

8. REGULATIONS AND ADVISORIES

The international and national regulations and guidelines regarding lead and lead compounds in air, water, and other media are summarized in Table 8-1.

ATSDR has not derived MRLs for lead. The EPA has not developed a reference concentration (RfC) for lead. EPA has also decided that it would be inappropriate to develop a reference dose (RfD) for inorganic lead (and lead compounds) because some of the health effects associated with exposure to lead occur at blood lead levels as low as to be essentially without a threshold (IRIS 2005).

EPA has assigned lead a weight-of-evidence carcinogen classification of B2, probable human carcinogen, based on inadequate information in humans and sufficient data in animals (IRIS 2005). The International Agency for Research on Cancer (IARC) has classified inorganic lead compounds as probably carcinogenic to humans (Group 2A) based on limited evidence of carcinogenicity in humans and sufficient evidence in animals (IARC 2004). IARC also determined that organic lead compounds are not classifiable as to their carcinogenicity to humans (Group 3) based on inadequate evidence of carcinogenicity in humans and animals (IARC 2004). The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens based on limited evidence from studies in humans and sufficient evidence from studies in experimental animals (NTP 2005). The American Conference of Governmental Industrial Hygienists (ACGIH) has categorized elemental lead and certain inorganic lead compounds, assessed as lead, as A3 carcinogens: carcinogenic in experimental animals at a relatively high dose not considered relevant to worker exposure. The data obtained from epidemiologic studies suggest that, except for uncommon routes or levels of exposure, these substances are unlikely to cause cancer in humans (ACGIH 2004). ACGIH has categorized lead chromate, assessed on the basis of both lead and chromium, as an A2 carcinogen. Although substances in this category are carcinogenic in experimental animals at dose levels that are considered relevant to worker exposure, the data from epidemiologic studies are insufficient to confirm an increased risk of cancer in exposed humans (ACGIH 2004).

OSHA requires employers of workers who are occupationally exposed to a toxic or hazardous substance to institute engineering controls and work practices that maintain or reduce their exposure to a level that is at or below the permissible exposure limit (PEL) established for the substance. For occupational exposures to lead, the employer must use engineering controls and work practices to achieve an

8. REGULATIONS AND ADVISORIES

Table 8-1. Regulations and Guidelines Applicable to Lead and Lead Compounds

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification Lead compounds, inorganic Lead compounds, organic	Group 2A ^a Group 3 ^b	IARC 2004
WHO	Air quality guidelines Drinking water quality guidelines	0.5 µg/m ³ 0.01 mg/L	WHO 2000 WHO 2004
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (TWA) Lead, inorganic	0.05 mg/m ³	ACGIH 2004
EPA	Hazardous air pollutant National primary and secondary ambient air quality standards ^c	Yes 1.5 µg/m ³	EPA 2004b 42 USC 7412 EPA 2005b 40 CFR 50.12
NIOSH	REL (TWA) ^d IDLH	0.05 mg/m ³ 100 mg/m ³	NIOSH 2005
OSHA	PEL (8-hour TWA) for toxic and hazardous substances for lead PEL (8-hour TWA) for general industry for tetraethyl lead ^e PEL (8-hour TWA) for construction industry for tetraethyl lead ^e PEL (8-hour TWA) for shipyard industry for tetraethyl lead ^e	50 µg/m ³ 0.075 mg/m ³ 0.1 mg/m ³ 0.1 mg/m ³	OSHA 2005d 29 CFR 1910.1025 OSHA 2005c 29 CFR 1910.1000 OSHA 2005b 29 CFR 1926.55 OSHA 2005a 29 CFR 1915.1000
b. Water			
EPA	Designated as hazardous substances in accordance with Section 311(b)(2)(A) of the Clean Water Act Lead acetate, lead chloride, lead fluoroborate, lead iodide, lead nitrate, lead sulfate, lead sulfide, and tetraethyl lead National primary drinking water standards MCLG MCL Action level Reportable quantities of hazardous substances designated pursuant to Section 311 of the Clean Water Act Lead acetate, lead chloride, lead fluoroborate, lead iodide, lead nitrate, lead sulfate, lead sulfide, and tetraethyl lead	Yes Zero Treatment technique ^f 0.015 mg/L 10 pounds	EPA 2005a 40 CFR 116.4 EPA 2002 EPA 2005c 40 CFR 117.3

8. REGULATIONS AND ADVISORIES

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Agency	Description	Information	Reference
NATIONAL (cont.)			
EPA	Residential lead hazards standards – TSCA Section 403		EPA 2005I
	Floors	40 µg/ft ²	
	Interior window sills	250 µg/ft ²	
	Bare soil in children's play areas	400 ppm	
	Bare soil in rest of yard	1,200 ppm average	
c. Food			
FDA	Action level (µg/mL leaching solution)		FDA 2000
	Ceramicware		
	Flatware (average of 6 units)	3.0 µg/mL	
	Small hollowware (other than cups and mugs) (any 1 of 6 units)	2.0 µg/mL	
	Large hollowware (other than pitchers) (any 1 of 6 units)	1.0 µg/mL	
	Cups and mugs (any 1 of 6 units) and pitchers (any 1 of 6 units)	0.5 µg/mL	
	Silver-plated hollowware		
	Product intended for use by adults (average of 6 units)	7 µg/mL	
	Product intended for use by infants and children (any 1 of 6 units)	0.5 µg/mL	
	Bottled drinking water	0.005 mg/L	FDA 2004 21 CFR 165.110
d. Other			
ACGIH	Carcinogenicity classification		ACGIH 2004
	Lead	A3 ^g	
	Biological exposure indices (lead in blood) ^h	30 µg/100 mL	
ATSDR	Action level for children	10 µg/dL	Agency for Toxic Substances and Disease Registry 1997
EPA	Carcinogenicity classification	Group B2 ⁱ	IRIS 2005
	Oral slope factor	Not available	
	Inhalation unit risk	Not available	
	RfC	Not available	
	RfD	Not applicable ^j	
	Superfund, emergency planning, and community right-to-know		
	Designated CERCLA hazardous substance	10 pounds	EPA 2005d 40 CFR 302.4
	Reportable quantity		
	Lead, lead acetate, lead chloride, lead fluoroborate, lead iodide, lead nitrate, lead phosphate, lead sulfate, lead sulfide, and tetraethyl lead		

8. REGULATIONS AND ADVISORIES

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Agency	Description	Information	Reference
NATIONAL (cont.)			
EPA	Superfund, emergency planning, and community right-to-know		
	Effective date of toxic chemical release reporting for lead	01/01/87	EPA 2005g 40 CFR 372.65
	Extremely hazardous substances		EPA 2005e 40 CFR 355, Appendix A
	Tetraethyl lead		
	Reportable quantity	10 pounds	
	Threshold planning quantities	100 pounds	
EPA	Superfund, emergency planning, and community right-to-know		
	Threshold amounts for manufacturing (including importing), processing, and otherwise using such toxic chemicals	100 pounds	EPA 2005f 40 CFR 372.28
NTP	Carcinogenicity classification	Reasonably anticipated to be human carcinogens	NTP 2005

^aGroup 2A: probably carcinogenic to humans

^bGroup 3: not classifiable as to carcinogenicity to humans

^cNational primary and secondary ambient air quality standards for lead and its compounds, measured as elemental lead by a reference method based on Appendix G to 40 CFR 50.12, or by an equivalent method, are: 1.5 µg/m³, maximum arithmetic mean averaged over a calendar quarter.

^dThe REL also applies to other lead compounds (as Pb), including metallic lead, lead oxides, and lead salts (including organic salts such as lead soaps but excluding lead arsenate). The NIOSH REL for lead (10-hour TWA) is 0.050 mg/m³; air concentrations should be maintained so that worker blood lead remains less than 0.060 mg Pb/100 g of whole blood.

^eSkin designation

^fTreatment Technique: lead is regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For lead, the action level is 0.015 mg/L.

^gA3: confirmed animal carcinogen with unknown relevance to humans

^hBEI: Women of child-bearing potential, whose blood exceeds 10 µg/dL, are at risk of delivering a child with a blood Pb over the current CDC guideline of 10 µg/dL. If the blood Pb of such child remains elevated, they may be at increased risk of cognitive deficits.

ⁱGroup B2: probable human carcinogen

^jSee IRIS record for complete oral RfD discussion (IRIS 2005).

ACGIH = American Conference of Governmental Industrial Hygienists; ATSDR = Agency for Toxic Substances and Disease Registry; BEI = biological exposure indices; CDC = Centers for Disease Control and Prevention; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life or health; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; REL = recommended exposure limit; RfC = inhalation reference concentration; RfD = oral reference dose; TSCA = Toxic Substances Control Act; TLV = threshold limit values; TWA = time-weighted average; USC = United States Code; WHO = World Health Organization

8. REGULATIONS AND ADVISORIES

occupational exposure of $50 \mu\text{g}/\text{m}^3$ (0.006 ppm) or lower, based on an 8-hour TWA (OSHA 2005d). When employee exposures to lead cannot be maintained $\leq 50 \mu\text{g}/\text{m}^3$ through engineering and work practice controls, the employer is required to provide the employees with respirators as a means of supplemental control. The specifications for different types of respirators and the conditions for their use are provided in the Code of Federal Regulations at 29 CFR 1910.1025. OSHA specifies $30 \mu\text{g}/\text{m}^3$ of air as the action level for employee exposure to airborne concentrations of lead (OSHA 2005d). Under the requirements for medical surveillance and biological monitoring, the blood lead level (PbB) of employees exposed to lead above the action level for >30 days/year must be monitored at least every 6 months. The frequency for sampling an employee's PbB increases to once every 2 months if the results of his or hers previous blood analysis indicated a PbB $\geq 40 \mu\text{g}/\text{dL}$ (OSHA 2005d). OSHA requires continuing the 2-month sampling protocol until the employee's PbB is below $40 \mu\text{g}/\text{dL}$ for two consecutive samplings. If an employee is working in an area where exposure to lead is at or above the action level, and the employee's periodic blood test or a follow-up test indicates a PbB $\geq 50 \mu\text{g}/\text{dL}$, the employer is required to remove the employee from that work area (OSHA 2005d). The relocation of an employee may also be instituted if the average of the three most recent blood tests or the average of all blood tests given over the most recent 6-month period indicates a PbB $\geq 50 \mu\text{g}/\text{dL}$. If however, the last single blood test taken during this period indicates a PbB $\leq 40 \mu\text{g}/\text{dL}$, relocation of the employee may not be required (OSHA 2005d). Except for the construction industry and certain aspects of the agricultural industry, more detailed requirements for limiting all occupational exposures to lead, including shipyard employment (OSHA 2005f), can be found in 29 CFR 1910.1025 (OSHA 2005d). On May 4, 1993, OSHA published an interim final rule, which reduced the permitted level of occupational exposure to lead for construction workers from an 8-hour TWA of $200 \mu\text{g}/\text{m}^3$ to an 8-hour TWA of $50 \mu\text{g}/\text{m}^3$ (OSHA 1993). As with other industries, the action level for occupational exposure to lead in the construction industry is $30 \mu\text{g}/\text{m}^3$ (OSHA 2005e). More detailed requirements for protecting construction workers from occupational exposures to lead can be found in 29 CFR 1926.62 (OSHA 2005e).

The EPA regulates lead under the Clean Air Act (CAA) and has designated lead as a hazardous air pollutant (HAP) (EPA 2004b). In the early 1970s, after determining that lead additives would impair the performance of emission control systems installed on motor vehicles and that lead particle emissions from motor vehicles presented a significant health risk to urban populations, the EPA began regulating the lead content in gasoline (EPA 1996a). In 1973, EPA instituted a phase-down program designed to minimize the lead content of leaded gasoline over time. By 1988, the total lead usage in gasoline had been reduced to <1% of the amount of lead used in the peak year of 1970 (EPA 1996a). The EPA defined unleaded gasoline as gasoline produced without the use of any lead additive and containing not more than 0.05 g of

8. REGULATIONS AND ADVISORIES

lead per gallon and not more than 0.0005 g of phosphorous per gallon. The 0.05 g per gallon criterion was allowed because EPA determined that this maximum trace level would provide adequate protection for catalyst emission control devices (i.e., prevent deterioration in emission control systems) and would be practicable for the petroleum industry. In 1990, Congress added Section 211(n) to the CAA and provided that after December 31, 1995, it would be unlawful to offer, sell, dispense, or transport, for use as fuel in any motor vehicle, any gasoline that contains lead or lead additives. The effective date for this prohibition was January 1, 1996 (EPA 1996a). On February 2, 1996, the EPA published a direct final rule revising its regulation for consistency with the CAA prohibitions; however, EPA's definition of unleaded gasoline still allowed the sale of gasoline containing trace amounts of lead up to 0.05 g/gallon. The current definition, however, expressly prohibits the use of any lead additive in the production of unleaded gasoline. The term "lead additive" was defined to include pure lead as well as lead compounds (EPA 1996a).

Lead is regulated by the Clean Water Effluent Guidelines and Standards, which are promulgated under the authority of the Clean Water Act (CWA). The regulations provide limitations on pollutant concentrations in waste water discharges from point source categories and represent the degree of reduction in pollutant concentration that is attainable through demonstrated technologies for new and existing sources. The regulations also provide standards of performance for new sources as well as pretreatment standards for new and existing sources. The effluent limitations establish the maximum discharge of pollutants allowed for 1 day and for a monthly average. The CWA establishes the basic structure for regulating the discharge of pollutants to waterways and is designed to ensure that all waters are sufficiently clean to protect public health and/or the environment. However, if waters and their sediments become contaminated from sources such as atmospheric deposition and discharges from industrial, municipal, or agricultural operations, toxic substances could concentrate in the tissue of fish and wildlife. Advisories have been developed and issued to warn people about the health risks of consuming lead-contaminated fish, shellfish, or wildlife and provide guidance as to the amount of fish or wildlife that can be safely consumed. Each state, Native American Tribe, or U.S. Territory establishes its own criteria for issuing fish and wildlife advisories. A fish or wildlife advisory will specify which waters (lake, rivers, estuaries, or coastal areas) or hunting areas have restrictions. The advisory provides information on the species and size range of the fish or wildlife of concern. The advisory may completely ban eating fish and shellfish, or recommend consumption limits (numbers of fish meals per specified time period) considered to be safe to eat. For example, an advisory may recommend that a person eat a certain type of fish no more than once a month. Advisories may specify the tissues of the fish or wildlife that can be safely eaten or proper preparation and cooking practices to help decrease exposure to lead. The fish or

8. REGULATIONS AND ADVISORIES

wildlife advisory is typically more restrictive to protect pregnant women, nursing mothers, and young children. Published information in the form of brochures on fish and wildlife advisories is available from state public health departments, natural resources departments, or fish and game departments. Signs may be posted in certain fishing and hunting areas frequently used by recreational fishers and hunters to warn them about specific contamination problems (EPA 1995b). Currently, 10 advisories are in effect in five states (Hawaii, Louisiana, Missouri, Ohio, and Tennessee), and one U.S. Territory (American Samoa) restricting the consumption of lead-contaminated fish and shellfish (EPA 2004d). No advisories were issued for wildlife.

In an effort to protect human health by reducing the lead levels in drinking water at consumers' taps to as close to the maximum contaminant level goal (MCLG) of zero, water system authorities are required to: (1) install or improve corrosion control to minimize lead levels at the tap while ensuring that treatment does not cause the water system to violate any national primary drinking water regulation; (2) install treatment to reduce lead in source water entering the distribution system; (3) replace lead service lines when >10% of targeted tap samples exceed 0.015 mg/L lead in drinking water if corrosion control and/or source water treatment does not bring lead levels below the lead action level; and (4) conduct public education programs if lead levels are above the action level (EPA 1991a).

The EPA also regulates the lead content in hazardous wastes as prescribed by the Resource Conservation and Recovery Act (RCRA). A solid waste may be defined as hazardous if it exhibits any of the four characteristics (ignitability, corrosivity, reactivity, and toxicity) used to identify hazardous wastes. A solid waste containing lead or lead compounds may be defined as a hazardous waste if it exhibits the characteristic of toxicity. The waste is said to exhibit the toxicity characteristic if the lead concentration in the extract obtained by subjecting a sample of the waste to the Toxicity Characteristic Leaching Procedure (TCLP) exceeds 5.0 mg/L (EPA 1990). On December 18, 1998, EPA issued a proposed rule under the Toxic Substances Control Act (TSCA) to provide new standards for the management and disposal of lead-based paint debris generated by individuals involved in abatements, renovations, and demolition of target housing and from lead removal and demolition of public and commercial buildings (EPA 1998a). As a result of the proposed rule and to avoid duplication and inconsistency in the management of lead-based paint debris, EPA also issued, on the same day a proposed rule that would temporarily suspend the applicability of the toxicity characteristic to these types of debris (EPA 1998b).

The Lead-Based Paint Poisoning Prevention Act, as amended by the National Consumer Information and Health Promotion Act of 1976, mandates that the use of lead-based paint in residential structures

8. REGULATIONS AND ADVISORIES

constructed or rehabilitated by any federal agency or with federal assistance in any form be prohibited (HUD 1998). By definition, residential structures include non-dwelling facilities operated by the owner and commonly used by children under 6 years old, such as childcare centers. The Act also authorized the Department of Housing and Urban Development (HUD) to promulgate regulations to eliminate lead-based paint from HUD-associated housing built prior to 1978. The regulatory definition of lead-based paint is “any paint or other surface coating that contains lead equal to or in excess of 1.0 mg/cm² or 0.5 percent by weight” (HUD 1997, 1998). For paints manufactured after June 22, 1977, however, Section 501(3) of the Act defines lead-based as any paint where the nonvolatile content contains 0.06% lead by weight. Purchasers and tenants of HUD-associated housing constructed before 1978 must be notified that the dwelling was constructed prior to 1978 and may contain lead-based paint. Information concerning the hazards of lead-based paint, the symptoms and treatment of lead-based paint poisoning, the precautions to be taken to avoid poisoning, and maintenance and removal techniques must also be provided (HUD 1998). The Residential Lead-Based Paint Hazard Reduction Act of 1992 (also known as Title X of the Housing and Community Development Act) requires sellers, landlords, and agents to provide the same type of information to potential purchasers or tenants of other “target housing” (i.e., constructed prior to 1978). Exceptions to these requirements include housing for elderly or disabled persons, unless a child <6 years of age is expected to reside in the dwelling; and dwellings without bedrooms such as studio/efficiency apartments, individual room rentals, dormitories, and military barracks (HUD 1998). Title IX also mandates a broad range of interrelated lead exposure activities, some of which require inter-agency collaboration.

In addition to HUD, the primary federal agencies responsible for promulgating regulations implementing the mandates of Title X are the EPA, the Department of Health and Human Services (DHHS) and the Department of Labor’s Occupational Safety and Health Administration (OSHA). Title X amends TSCA by adding Title IV, entitled “Lead Exposure Reduction”. Title IV provides the authority for developing standards that reduce lead-based paint hazards in housing and environmental media (EPA 1998a). Section 402 of Title IV requires the EPA to promulgate regulations for accrediting training programs and certification of persons engaging in “lead-based paint activities” such as for lead abatement and renovation. The aim of the ruling is to ensure that individuals conducting these activities are properly trained and certified. The EPA/HUD training and certification program provides for five categories of lead-based paint professionals: supervisors, workers, inspectors, risk assessors, and project designers; and three categories of activities: inspection, risk assessment, and abatement. Section 403 of Title IV requires EPA to develop standards for lead-based paint hazards in most pre-1978 housing and child-occupied facilities and to address by regulation(s) the definition of “lead-based paint hazards”, “lead-

8. REGULATIONS AND ADVISORIES

contaminated dust", and "lead-contaminated soil". On June 3, 1998, EPA issued several proposed standards in a notice of proposed rulemaking. It was proposed that lead-based paint hazards be described as "paint in poor condition" and defined as $>10 \text{ ft}^2$ of deteriorated paint on exterior surface areas and $>2 \text{ ft}^2$ on interior surface areas (EPA 1998b). The proposed standard for a lead-dust hazard is an average level of lead in dust of $\geq 40 \text{ } \mu\text{g}/\text{ft}^2$ on uncarpeted floors and $\geq 250 \text{ } \mu\text{g}/\text{ft}^2$ on interior window sills (EPA 2005l). For soils, an average concentration of 400 ppm/yard was the proposed standard at which the public should be made aware of the risk associated with exposure to lead (EPA 1998b).

Section 404 of Title IV concerns the authorization requirements for state and tribal programs. States and Native American tribes can seek authorization from EPA to implement their own lead training, accreditation, and certification programs. On August 26, 1996, EPA published the final rule establishing the requirements that state or tribal programs must meet for authorization to administer and enforce the standards and regulations promulgated in accordance with Title IV (EPA 1998c). According to "The Lead Listing" provided by the National Lead Service Providers Listing System, as of July 1, 1998, 22 states have established operational lead programs that actively certify lead service providers. Local, certified (licensed) lead-based paint inspectors, risk assessors, and laboratories can be located by calling the National Lead Information Center and Clearinghouse (1-800-LEAD-FYI [1-800-532-3394]) or through the Internet at <http://www.leadlisting.org> (HUD 1997). The Lead Listing is operated by a private entity for HUD's Office of Lead Hazard Control.

Section 406 of Title IV directs the EPA to develop consumer information concerning the hazards of exposure to lead and procedures to be followed during housing renovations or remodeling. On June 1, 1998, the EPA issued its final rule on the requirements for lead hazard education prior to conducting renovations in target housing (EPA 1998a). It is important to note that while the federal disclosure program requires property owners to make others aware of the potential lead hazards in or on their property, the program does not require the property owner to conduct inspections or risk assessments prior to selling or leasing property. Regulations responding to the mandates of Title IV are codified at 40 CFR 745; Lead-Based Paint Poisoning Prevention in Certain Residential Structures.

Lead also appears on the FDA's list of poisonous and deleterious substances, which was established to control levels of contaminants in human food and animal feed. The action levels established for these substances represent limits at or above which the FDA will take legal action to remove the affected consumer products from the market (FDA 2000). In 1993, the FDA has established an action level for lead in fruit beverages ($80 \text{ } \mu\text{g}/\text{kg}$) packaged in lead-soldered cans (FDA 1998b); in 1995, the use of lead-

8. REGULATIONS AND ADVISORIES

soldered cans was banned by the FDA. Lead solders are alloys of metals that contain lead and are used in the construction of metal food cans. The FDA considers any food packaged in containers that use lead in can solders to be adulterated and in violation of the Federal Food, Drug, and Cosmetic Act (FDA 1995). As of February 8, 1996, the FDA considers wine in bottles capped with tin-coated lead foil capsules to be adulterated (FDA 1996). Tin-coated lead foil has been used as a covering applied over the cork and neck areas of wine bottles to prevent insect infestations, as a barrier to oxygen, and for decorative purposes. Because it can be reasonably expected that lead could become a component of the wine, the use of these capsules is also a violation of the Federal Food, Drug, and Cosmetic Act (FDA 1996). The FDA has reviewed several direct human food ingredients and has determined them to be “generally recognized as safe” when used in accordance with current good manufacturing practices. Some of these ingredients contain allowable concentrations of lead ranging from 0.1 to 10 ppm (FDA 1998a).

The Lead Contamination Control Act of 1988 mandates that the Consumer Product Safety Commission (CPSC): (1) require the repair or recall of drinking water coolers containing lead in parts that come in contact with drinking water; (2) prohibit the sale of drinking water coolers that are not lead-free; (3) require that states establish programs to assist educational agencies in testing and remediating lead contamination of drinking water in schools; and (4) require that EPA certify testing laboratories and provide for coordination by the CDC of grants for additional lead screening and referral programs for children and infants (Congressional Record 1988). The CPSC has declared paints and similar surface coating having a lead content that exceeds the 0.06% by weight limit to be “banned hazardous products” (CPSC 1977). Paints and surface coatings with lead concentrations exceeding the 0.06% limit are defined as “lead-containing paint”. Except for applications to motor vehicles and boats, once lead-containing paints are applied to toys or other articles intended for use by children and articles of furniture manufactured for consumer use, these items also become “banned hazardous products” (CPSC 1977). These products may be exempt from the ban if, at a minimum, the main label on the product includes the single word “Warning” and the statement: “Contains Lead. Dried Film of This Paint May Be Harmful If Eaten or Chewed” (CPSC 1977).

The CDC determined in 1991 that PbBs $>10 \mu\text{g/dL}$ in children were to be considered elevated (CDC 1991). In its annual publication of threshold limit values (TLVs) and biological exposure indices (BEIs), the ACGIH notes that women of child-bearing age who have a PbB exceeding the CDC guideline value are at risk of delivering children with a PbB $>10 \mu\text{g/dL}$ (ACGIH 1998). In its report to Congress, NIOSH summarizes occupational exposure information and provides recommendations for workers (NIOSH 1997b).

8. REGULATIONS AND ADVISORIES

The ACGIH also notes that if a child's PbB remains elevated, the child may be at increased risk of cognitive deficits (ACGIH 1998). The ACGIH has adopted BEIs for various substances. The BEI for a substance is an industrial hygiene reference value to be used in evaluating potential health hazards. It is important to note that BEIs are guideline values, and that they are not intended for use as measures of adverse effects or for diagnosis of occupational illness (ACGIH 1998). They represent the level of substance most likely to be observed in specimens (e.g., blood or urine) collected from a healthy worker who has been exposed to a chemical at its TLV. The TLV refers to the airborne concentration of a substance at which nearly all workers may be repeatedly exposed, day after day, without adverse health affects. BEIs apply to 8-hour exposures occurring 5 days/week. The BEI for lead is 30 µg/dL (ACGIH 2004). The recommended exposure level (REL) for lead in the air adopted by the NIOSH is 0.05 mg/m³ (NIOSH 2005). NIOSH also recommends maintaining air concentrations so that worker blood lead remains at <60 µg/dL (NIOSH 1997a).