each employee whose last BLL was at or above 20 µg/dL of whole blood, and during the removal period of each employee removed from exposure to lead due to an elevated BLL.

---

[10] ACOEM's recommendations refer to "significant lead exposure", defined as an airborne or surface lead content known or reasonably anticipated to cause elevated BLL (ACOEM 2016, p. e372, Table 1); and refer to a "lead-exposed worker", defined as "any worker who is handling or disturbing materials with a significant lead content in a manner that could reasonably be expected to cause potentially harmful exposure through lead dust inhalation or ingestion, regardless of airborne lead concentrations or surface contamination levels" (ACOEM 2016, p. e372).

[11] The proposed return-to-work level is 15 µg/dL in Washington and 10 µg/dL in California.

(6) Should OSHA consider revising the required frequency and the BLLs related to the schedule of blood lead testing? Would requirements similar to those included in Washington DOSH and Cal/OSHA's drafts be appropriate? If not, what would be an appropriate frequency for blood lead testing? Please explain your answer.

4. Analytical Methods for BLL Testing.

As discussed previously in Section I.C.2, *Medical Surveillance and Management for Elevated Blood Lead*, OSHA standards do not specify a particular method for analyzing BLL but require that the method of sampling and analysis used is accurate to plus or minus 15 percent or 6 µg/100 ml, whichever is greater (to a 95 percent confidence level). In a memorandum to OSHA Regional Administrators, the agency specified that in lieu of approval by OSHA or CDC, the agency will accept the use of a blood lead analysis laboratory that has been approved under the U.S. Department of Health and Human Services (HHS), Centers for Medicare and Medicaid Services (CMS), blood lead laboratory monitoring system pursuant to the Clinical Laboratory Improvement Amendments (CLIA) regulations, 42 CFR Part 493 (OSHA 2018). All blood lead analysis performed in a CLIA-compliant lab must meet the Proficiency Testing requirement of ±4 µg/dL or 10%, whichever is greater.

(7) Should OSHA consider revising its standard to require the use of a blood lead analysis laboratory that has been approved under the CMS blood lead laboratory monitoring system pursuant to the CLIA regulations, consistent with OSHA's 2018 memorandum? Please explain your answer.

(8) Are there methods other than collecting a venous sample that would meet the accuracy requirements of the lead standard? Please describe the advantages and limitations of such methods.

(9) Are portable direct reading instruments for measuring BLL available that meet the accuracy requirements of the OSHA lead standards and would be considered equivalent to an analysis conducted by a laboratory approved by OSHA or CDC?

(10) Do you use or have knowledge of other measures of lead in the body? Please describe and explain whether and how they could be used effectively for medical monitoring of workers exposed to lead and the relative costs of those measures (i.e., cost-effectiveness).

5. Employee Notification of BLL Results.

OSHA's general industry standard requires the employer to notify each employee whose BLL is at or above 40 μg/dL within five working days after the receipt of biological monitoring results. OSHA's construction standard requires the employer to notify each employee in writing of their BLL within five working days after the receipt of biological monitoring results, regardless of the BLL detected.

The Washington DOSH stakeholder review draft and Cal/OSHA's discussion draft include a requirement that employers must make sure workers receive all blood testing results, regardless of level, within five days of receiving them from the medical providers.

(11) Should OSHA revise its general industry standard to require employers to notify all employees who receive blood lead testing of their results, similar to the requirements of its construction standard and requirements under consideration by Washington DOSH and Cal/OSHA? If not, what criteria should be used to determine which employees should be notified of their results? Please explain your answer.

6. ZPP.

ACOEM's Position Statement (2016) advised OSHA that ZPP testing is insufficiently sensitive as a measure of lead exposure when BLLs are below 25 mg/dL and is no longer needed since BLL testing is superior and readily available (ACOEM

2016, p. e372). In January 2019, MIOSHA removed a previous requirement to analyze for the zinc protoporphyrin level. Washington DOSH's stakeholder review draft and Cal/OSHA's discussion draft also would eliminate ZPP testing requirements.

(12) Should OSHA remove the requirement for ZPP testing currently included in its lead standards? Please explain your recommendation to continue or discontinue ZPP testing as part of medical surveillance for lead-exposed workers.

7. Provisions for Worker Privacy.

Under the medical surveillance provisions of OSHA's lead standards, employers are provided with the results of an individual employee's BLL measurements, in addition to the physician's opinion as to whether the employee has any detected medical condition that would place the employee at increased risk from lead exposure; recommended special protective measures or lead exposure limitations; and any recommended limitation upon the employee's use of respirators. Physicians are prohibited from revealing to the employer any findings, including laboratory results, or diagnoses *unrelated* to an employee's occupational exposure to lead.

More recent OSHA standards include measures to enhance employee privacy and encourage employees to participate in medical surveillance by minimizing fears about retaliation or discrimination based on medical findings. In OSHA's beryllium standard, for example, the information provided to the employer may not contain the results of medical exams performed. The physician may, if authorized by the employee in writing, inform the employer of any recommendations for limitations on exposure to beryllium and for further testing at another facility and/or continued medical surveillance.

(13) Should OSHA update the lead standards' employee privacy protections, including restriction of employer access to an individual employee's BLL measurements? Please explain your recommendation.

C. Permissible Exposure Limit (PEL)

For workers exposed to lead above the PEL of 50 µg/m^3 for more than 30 days per year, OSHA's general industry lead standard requires employers to implement engineering and work practice controls (including administrative controls) to maintain exposures at or below the PEL. For workers exposed to lead above the PEL for 30 days or less per year, the standard requires employers to implement engineering controls to reduce exposures to lead to 200 µg/m^3 and then allows the use of any combination of controls (engineering, work practice, respiratory controls) to maintain exposures at or below 50 µg/m^3.

California and Washington State's drafts include revisions to their permissible exposure limits. Cal/OSHA's discussion draft includes a reduction in the PEL from 50 µg/m^3 to 10 µg/m^3 and the action level from 30 µg/m^3 to 2 µg/m^3.[12] The Washington DOSH stakeholder review draft includes a reduction in the PEL from 50 µg/m^3 to 20 µg/m^3.

(14) Should OSHA consider reducing its PEL of 50 µg/m^3 for occupational lead exposure or its action level of 30 µg/m^3? At what level do you believe the PEL should be set to reduce the harmful effects of lead exposure in exposed workers? Do you think this level would be technologically and economically feasible for affected industries (see OSH Act Sec. 6(b)(5), 29 USC 655(b)(5))? Please explain your answer and, if available, provide data pertinent to the benefits, feasibility, and expected increase in costs of revising the federal PEL or action level for airborne lead. (Please note that OSHA requests detailed information on costs of already-existing requirements and

[12] CDPH contracted with Cal/EPA to evaluate the relationship between occupational airborne lead exposure and BLLs. Using health-based biokinetic modeling, Cal/EPA found that workplace air lead levels should be limited to an 8-hour time-weighted average (TWA) of 2.1 µg/m^3 in order to prevent BLLs exceeding 10 µg/dL in at least 95% of workers with regular and long-term exposure. See CDPH 2013 for further details. CDPH's PEL recommendation can be viewed at: https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/LeadStdPELRec.pdf.

voluntary practices in a series of provision-specific questions in Section H, Questions for Employers on Current Practices).

(15) Cal/OSHA's discussion draft includes a Separate Engineering Control Airborne Limit (SECAL) for selected processes in lead acid battery manufacturing.[13] Should OSHA consider implementing a SECAL for occupational lead exposure for specific processes if industry-wide compliance with a proposed revision to the PEL is demonstrably infeasible for specific processes?

(16) Should OSHA consider removing the provision of OSHA's general industry lead standard that allows employers to use respiratory protection to comply with the PEL for workers exposed to lead above the PEL for 30 days or less per year? Please explain your answer and, if applicable, your recommendation on how employers should be required to limit exposures of workers exposed above the PEL for 30 days or less per year.

D. Personal Protective Equipment (PPE), Hygiene, and Training

(17) The Washington DOSH stakeholder review draft would require employers to provide and ensure the use of impermeable PPE when employees are working with lead compounds that may be absorbed through the skin for any work covered by the scope of the rule. Should OSHA consider a similar requirement for its lead standards? Please explain your answer and any evidence available on the feasibility and cost of this requirement if adopted by OSHA.

(18) The Washington DOSH stakeholder review draft would require employers to prohibit workers covered by the scope of the rule from cleaning or laundering protective clothing or equipment at home. Should OSHA consider a similar

---

[13] Specifically, the Cal/OSHA Discussion Draft's SECAL for oxide production, paste mixing, grid pasting and parting, and battery assembly would require employers to comply with a 50 $\mu g/m^3$ exposure limit at the effective date, then with a limit of 40 $\mu g/m^3$ at five years from the effective date. The Cal/OSHA Discussion Draft SECAL for grid production and small parts casting, and plate formation would require employers to comply with an exposure limit of 50 $\mu g/m^3$ at the effective date, then with a limit of 30 $\mu g/m^3$ at five years from the effective date.

requirement for its lead standards? Please explain your answer and any evidence available on the feasibility and cost of this requirement if adopted by OSHA.

(19) The Washington DOSH stakeholder review draft includes requirements that employees be provided with hygiene facilities and PPE when any of the following criteria are met:

1. Employees work in areas with surfaces at a "Surface Action Level" of 1000 µg/dm² (equivalent to 9290 µg/ft²);[14]
2. Employees disturb or touch metals with a "Metals Action Level" of 20 percent or more lead content by weight;
3. Employees disturb any materials with a "Non-metal Action Level" of 0.5 percent or more lead content by weight (5000 ppm); or
4. Employees welding, burning, or grinding, or otherwise creating aerosols or fumes from materials with a "Burning/Grinding/Blasting Action Level" of 0.1 percent or more lead content by weight (1000 ppm).

Material content criteria (items #2 through 4) are applied during any activity that could release lead or lead compounds from the material in a form that could be inhaled, ingested, or absorbed through the skin. The metals action level (item #2) also applies when workers directly contact the metal with skin, personal protective equipment, or clothing.

Should OSHA add hygiene and PPE provisions similar to any or all of those described above, which are being considered for adoption by Washington DOSH? Please explain your answer and, if available, provide information on the feasibility and cost of these requirements if adopted by OSHA.

[14] The Washington DOSH stakeholder review draft defines surface contamination as "free lead in dust or residues on a surface that can be transferred to other surfaces on contact" and specifies that single sample testing is sufficient for determining whether surfaces are contaminated.

(20) Are there issues or concerns related to surface contamination or material content criteria for hygiene and PPE requirements that OSHA should consider?

OSHA's lead standards require employers to provide PPE in a clean and dry condition daily to employees whose exposure levels (without regard to respirator use) are over 200 μg/m^3 of lead as an 8-hour TWA, and weekly for other lead-exposed employees. Cal/OSHA's discussion draft would require the employer to provide PPE in a clean and dry condition daily to employees whose exposure levels (without regard to respirator use) exceed 30 μg/m^3 of lead as an 8-hour TWA. It would maintain the requirement to provide required PPE at least weekly for all other lead workers exposed above the proposed PEL (10 μg/m^3). Washington DOSH's stakeholder review draft would require the employer to replace or launder PPE at least daily for employees whose exposure levels exceed 50 μg/m^3 of lead as an 8-hour TWA. In addition, it would require the employer to repair, replace, or launder protective clothing at least weekly, and when visibly contaminated or damaged, for employees whose exposure levels exceed 20 μg/m^3 of lead as an 8-hour TWA.

(21) Should OSHA consider revising the requirements for employers to provide clean or new PPE to workers? Please provide specific recommendations for frequency and exposure triggers, and please explain your answers.

(22) Washington DOSH's stakeholder review draft would require that the training provided to all lead-exposed workers include information on special precautions for pregnant workers. Should OSHA consider including a similar requirement to include material on precautions for pregnant workers in the training provisions of its lead standards?

E. Safe Harbor Compliance Protocols

The Washington DOSH stakeholder review draft includes several safe harbor protocols which provide employers alternative methods of compliance, including some provisions that would relax requirements for exposure monitoring and for use of engineering and work practice controls to meet the proposed PEL. Employers following a safe harbor compliance protocol completely would be considered in compliance with the lead rule for tasks covered and would not be cited for departing from the main body of requirements of the lead rule for those tasks. However, if an employer does not follow the provided safe harbor protocol properly, the criteria and requirements of the main body of the Washington DOSH rule would be used to assess compliance. The Washington DOSH stakeholder review draft includes protocols that could potentially be used by an employer in any industry, including the *Well Managed Blood Lead Levels Safe Harbor Protocol* and the *Clean Areas Safe Harbor Protocol* described below, as well as industry- or task-specific protocols, including the *Safe Harbor Protocol for Handling Lead-Containing Articles in Retail Settings,* the *Safe Harbor Protocol for Office and Residential Settings,* and the *Safe Harbor Protocol for Incidental Lead Paint in Construction/Renovation, Repair, and Painting (RRP) Work* described below.

1. Well Managed Blood Lead Levels Safe Harbor Protocol.

The Washington DOSH stakeholder review draft describes a protocol that provides an employer greater flexibility than would otherwise be required for implementing PPE, work practices, and other lead exposure controls, where the employer demonstrates that their program effectively controls employee BLLs. The compliance protocol would provide a safe harbor for employers who voluntarily submit worksite blood lead records demonstrating that employee BLLs are effectively managed. To demonstrate effective control of employee BLLs, the employer would be required to conduct blood lead testing for all workers at the facility with known or potential exposure to lead; provide ongoing documentation of effective blood level management to

Washington DOSH; and, upon request, communicate with Washington DOSH if questions or concerns arise from review of the documentation provided. Employers following this protocol would not be subject to scheduled inspections for lead related issues, and the requirements associated with a new PEL of 20 µg/m^3 (8-hour TWA) would not be enforced where airborne exposures are below the proposed Secondary Permissible Exposure Limit (SPEL) of 50 µg/m^3 (8-hour TWA).[15]

In the Washington DOSH stakeholder review draft, effective management of BLLs is indicated by: blood lead testing for all workers at the facility with exposure to lead covered by the rule, including baseline tests for all exposed workers, annual tests for all exposed or potentially exposed workers, and more frequent tests for all workers meeting the requirements for periodic testing in the Washington DOSH lead rule; and a record of well managed BLLs, meaning that: (1) the average BLLs for workers exposed above 20 µg/m^3 is below 10 µg/dL and the BLLs for each worker in the group is kept below 20 µg/dL; and (2) BLLs for the group of all other workers (those exposed below 20 µg/m^3) are kept below 10 µg/dL.[16]

To qualify for this safe harbor, the employer would be required to submit documentation annually for each establishment for which the safe harbor will be claimed.[17] The required documentation includes the employer's lead control programs for

---

[15] Under this protocol, the following medical surveillance provisions would apply: workers with BLLs found above 20 µg/dL would be tested monthly until their BLL is below 15 µg/dL for two monthly tests; workers would be eligible for the medical removal requirements included in the rule; and workers with a BLL greater than 10 µg/dL for more than 4 months must have their case reviewed by a physician.

[16] Under the Washington DOSH stakeholder review draft, infrequent elevated BLLs above 20 µg/dL would not disqualify an employer when: (1) the elevated BLL is documented as a baseline level prior to work with the company at this facility or any other facility operated by the employer, or (2) the employer documents the exposure incident responsible for the elevated BLL and takes corrective action to effectively prevent further exposures.

[17] Under the Washington DOSH stakeholder review draft, documentation would be submitted annually to maintain coverage by the safe harbor, using forms and formats supplied by the DOSH. The employer would need to be responsive to questions from the department regarding the submitted documentation and must allow for onsite auditing of the submission by DOSH. If DOSH reviews the documentation and does not agree that it shows that the establishment qualifies for this safe harbor, the department would notify the employer in writing, including a description of how the documentation fails to qualify. If information in the

the establishment; the employer's assessments of lead exposures for the establishment; names of all workers onsite during the previous two years (including workers of other employers); for each worker, whether they are known to have had exposures at any action level, at the PEL or at the SPEL; the record of all blood lead testing for the establishment for the past two years (or new testing only when resubmitting annually); and a report detailing actions taken in response to increased lead exposure or elevated blood BLLs found during the previous year.

(23) Should OSHA consider a safe harbor protocol approach similar to the *Well Managed Blood Lead Levels* protocol described above, which is being considered for adoption in Washington State? What aspects of the protocol would be beneficial? Are there issues, concerns, or different approaches to a "safe harbor" based on well-managed BLLs that OSHA should consider?

2. Clean Areas Safe Harbor Protocol.

The Washington DOSH stakeholder review draft describes a protocol that would relieve employers from implementing the requirements of the lead rule for workers in clean areas who do not have lead-related tasks. The clean areas protocol described by Washington DOSH could be used to designate parts of a facility, such as offices or work areas where lead-containing materials are not present, as clean so that workers in those areas are not covered by the lead rule. The protocol could also be used for facilities where lead is present in building materials, such as lead based paint, but is normally undisturbed by activities of the employer. Where a clean area is designated within a work establishment, workers and other individuals are not required to use protective equipment, work practices, or controls to prevent lead exposure and will not necessarily be trained about lead hazards.

---

submission appears to constitute a violation of a Washington Industrial Safety and Health Act (WISHA) rule, the employer would be informed and asked to provide proof of abatement for serious violations.

The Washington DOSH stakeholder review draft sets out criteria for establishing clean areas, wherein all worker-accessible surfaces must be shown using ongoing surface sampling for free lead. Lead coatings and lead-containing materials may be present where lead is well contained and not released to surface sampling. When sampling indicates that lead is being brought into the clean area or released from damaged materials in the area, non-lead workers must be kept from the vicinity until the hazard is abated and sampling in the area of the release indicates the area is clean.

The following criteria would be used to determine if routine cleaning is sufficient to maintain surface lead on all worker accessible surfaces below 4.3 μg/dm² (equivalent to 40 μg/ft²). Single sample testing, conducted as specified in Washington DOSH's stakeholder review draft, may be used to identify clean areas. If initial sampling indicates that lead on worker accessible surfaces is below 4.3 μg/dm², the area represented by such sampling is considered "clean" and the employer would not be required to implement requirements of the lead rule (outside of this protocol) therein.[18] When there is activity that could reintroduce lead into the area, repeat sampling would be required every two years.

In an area where initial sampling indicates the presence of surface lead on worker accessible surfaces at or above 4.3 μg/dm², Washington DOSH's proposed protocol would provide for representative four-sample testing to demonstrate that ongoing cleaning is sufficient to maintain minimal lead levels.

(24) Should OSHA consider a safe harbor protocol approach similar to the *Clean Areas* protocol described above, which is being considered for adoption in Washington State? What aspects of the protocol would be beneficial? Are there issues, concerns, or different

[18] Note: Washington DOSH's stakeholder review draft contemplates that maintenance and housekeeping staff working in a clean area may be doing work covered by the lead rule.

approaches to a “safe harbor” based on identification of clean areas using surface sampling that OSHA should consider?

3. Safe Harbor Protocol for Handling Lead-Containing Articles in Retail Settings.

The Washington DOSH stakeholder review draft describes a protocol that could be applied to workers handling lead-containing products for sale in retail settings where it is expected that lead will be generally well controlled. The Retail Settings protocol would not cover areas of a retail facility used for maintenance or repair work that may disturb lead-containing materials, and would not cover retail gun shops co-located with gun ranges. For areas of a retail establishment where lead products are not sold, retail employers could selectively apply the Clean Areas compliance protocol described above. Under the Retail Settings protocol, retail employers could assume that workers are covered by the Basic Rules set out in the DOSH stakeholder review draft, which include requirements for cleaning practices, hygiene, PPE, and provisions for hazard communication and training. Exposure assessments would not be required for workers who only handle lead-containing materials in retail activities including receiving, stocking, sales, and housekeeping in the retail activity areas. In addition, retail workers would not be covered under the Action Rules (which include ongoing exposure monitoring and blood lead testing) or the PEL and SPEL Rules (which include requirements covering routine control of airborne lead exposure and respirator use, as well as heightened requirements in the provisions for cleaning, hygiene, PPE, hazard communication and training, exposure monitoring and medical surveillance).

The Washington DOSH stakeholder review draft sets out several conditions that must be met by the employer to implement the Retail Settings Protocol, such as requiring that lead-containing materials be kept segregated from other materials in the establishment and inspected when received in the establishment for damage to packaging or the product that could release lead; that any manufacturing, repair, assembly, or

maintenance work involving lead-containing products that generates lead aerosols or dust must be performed in a separate area of the establishment away from the retail space and must follow protocols to prevent lead contamination of the retail space; and that the employer must implement specific housekeeping practices (e.g., prohibition of dry sweeping, use of wet wiping/mopping and/or HEPA filtered vacuums) around lead-containing products or areas where these products are stored.

(25) Should OSHA consider a safe harbor protocol approach similar to the Retail Settings Protocol described above, which is being considered for adoption in Washington? What aspects of the Protocol would be beneficial? Are there issues, concerns, or different approaches to a "safe harbor" for retail settings that OSHA should consider?

4. Safe Harbor Protocol for Office and Residential Settings.

The Washington DOSH stakeholder review draft describes a protocol for employees working within a facility that has lead-based paint or paint with lead pigments doing work that does not disturb painted surfaces. This protocol would, for example, allow the employer to assume that workers in office and residential settings are not covered by the lead rule unless doing maintenance, remodeling, or repair work. Under this protocol, workers occupying a facility for office work are not covered by the rule, except when there is an incident causing a significant release and exposure to lead; and except for workers doing housekeeping work, who would be covered under the Basic Rules requirements for cleaning practices, hygiene, PPE, and provisions for hazard communication and training.

To implement this protocol, employers and building owners may assume that paint contains lead or conduct screening tests to determine lead content. For this protocol, it is expected that there may be minor releases due to normal wear and tear and light repair work in the facility. The building owner or employer would be required to make written documentation of the lead assessment available in the facility for occupants,

housekeeping workers, and maintenance workers. Maintenance or housekeeping staff would be required to make at least quarterly visual inspections of the facility for damage to lead paint surfaces in occupied areas. Whenever damage is discovered, by inspection, occupant report, or other observations, the building owner or employer would be required to assess the damage and ensure any repair and clean-up is done in a timely manner using methods that limit the spread of lead-containing materials (e.g., wet wiping, use of HEPA filtered vacuums).

(26) Should OSHA consider a safe harbor protocol approach similar to the Office and Residential Settings protocol described above, which is being considered for adoption in Washington? What aspects of the protocol would be beneficial? Are there issues, concerns, or different approaches to a "safe harbor" that OSHA should consider for work in office and residential settings that does not involve maintenance, remodeling, or repair work?

5. Safe Harbor Protocol for Incidental Lead Paint in Construction/Renovation, Repair, and Painting (RRP) Work.

The Washington DOSH stakeholder review draft describes a protocol for use by contractors and maintenance operations handling lead-containing paint. This protocol would apply to employers conducting incidental lead paint work covered by the EPA renovation, repair and painting work rules, or doing similar work. It is not intended for lead abatement work as defined by the U.S. Department of Commerce and EPA, which would be expected to involve greater levels of exposure than is contemplated by this protocol.

This protocol assumes that: (1) work will be done with hand tools or power tools with HEPA filtered dust collection systems; (2) the work occurs in residential or similar construction where the primary lead-containing material is finish paint on wood or wallboard substrates, rather than structural steel; (3) contractors conducting this work are

in compliance with the Department of Commerce and EPA programs and have certification from them when required; and (4) training required for environmental certification will be supplemented with additional information on Washington DOSH rules, including for personal protective equipment, respiratory protection, hygiene practices, and work practices.

This protocol would require workers disturbing painted surfaces to wear half-face respirators with P100 filters or more protective respirators and would allow for workers to request Powered Air Purifying Respirators (PAPRs) with HEPA cartridges. The employer must implement a respiratory protection program (including identification of a respirator program administrator; identification of the respirator models and configuration the employer will require for each task performed; and the process for medical clearance and fit testing of workers) and must provide personal protective equipment including either safety glasses/goggles or full face respirators; disposable overalls or overalls that are laundered per Washington DOSH rule requirements; work boots; disposable shoe covers or dedicated work boots that are not worn off the worksite for workers scraping or sanding paint; gloves or a glove combination sufficient to prevent lead accumulation on the hands and provide necessary protection from cuts or other hand hazards; and other personal protective equipment necessary based on other hazards at the worksite.

Employers using this protocol would provide workers with workplace-specific training (see DOSH Stakeholder Review Draft – Action Rules). Work covered under the EPA/Department of Commerce rules must be conducted by workers meeting the minimum training and certification standards of that program, with additional training on worker safety issues including health effects of lead, respiratory protection, PPE, work practices specific to the worksite, and limits of work practices. An on-site competent

person must be able to recognize lead-related hazards and have authority to take action to correct lead issues at the worksite.

Under this protocol, direct monitoring of employee exposure would not be required. The employer could presume that employee exposure to airborne lead is no greater than 10 times the proposed PEL of 20 µg/m³ as an eight-hour TWA.[19] While this presumption is used, the employer must meet all requirements of the rule consistent with this level of exposure, including: baseline blood lead testing for all workers contacting lead-containing coatings[20] or in the vicinity of any work disturbing these materials, follow-up blood lead testing every two months for the first six months and every six months thereafter, and blood lead testing at the conclusion of work; lead control areas around any work disturbing lead-containing coatings; respirator use for all workers disturbing lead-containing coatings; and provision of appropriate PPE, a clean change area, and hygiene facilities including dedicated handwashing, boot cleaning, and showers as necessary.

(27) Should OSHA adopt a safe harbor protocol approach similar to the protocol described above for incidental lead paint in RRP work that is being considered for adoption in Washington? What aspects of the protocol would be beneficial? Are there issues, concerns, or different approaches to a protocol for RRP work that OSHA should consider?

F. Environmental Effects

[19] Employers could choose to conduct exposure assessments to determine actual lead exposure levels and tailor their program under this protocol as indicated by those results. However, direct monitoring of exposure would not be required when not feasible in the timeframe of the project. Employers would assume paint in structures built before 1978 contains lead in quantities that will require controls and PPE as specified in this protocol. Paint could be tested by collecting samples for laboratory analysis, use of X-ray fluorescence, or following EPA/Department of Commerce rules for colorimetric testing kits. The protocol would require any paint found to potentially contain 5000 ppm lead or more than 1 mg/cm² of lead on the surface to be treated as a lead-containing material.

[20] "Lead-containing coatings" refers to coatings that are known or presumed to contain lead.

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321, et seq.), the Council on Environmental Quality (CEQ) regulations (40 CFR part 1500), and the Department of Labor (DOL) NEPA Compliance Procedures (29 CFR part 11) require that OSHA give appropriate consideration to environmental issues and the impacts of proposed actions significantly affecting the quality of the human environment. OSHA intends to collect written information and data on possible environmental impacts that could occur outside of the workplace (e.g., exposure to the community through contaminated air/water, contaminated waste sites, etc.) if the agency were to revise the existing standard for occupational exposure to lead. Such information should include both negative and positive environmental effects that could be expected to result from guidance or a revised standard. Specifically, OSHA requests comments and information on the following:

(28) What is the potential direct or indirect environmental impact (for example, the effect on air and water quality, energy usage, solid waste disposal, and land use) from a reduction in BLL triggers or other changes to the OSHA lead standards?

(29) Are there any situations in which reducing lead exposures to employees would be inconsistent with meeting environmental regulations?

G. Duplicative, Overlapping, or Conflicting Rules

This section examines whether there are any duplicative, overlapping, or conflicting regulations concerning lead that OSHA should be aware of. In your explanation, please explain in detail if there are any such concerns of which the agency should be aware.

(30) Are there any federal regulations that might duplicate, overlap, or conflict with modifications to the current lead standards? If yes, please identify and explain how they would duplicate, overlap, or conflict.

(31) Are there any federal programs in areas such as defense or energy that might be impacted by modifications to the current lead standards? If yes, please identify and explain how they would be impacted.

H. Questions for Employers on Current Practices

OSHA requests that commenters, when answering questions regarding economic impact, be as specific as possible. For example, if an employer is using a modified medical surveillance program, then helpful information would include the following: the medical testing necessary; the exposure status or types of employees who would receive medical testing; the frequency of the testing; and the medical surveillance costs. The agency invites comment on the labor time and level of labor expertise required to implement proposed methods, even if dollar-cost estimates are not available. For discussion of equipment-related costs, OSHA requests that commenters estimate relevant factors such as purchase price, cost of installation, cost of equipment maintenance, cost of training, and expected life of the equipment. Also, please discuss the quantitative benefits (e.g., reductions in BLLs) and the associated costs (e.g., cost of an exposure control method). Because there are some differences between OSHA's lead standards for general industry and construction, please specify which standard is applicable to your work.

(32) If you use criteria more stringent than OSHA's requirements for conducting blood lead testing on your employees, how do your criteria differ from OSHA's requirements?

(33) If you use criteria more stringent than OSHA's requirements for notifying employees of their BLL and ZPP results, how do your criteria differ from OSHA's requirements?

(34) If you use criteria more stringent than OSHA's requirements for medical removal protection in your work environment or industry, how do your criteria differ from

OSHA's requirements? Please include the criteria, such as the BLL, for both medical removal and return to work status.

(35) What are your current costs of medical removal per employee (where possible, please monetize in terms of dollars per time unit (e.g., per month, per year))? Would your company be able to reassign the medically removed worker to a job at least at the clerical level that the employee would find acceptable? Please include specific examples of hourly wages (per job category) for the employee's regular occupation and the hourly wages for the medically assigned clerical job, if available.

(36) How many of your employees, over the past 10 years, have been removed from lead-exposed work due to elevated BLLs? If possible, please submit anonymized examples of employees who were brought into the medical removal program, their BLL level at the time of removal, and the time required to bring the BLL level below 40 µg/dL (or an alternative specified level).

(37) Over the past ten years, how many, or what percentage, of your employees were removed from lead-exposed work due to elevated BLLs exceeding the maximum 18-month time period and were unable to return to work?

(38) OSHA's lead standards set a BLL of below 40 µg/dL (two consecutive tests) for return to lead-exposed work for medically removed workers. As discussed earlier in this ANPRM, in Section I.A. Background; Events Leading to this Action, OSHA is considering lowering the BLL for medical removal. If possible, please submit estimated increases in the number of affected employees and in costs if the BLL for allowing return to work were reduced to a level lower than OSHA's current BLL of 40 µg/dL. Please specify the BLL for return to work you assume in your estimation.

(39) How many and what percentage of your employees are currently in your medical surveillance program? How many of these employees receive BLL testing? How many receive ZPP monitoring?

(40) What are your current costs of medical surveillance per employee? Please include specific examples of resource requirements in terms of additional staffing or time commitments (per job category), costs for purchase of testing materials (dollar cost per unit), expected life of equipment, and costs for energy usage and any other additional expenses.

(41) The OSHA lead standard for general industry requires the employer to institute a medical surveillance program for all employees who are or may be exposed at or above the AL (30 $\mu g/m^3$) for more than 30 days per year. There are three requirements for biological monitoring that are triggered by the current AL (30 $\mu g/m^3$):

- At least every 6 months for each employee;
- At least every two months for each employee whose last blood lead test indicated a BLL at or above 40 µg/dL. This frequency shall continue until two consecutive blood lead tests indicate a BLL below 40 µg/dL; and
- At least monthly during the removal period of each employee removed from exposure to lead due to an elevated BLL.

If possible, please discuss and/or submit quantitative estimates of the increases in the number of affected employees and in medical surveillance costs or other pertinent costs if the AL (30 $\mu g/m^3$) were decreased. Please specify the AL you assume in your estimation.

(42) Have you upgraded engineering controls to reduce airborne concentrations of lead in your facility? If yes, please describe the controls and whether you observed a subsequent reduction in BLLs. If so, did you monitor to what extent workers' BLLs were reduced following implementation of upgraded controls? Please provide data, if available, on airborne lead concentrations in your facility and on workers' BLLs prior

to and following the upgrades. Also provide related initial and annual engineering control costs of upgraded controls, as well as the expected life of the equipment.

(43) Please describe your control strategies to reduce lead surface contamination and the potential for dermal exposure to lead in your facility, such as housekeeping procedures, hygiene areas and practices, and personal protective clothing and equipment (PPE). Please describe such controls, their costs, and explain how well they work and why. To what extent were you able to lower the surface levels of lead? Did you see a subsequent reduction in employee BLLs? Please provide supporting data, if available.

Personal Protective Clothing and Equipment (PPE).

Employers are required to provide work clothing and equipment if an employee is exposed to lead above the PEL or where the possibility of skin or eye irritation exists.

(44) Do you provide PPE in your workplace, including equipment providing respiratory protection? If yes, has it reduced BLLs in your workers? Please describe the type of PPE that you provide.

(45) Does your company have triggers for PPE that are different from requirements under OSHA's lead standards? Please describe the triggers used for providing PPE.

(46) If your firm purchases clothing and equipment to protect employees from lead exposure, please estimate the PPE costs necessary to comply with the current OSHA lead standard. Please give costs on a per employee basis and at an aggregated level, if available.

(47) Have you upgraded PPE to reduce worker exposure to lead? If yes, please describe the controls and whether you observed a subsequent reduction in BLLs. If so, to what extent were workers' BLLs reduced following implementation of upgraded PPE, if applicable? Please provide data, if available.

Housekeeping.

OSHA's lead standards contain a housekeeping provision that requires employers to keep surfaces as free as practicable from lead, encourages the use of vacuuming to clean surfaces, limits the use of dry sweeping and shoveling, and prohibits using compressed air to clean surfaces. Some variation exists between the housekeeping provisions for general industry and construction.

(48) Do you have housekeeping procedures? If yes, please describe.

(49) Does your company have cleaning criteria specific to surfaces? This may include a schedule for cleaning and periodic surface cleanliness measurements, specific types of cleaning practices and activities, or other activities associated with surface decontamination.

(50) What are your current housekeeping costs to comply with the OSHA lead standard? Please provide the amount of time allocated for housekeeping costs calculated on an hourly basis.

Hygiene Facilities and Practices.

OSHA's lead standards contain hygiene facilities and practices provisions that require employers to provide showers, change rooms, and lunchrooms when workers are exposed to lead above the PEL without regard to the use of respirators. The employer must also ensure that food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied in areas where workers are exposed above the PEL. Some variation exists between the hygiene facilities and practices provisions for general industry and construction.

(51) Have you provided hygiene facilities or used hygiene practices beyond the requirements of OSHA's lead standards? This may include more frequent hand washing breaks or providing access and time for showers at exposures below the PEL. Please describe how your practices differ from requirements in OSHA's lead standards.

(52) What are your current costs to comply with the hygiene provisions of OSHA's lead standards? Please provide the amount of time allocated for hygiene costs calculated on an hourly basis.

BLLs and Lead Dust Contamination.

Some federal agencies, such as the U.S. Department of Housing and Urban Development (HUD) and the EPA, have established lead dust hazard action levels for surfaces (HUD, 2012; EPA 2001). OSHA is interested in information on using lead dust hazard surface measurements and any observed correlation between surface lead dust levels and elevated BLLs.

(53) Have you taken lead dust surface measurements in your work environment? If so, what are your procedures and current costs for this testing? Please specify the labor and equipment costs for the testing. Have you experienced any impediments or limitations when using wipe sampling to identify surface contamination with lead? What can be done to overcome these barriers?

(54) If you have taken lead dust surface measurements, are they qualitative (presence of lead only) or quantitative? If quantitative, do you use lead dust hazard levels established by HUD and EPA? Please provide any data you have on quantitative surface contamination measurements in your work environment.

(55) Have you evaluated lead surface contamination to investigate elevated employee BLLs in areas where airborne lead exposure was below the PEL? If yes, what were your findings?

(56) Have you taken wipe samples of skin or clothing to identify lead contamination? If yes, what were your findings?

(57) Have you found any correlation between BLLs and lead surface contamination, particularly when airborne exposures are below the PEL?

Impact on Small Business Entities.

Under the Regulatory Flexibility Act (5 U.S.C. 601 et seq.), OSHA is required to assess the impact of proposed and final rules on small entities. OSHA requests that members of the small business community, or other parties familiar with regulation of small business, address any special circumstances facing small firms in controlling occupational exposure to lead.

(58) How many and what kinds of small businesses or other small entities in your industry could be affected by lower protective BLL triggers in the OSHA lead standard for general industry? Describe any such effects.

(59) How many and what kinds of small businesses or other small entities in your industry could be affected by lower BLL triggers in the OSHA lead standard for construction? Describe any such effects.

(60) Are there special issues or reasons that lower BLL triggers are more difficult or costlier to implement in small firms? Please describe.

(61) Are there any reasons why benefits from reducing worker BLLs would be different in small firms than in larger firms? With regard to potential impacts on small firms, please describe specific concerns that OSHA should address and any alternatives that might serve to minimize these impacts while meeting the requirements of the OSH Act.

Authority and Signature

Douglas Parker, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC, 20210, authorized the preparation of this document pursuant to the following authorities: sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), Secretary's Order 8-2020 (Sept. 18, 2020), and 29 CFR part 1911.

Signed at Washington, DC, on June 21, 2022.

Douglas L. Parker
Assistant Secretary of Labor for Occupational Safety and Health.

References:

Abt Associates (Abt). (2021). Revised Number of BLL Cases and Firms. Memorandum. Abt Associates, Division of Health and Environment. August 9, 2021.

Adult Blood Lead Epidemiology and Surveillance (ABLES). (2019). Elevated Blood Lead Levels (BLL) among Employed Adults - United States, 2016.

Adult Blood Lead Epidemiology and Surveillance (ABLES). (2020). Tables provided by Rebecca Tsai (NIOSH) to Matt LaPenta (Abt Associates).

Adult Blood Lead Epidemiology and Surveillance (ABLES). (2021). BLL Reference Guide. Retrieved from: *https://www.cdc.gov/niosh/topics/ables/ReferenceBloodLevelsforAdults.html*. Accessed on October 7, 2021.

Agency for Toxic Substance and Disease Registry (ASTDR). (2007). Toxicological Profile for Lead. *http://www.atsdr.cdc.gov/ToxProfiles/tp13.pdf.* Accessed on November 10, 2020.

Agency for Toxic Substance and Disease Registry (ASTDR). (2020). Toxicological Profile for Lead. Retrieved from: *http://www.atsdr.cdc.gov/ToxProfiles/tp13.pdf.* Accessed on November 10, 2020.

American College of Government Industrial Hygienists (ACGIH). (2013). Threshold limit values for chemical substances and physical agents and biological exposure indices. American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

American College of Occupational and Environmental Medicine (ACOEM). (2016). Workplace Lead Exposure: ACOEM Position Statement. JOEM. 58(12): e371-374.

Association of Occupational and Environmental Clinics (AOEC). (2007). Medical Management Guidelines for Lead-Exposed Adults. Retrieved from: *http://www.aoec.org/documents/positions/MMG_FINAL.pdf.* Accessed on November 10, 2020.

California Department of Public Health (CDPH). (2009). Medical Guidelines for the Lead-Exposed Worker. Retrieved from: *http://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/medgdln.pdf.* Accessed on November 10, 2020.

California Department of Public Health (CDPH). (2010). Summary of CDPH Proposed Changes to the General Industry Lead Standard. Retrieved from *https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/LeadStdRecsSummary.pdf.* Accessed on July 14, 2021.

California Department of Public Health (CDPH). (2011). Background to OLPPP's Proposed Changes to the Lead in Construction Standard. Retrieved from: *https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/LICStdRecsSummary.pdf.* Accessed on July 14, 2021.

California Department of Public Health (CDPH). (2013). Occupational Lead Poisoning Prevention Program (OLPPP). Retrieved from: *https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/OLPPP.aspx.* Accessed on November 10, 2020.

California Department of Public Health (CDPH). (2020a). Table 1. Number of California Workers Tested in 2015-2018, by BLL Threshold and Industry.

California Department of Public Health (CDPH). (2020b). Table 2. Number of California Employers Testing BLLs from 2015-2018, by BLL Threshold and Industry.

Centers for Disease Control and Prevention (CDC). (1982.) Centers for Disease Control and Prevention (CDC). (1982, March 19). Current Trends Blood-Lead Levels in U.S. Population. MMWR. Morbidity and Mortality Weekly Reports. Retrieved from: *https://www.cdc.gov/mmwr/preview/mmwrhtml/00000225.htm.* Accessed on July 14, 2021.

Centers for Disease Control and Prevention, National Notifiable Diseases Surveillance system (NNDSS). (2016). Lead, Elevated Blood Levels, 2016 Case Definition. Retrieved from: *https://ndc.services.cdc.gov/case-definitions/lead-elevated-blood-levels-2016/.* Accessed on November 10, 2020.

Council on State and Territorial Epidemiologists (CSTE). (2015). Public Health Reporting and National Notification for Elevated Blood Lead Levels. 15-EH-01.

Environmental Protection Agency (U.S. EPA). (2013). Final Report: Integrated Science Assessment for Lead. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/075F, 2013. Retrieved from: *https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721*. Accessed November 23, 2021.

Grandjean P, Jorgensen PJ, Viskum S. (1991). Temporal and inter-individual variation in erythrocyte zinc-protoporphyrin in lead exposed workers. Br J Ind Med. 94: 111-115.

Hu H, Shih R, Rothenberg S, Schwartz BS. (2007). The Epidemiology of Lead Toxicity in Adults: Measuring Dose and Consideration of Other Methodologic Issues. Environ Health Perspect. 115: 455–462.

Kosnett MJ, Wedeen RP, Rothenberg SJ, Hipkins KL, Materna BL, Schwartz BS, Hu H, Woolf A. (2007). Recommendations for medical management of adult lead exposure. Environ Health Perspect. 115: 463-471.

Martin CJ, Werntz CL, Ducatman AM. (2004). The interpretation of zinc protoporphyrin changes in lead intoxication: a case report and review of the literature. Occup Med. 54 (8): 587-591.

Michigan Occupational and Environmental Medicine Association (MOEMA). (2019). MOEMA Update, Volume 19, Issue 1. Retrieved from: *http://www.moema.org/files/MOEMA_UPDATE_SUMMER_2019.pdf.*

National Institute for Occupational Safety and Health (NIOSH). (1995). Report to Congress on Workers' Home Contamination Study Conducted Under the Workers' Family Protection Act (29 U.S.C. 671a). Retrieved from: *https://www.cdc.gov/niosh/docs/95-123/default.html.* Accessed on November 23, 2021.

National Institute for Occupational Safety and Health (NIOSH). (2016). ABLES Data Summaries (2016). Retrieved from: *https://www.cdc.gov/niosh/topics/ables/data.html*. Accessed on November 10, 2020.

National Institute for Occupational Safety and Health (NIOSH). (2021). Understanding Blood Lead Levels (February 2021). Retrieved from: *https://www.cdc.gov/niosh/topics/ables/ReferenceBloodLevelsforAdults.html*. Accessed on November 10, 2020.

National Institute for Occupational Safety and Health (NIOSH). (2018). Request for Information About Inorganic Lead (CAS No. 7439–92–1). August 2018. Retrieved from: *https://www.cdc.gov/niosh/docket/review/docket315/pdfs/315-FRN-2018-18019.pdf.* Accessed on July 14, 2021.

National Research Council (NRC). (2013). Potential Health Risks to DOD Firing-Range Personnel from Recurrent Lead Exposure. Committee on Potential Health Risks from Recurrent Lead Exposure of DOD Firing Range Personnel Committee on Toxicology Board on Environmental Studies and Toxicology Division on Earth and Life Studies; National Research Council of the National Academies. The National Academies Press, Washington, DC.

National Toxicology Program (NTP). (2012). NTP Monograph: Health effects of low-level lead. Retrieved from: *https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead_newissn_508.pdf.* Accessed on November 10, 2020.

Occupational Safety and Health Administration (OSHA). (2007). Regulatory Review of 29 CFR 1926.62 lead in Construction. August 2007. Retrieved from: *https://www.osha.gov/dea/lookback/lead-construction-review.html*. Accessed on November 10, 2020.

Occupational Safety and Health Administration (OSHA). (2008). OSHA Instruction, National Emphasis Program – Lead. Directive number CPL 03-00-009. August 14, 2008. Retrieved from: *https://www.osha.gov/sites/default/files/enforcement/directives/CPL_03-00-0009.pdf*. Accessed on November 10, 2020.

Occupational Safety and Health Administration (OSHA). (2013). Memorandum. Expanded Targeting of Establishments Under the Lead NEP. November 2013. Retrieved from: *https://www.osha.gov/laws-regs/standardinterpretations/2013-11-25.* Accessed on July 14, 2021.

Occupational Safety and Health Administration (OSHA). (2018). Memorandum. [De Minimis] Violation Notices: Blood Laboratory Proficiency Testing and Approval. Retrieved from: *https://www.osha.gov/laws-regs/standardinterpretations/2018-10-01.* Accessed on July 14, 2021.

Occupational Safety and Health Administration (OSHA). (2020a). Lead Exposure – Table 2 – Industry Group Profile (Subcategory) OSHA Information System (OIS) Personal Sampling Data for Lead (2014-2018). Salt Lake Technical Center. Retrieved from: *https://www.osha.gov/lead/industry-group-profile*. Accessed on November 10, 2020.

Occupational Safety and Health Administration (OSHA). (2020b). OSHA Enforcement Data, Inspection. Retrieved from: *https://enforcedata.dol.gov/views/data_summary.php*. Accessed on April 3, 2020.

Occupational Safety and Health Administration (OSHA). (2020c). OSHA Enforcement Data, Violation. Retrieved from: *https://enforcedata.dol.gov/views/data_summary.php*. Accessed on April 3, 2020.

Office of Environmental Health Hazard Assessment (OEHHA). (2014). California Environmental Protection Agency; (2014). Estimating Workplace Air and Worker Blood Lead Concentration using an Updated Physiologically-based Pharmacokinetic (PBPK) Model. Retrieved from: *https://oehha.ca.gov/air/document/oehha-presentation-pbpk-model-blood-lead-and-worker-exposure*. Accessed on July 12, 2021.

Payne S, et al. (2017). Blood Lead Levels in California Workers: Data Reported to the Occupational Blood Lead Registry, 2012-2014. Richmond, CA, California Department of Public Health, Occupational Health Branch.

Schwartz BS, Hu H. (2007). Adult lead exposure: time for change. Environ Health Perspect. 115(3): 451-454.

Shih RA, Hu H, Weisskopf MG, Schwartz BS. (2007). Environ Health Perspect. 115(3): 483-492.

U.S. Census Bureau, 2017, Statistics of US Businesses, Program Glossary. Available at: *https://www.census.gov/programs-surveys/susb/about/glossary.html*.

U.S. Department of Defense (DOD). (2018.) DoD 6055.05-M. Occupational Medical Examinations and Surveillance Manual, Incorporating Change 3, August 31, 2018.

U. S. Department of Health and Human Services (HHS). (2022). Fourth national report on human exposure to environmental chemicals, updated tables, March 2022, volume one. Retrieved from: *https://www.cdc.gov/exposurereport/data_tables.html*. Accessed April 25, 2022.

U.S. Department of Housing and Urban Development (HUD). (2012). Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (2012 Edition). Retrieved from: *https://www.hud.gov/program_offices/healthy_homes/lbp/hudguidelines*. Accessed on November 10, 2020.

Appendix A

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
1151	Support Activities for Crop Production	2	1	0	0	0
2122	Metal Ore Mining	466	78	36	11	0
2123	Nonmetallic Mineral Mining and Quarrying	17	2	0	0	0
2131	Support Activities for Mining	35	5	0	0	0
2211	Electric Power Generation, Transmission and Distribution	25	22	22	10	0
2212	Natural Gas Distribution	138	19	11	2	0
2213	Water, Sewage and Other Systems	9	9	0	0	0
2361	Residential Building Construction	769	145	83	37	2
2362	Nonresidential Building Construction	864	323	204	67	9
2371	Utility System Construction	87	50	36	10	1
2373	Highway, Street, and Bridge Construction	386	136	91	43	4
2379	Other Heavy and Civil Engineering Construction	51	10	10	8	1
2381	Foundation, Structure, and Building Exterior Contractors	251	171	95	11	1
2382	Building Equipment Contractors	488	132	58	31	4
2383	Building Finishing Contractors	2,746	655	452	199	34
2389	Other Specialty Trade Contractors	1,305	354	227	47	9
2399	Construction (Specific industry unknown)	516	86	25	25	0
3231	Printing and Related Support Activities	146	20	11	2	0
3241	Petroleum and Coal Products Manufacturing	11	11	0	0	0
3251	Basic Chemical Manufacturing	42	20	11	2	0
3252	Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing	175	25	13	3	0
3255	Paint, Coating, and Adhesive Manufacturing	38	21	12	2	0
3259	Other Chemical Product and Preparation Manufacturing	158	22	12	2	0

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
3271	Clay Product and Refractory Manufacturing	99	50	27	5	0
3272	Glass and Glass Product Manufacturing	5,156	715	398	113	2
3279	Other Nonmetallic Mineral Product Manufacturing	12	2	0	0	0
3311	Iron and Steel Mills and Ferroalloy Manufacturing	99	13	13	13	1
3312	Steel Product Manufacturing from Purchased Steel	184	26	14	3	0
3314	Nonferrous Metal (except Aluminum) Production and Processing	1,431	224	189	187	13
3315	Foundries	1,103	152	102	28	1
3323	Architectural and Structural Metals Manufacturing	994	142	91	44	2
3324	Boiler, Tank, and Shipping Container Manufacturing	261	38	23	7	0
3325	Hardware Manufacturing	166	23	13	2	0
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	53	15	15	14	0
3328	Coating, Engraving, Heat Treating, and Allied Activities	256	39	22	10	0
3329	Other Fabricated Metal Product Manufacturing	1,100	187	154	46	1
3333	Commercial and Service Industry Machinery Manufacturing	133	19	10	2	0
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	17	17	0	0	0
3339	Other General Purpose Machinery Manufacturing	65	9	9	2	0
3341	Computer and Peripheral Equipment Manufacturing	6	1	0	0	0
3342	Communications Equipment Manufacturing	146	31	17	3	0
3343	Audio and Video Equipment Manufacturing	4	0	0	0	0
3344	Semiconductor and Other Electronic Component Manufacturing	323	37	25	9	1
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	394	72	37	11	0
3359	Other Electrical Equipment and Component Manufacturing	851	165	136	136	24
3363	Motor Vehicle Parts Manufacturing	994	142	89	33	2
3364	Aerospace Product and Parts Manufacturing	427	96	40	21	1
3366	Ship and Boat Building	23	23	13	13	0

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
3369	Other Transportation Equipment Manufacturing	9	8	0	0	0
3399	Other Miscellaneous Manufacturing	296	53	53	12	0
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	305	57	31	6	0
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	330	46	25	6	0
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	130	18	10	2	0
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	12	2	0	0	0
4239	Miscellaneous Durable Goods Merchant Wholesalers	629	141	141	130	3
4244	Grocery and Related Product Merchant Wholesalers	7	1	0	0	0
4247	Petroleum and Petroleum Products Merchant Wholesalers	14	2	0	0	0
4413	Automotive Parts, Accessories, and Tire Stores	136	19	10	2	0
4441	Building Material and Supplies Dealers	134	19	10	2	0
4451	Grocery Stores	8	1	0	0	0
4483	Jewelry, Luggage, and Leather Goods Stores	125	18	10	2	0
4511	Sporting Goods, Hobby, and Musical Instrument Stores	780	109	60	11	0
4821	Rail Transportation	8	8	8	2	0
4841	General Freight Trucking	13	13	0	0	0
4842	Specialized Freight Trucking	12	3	0	0	0
4851	Urban Transit Systems	3	3	3	2	0
4881	Support Activities for Air Transportation	21	21	21	12	0
4883	Support Activities for Water Transportation	306	45	25	6	0
4884	Support Activities for Road Transportation	183	11	10	3	0
4911	Postal Service	0	0	0	0	0
4921	Couriers and Express Delivery Services	8	1	0	0	0
5111	Newspaper, Periodical, Book, and Directory Publishers	131	18	10	2	0
5173	Wired and Wireless Telecommunications Carriers	10	1	0	0	0

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
5182	Data Processing, Hosting, and Related Services	0	0	0	0	0
5211	Monetary Authorities-Central Bank	131	18	10	2	0
5242	Agencies, Brokerages, and Other Insurance Related Activities	10	3	0	0	0
5311	Lessors of Real Estate	7	4	0	0	0
5313	Activities Related to Real Estate	231	32	18	3	0
5323	General Rental Centers	53	19	10	4	0
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	113	16	9	2	0
5413	Architectural, Engineering, and Related Services	218	88	65	12	0
5415	Computer Systems Design and Related Services	121	17	9	2	0
5416	Management, Scientific, and Technical Consulting Services	153	53	19	7	0
5417	Scientific Research and Development Services	12	12	8	2	0
5419	Other Professional, Scientific, and Technical Services	125	18	10	2	0
5611	Office Administrative Services	118	17	9	2	0
5613	Employment Services	119	45	34	10	0
5614	Business Support Services	12	2	0	0	0
5616	Investigation and Security Services	395	66	36	7	0
5617	Services to Buildings and Dwellings	127	18	10	2	0
5621	Waste Collection	102	35	19	4	0
5622	Waste Treatment and Disposal	39	28	22	6	0
5629	Remediation and Other Waste Management Services	1,663	739	494	190	4
6111	Elementary and Secondary Schools	4	3	3	2	0
6112	Junior Colleges	146	20	11	2	0
6113	Colleges, Universities, and Professional Schools	11	8	0	0	0
6115	Technical and Trade Schools	714	100	46	10	0
6116	Other Schools and Instruction	745	111	61	19	0
6211	Offices of Physicians	9	9	0	0	0

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
6214	Outpatient Care Centers	9	5	0	0	0
6215	Medical and Diagnostic Laboratories	9	9	0	0	0
6219	Other Ambulatory Health Care Services	9	4	4	4	0
6221	General Medical and Surgical Hospitals	10	4	0	0	0
6222	Psychiatric and Substance Abuse Hospitals	12	12	0	0	0
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	15	15	0	0	0
6241	Individual and Family Services	51	18	10	2	0
6243	Vocational Rehabilitation Services	10	1	0	0	0
7115	Independent Artists, Writers, and Performers	3	1	0	0	0
7121	Museums, Historical Sites, and Similar Institutions	309	50	30	21	0
7131	Amusement Parks and Arcades	3	3	0	0	0
7139	Other Amusement and Recreation Industries	6,656	1024	619	205	9
8111	Automotive Repair and Maintenance	3,333	553	310	72	1
8112	Electronic and Precision Equipment Repair and Maintenance	29	17	17	11	0
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	79	14	10	6	0
8114	Personal and Household Goods Repair and Maintenance	953	133	71	34	1
8122	Death Care Services	145	20	11	2	0
8131	Religious Organizations	12	3	0	0	0
8139	Business, Professional, Labor, Political, and Similar Organizations	488	72	50	28	1
9211	Executive, Legislative, and Other General Government Support	0	0	0	0	0
9221	Justice, Public Order, and Safety Activities	0	0	0	0	0
9231	Administration of Human Resource Programs	0	0	0	0	0
9241	Administration of Environmental Quality Programs	0	0	0	0	0
9251	Administration of Housing Programs, Urban Planning, and Community Development	0	0	0	0	0

Table 1: Summary of Annual Number of Firms with BLL Tests and Cases

NAICS	NAICS Description	Estimated Number of Firms where Employees Receive BLL Tests	Estimated Number of Firms with BLL Cases			
			BLL ≥5	BLL ≥10	BLL ≥25	BLL ≥ Medical Removal BLL[2]
9261	Administration of Economic Programs	0	0	0	0	0
9281	National Security and International Affairs	0	0	0	0	0
	Total	**44,144**	**8,611**	**5,302**	**2,087**	**137**

[1] The Census Bureau defines an establishment as a single physical location at which business is conducted or services or industrial operations are performed. The Census Bureau defines a business firm or entity as a business organization consisting of one or more domestic establishments in the same state and industry that are specified under common ownership or control. The firm and the establishment are the same for single-establishment firms. For each multi-establishment firm, establishments in the same industry within a state will be counted as one firm; the firm employment and annual payroll are summed from the associated establishments.

[2] Medical removal levels are BLL ≥50 µg/dL in Construction (NAICS 23) and BLL ≥60 µg/dL in General Industry.

[FR Doc. 2022-13696 Filed: 6/27/2022 8:45 am; Publication Date: 6/28/2022]