Occupational Exposure to Cadmium in the Construction Industry

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3139
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U.S. Department of Labor
Robert B. Reich, Secretary

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Introduction

In its elemental form, cadmium is either a blue-white metal or a grayish-white powder found in lead, copper, and zinc sulfide ores, but most cadmium compounds are highly colored from brown to yellow and red. Cadmium's uses vary from an electrode component in alkaline batteries to a stabilizer in plastics.

In 1971, the Occupational Safety and Health Administration (OSHA) moved to protect cadmium-exposed employees by adopting the American National Standards Institute's threshold limit values (TLVs) for cadmium as a national consensus standard under section 6 (a) of the Occupational Safety and Health (OSH) Act of 1970. The consensus standard established for the construction industry an 8-hour time-weighted average (TWA) permissible exposure limit (PEL) of 100 micrograms of cadmium per cubic meter of air (100 $\mu g/m^3$) for cadmium oxide fumes and 200 micrograms of cadmium per cubic meter of air (200 $\mu g/m^3$) for metal dust and soluble salts. Several studies, however, provided evidence of lung cancer and kidney disease from occupational exposure to cadmium at and below these established PELs.

In July 1987, OSHA determined the need for a rulemaking under section 6 (b) of the OSH Act to reduce worker exposure to cadmium. In 1990, OSHA published a notice of proposed rulemaking on cadmium to establish a PEL of either 5 $\mu g/m^3$ or 1 $\mu g/m^3$, to reduce the level of worker exposure to cadmium by more than 95 to 99 percent.[1] The PEL is a TWA concentration that must not be exceeded during any 8-hour work shift of a 40-hour workweek.

On September 14, 1992, OSHA published in the *Federal Register* a final rule for cadmium in the construction industry under *Title 29 Code of Federal Regulations Part 1926.63.*[2] The rule, effective December 14, 1992, establishes a PEL of 5 $\mu g/m^3$ for all cadmium compounds, including dust and fumes, and other

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[1] *Federal Register* 55 (25): 4052-4147 on February 6, 1990.

[2] This booklet is not a substitute for requirements of the rule. The complete regulatory text of the cadmium rule and appendices are published in the *Federal Register* 57 (178): 42102-42463. Start-up dates for certain provisions of the rule are later for small construction businesses. See section **Effective Dates** in this booklet for complete discussion of this modification.

protective provisions for cadmium in the construction industry. The rule also establishes the action level, which is defined as a level of cadmium in the air of the workplace that is half of the PEL, or 2.5 μg/m³, calculated as an 8-hour TWA. If exposure occurs at or above the action level, employers must determine the airborne level and follow the provisions in the rule applicable to that level, such as providing medical surveillance, performing air monitoring, and providing a respirator to any employee who requests one.

OSHA estimates that approximately 70,000 employees in the construction industry are potentially exposed to cadmium.[3] OSHA developed a separate standard regulating exposure to cadmium in the construction industry to reflect differences between general industry and construction operations and operations of various types within the construction industry. In recognition of this wide diversity in construction projects, OSHA specifically identified, in the final rule, those additional requirements that apply to such construction operations. For example, the construction industry is characterized by non-fixed worksites that are temporary in nature and differ from those in general industry in regard to the need for a designated competent person as well as significant differences between workplaces in terms of site conditions, size and scope of tasks, methods of operation, and environmental conditions. Furthermore, employees in the construction industry often do not remain in construction or in the employ of the same employer for a long period of time, in contrast to employees in fixed-site manufacturing facilities. Thus, the special characteristics of construction operations made it necessary to tailor some of the requirements traditionally included in OSHA health standards to the specific needs of the construction industry.

Scope and Application

The final cadmium rule for the construction industry applies to all occupational exposure to cadmium and all cadmium compounds in all forms, including fumes and dusts, and in all construction work where an employee may be potentially exposed to cadmium. Such work involves construction, alterations, and repairs. The activities include, but are not limited to, wrecking, demolishing, and salvaging structures where cadmium or cadmium-containing materials are present; cutting, brazing, grinding, or welding on surfaces that are painted with cadmium-

[3] OSHA, Office of Regulatory Analysis, 1992.

containing paints; and transporting, storing, and disposing of cadmium or cadmium-containing materials on the site or location where construction activities are performed.

Provisions of the Rule

The cadmium rule for the construction industry contains many of the same requirements as those for general industry, such as the aforementioned exposure limits, and provisions pertaining to respiratory protection, emergency situations, protective work clothing and equipment, housekeeping, and hygiene facilities[4]. These items are highlighted as follows:

- *Respiratory Protection.* Where applicable, the employer must provide respirators at no cost to employees and ensure that they are used in compliance with the standard.[5] Powered air-purifying respirators must be provided to employees who request them and where this respirator will provide adequate protection. Employers must ensure that employees use respirators in regulated areas and that respirators are properly fitted and used. Employees required to wear respirators must have limited medical exams prior to being assigned to an area where respiratory protection is required unless they have had a comparable exam within the preceding 12 months. Employees must be allowed to leave a regulated area to readjust face pieces and to change filters or to wash their faces to avoid skin irritation.
- *Emergency Situations.* Employers must develop and implement a written plan for emergency situations involving substantial releases of airborne cadmium.
- *Protective Work Clothing and Equipment.* Employers must provide protective clothing and equipment—such as coveralls, shoe covers, head coverings, and goggles—for employees exposed above the PEL and for employees with skin and eye irritation from cadmium exposure. The employer must ensure that contaminated clothing and equipment are placed in closed containers in change rooms prior to cleaning, laundering, maintaining, or discarding. The employer must provide clean

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[4] For an overview of these provisions, see OSHA booklet 3136 *Occupational Exposure to Cadmium.* A complete discussion of these provisions is found in the general industry standard, which was published on September 14, 1992, in the *Federal Register* under Title 29 CFR, Part 1910.1027.

[5] See 1926.63, section (g)(1) for respirator use.

and dry personal protective clothing and equipment at least weekly, or more often, as necessary to maintain effectiveness. The employer must notify those who launder or clean these items of the potential hazards of cadmium exposure.

- *Housekeeping.* Employers must maintain all surfaces as free as practicable of accumulations of cadmium and clean up spills promptly. Compressed air may be used to clean up accumulations of cadmium if it does not disperse cadmium into the air; vacuuming using a high-efficiency particulate air filter is preferable. The employer also must ensure that waste, scrap, debris, bags, containers, equipment, and clothing contaminated with cadmium and consigned for disposal be collected and disposed of in sealed impermeable bags or other closed impermeable containers. These bags and containers must be labeled according to the provisions of the rule, and disposed of according to applicable federal, state, and local regulations.
- *Hygiene Facilities and Practices.* The employer must provide facilities for showering and handwashing, change rooms, and lunch rooms for employees exposed above the TWA PEL. Change rooms must be equipped with separate storage facilities for street clothes and personal protective clothing/equipment and must be designed to prevent dispersing cadmium and contaminating the employee's street clothes. The lunch area should be readily accessible to employees. The level of cadmium in lunch areas must be below the action level of 2.5 $\mu g/m^3$. Before entering the lunch area, employees must clean or remove their protective clothing by HEPA vacuuming or some other removal method that does not disperse cadmium into the air. Also, employees exposed to cadmium above the PEL must shower at the end of the work shift and must wash their hands and faces prior to eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics.

Other provisions are included to deal with the differences in job duration, worker exposure, and work site conditions in the construction industry. These provisions include (1) designating a competent person on a construction site; (2) conducting exposure monitoring; (3) establishing regulated areas; (4) establishing compliance methods; (5) conducting medical surveillance; (6) communicating cadmium hazards to employees; (7) keeping exposure and medical records; and (8) delaying, in certain instances, the effective date of specific provisions of the rule.

Competent Person

OSHA established a "competent person" provision in the construction cadmium standard because there were no accurate exposure data available regarding the average length of exposure per week, the exposure levels, and the worker turnover in various job categories. The standard, therefore, requires employers to designate a person capable of identifying existing and potential cadmium hazards in the workplace and taking prompt, corrective actions to eliminate or control such hazards.

The designated "competent person" must be able at least to (1) determine, prior to beginning a job, whether cadmium is present in the workplace; (2) establish regulated areas and ensure that access to and from those areas is limited to "authorized" employees; (3) ensure the adequacy of any employee exposure-monitoring required by the standard; (4) ensure that all employees exposed to airborne cadmium levels above the PEL wear the appropriate personal protective equipment and are trained to use appropriate methods to control cadmium exposure; (5) ensure that proper hygiene facilities are provided and that workers are trained to use these facilities; and (6) ensure that required engineering controls are implemented, maintained in proper operating condition, and functioning properly.

Exposure Monitoring

There are four significant exposure monitoring provisions of the cadmium standard for construction: (1) prior to performing any construction work where employees may be exposed to cadmium, the employer must determine—through a designated competent person—whether cadmium is present in the workplace, and whether there is a possibility that an employee may be exposed to cadmium at or above the action level; (2) if the employee periodically performs tasks that may expose him or her to a higher concentration of airborne cadmium, the employer must monitor the employee while performing those tasks; (3) no minimum frequency for monitoring is required under the construction industry's cadmium standard (e. g., the changing nature of job and work conditions often limit the value of periodic monitoring on a fixed schedule); and (4) the employer shall notify each affected employee, in writing, of the results and shall post the results in an appropriate location accessible to affected employees, no later than 5 working days after receiving the results of any monitoring that is performed.

Regulated Areas

Whenever an employee is or can reasonably be expected to be exposed to cadmium in excess of the PEL, the employer is required to establish a regulated area alerting employees to the hazards.

Regulated areas must:

- Be set apart from the rest of the workplace in a way that establishes and alerts employees to the boundaries of the area;
- Be entered ONLY by authorized persons;
- Be entered ONLY by persons using proper respirators; and,
- Be accessible to employees who refrain from eating, drinking, smoking, chewing tobacco or gum and applying cosmetics in such areas. Employees must not carry, store, or use products associated with such activities in these areas.

Warning signs bearing the following information must be posted at all approaches to regulated areas:

> DANGER...CADMIUM...CANCER HAZARD...CAN CAUSE LUNG AND KIDNEY DISEASE... AUTHORIZED PERSONNEL ONLY...RESPIRATORS REQUIRED IN THIS AREA.

OSHA requires that employers consider establishing regulated areas whenever the following construction activities are conducted:

- Electrical grounding with cadmium welding;
- Cutting, brazing, burning, grinding, or welding on surfaces that are painted with cadmium-containing paints;
- Electrical work using cadmium-coated conduits;
- Using cadmium-containing paints;
- Cutting and welding cadmium-plated steel;
- Brazing or welding with cadmium alloys;
- Fusing of reinforced steel by cadmium welding;
- Maintaining or retrofitting cadmium-coated equipment; and
- Wrecking and demolishing where cadmium is present.

Methods of Compliance

Employers must implement engineering and work practice controls to reduce and maintain worker exposure to cadmium at or below the PEL. Engineering controls might include installing equipment, (e. g., source point capture) or modifying a process, (e. g., enclosure) to control employee exposure levels. Work practice controls include practices such as not eating, drinking, or applying cosmetics in regulated areas.

Some of the provisions that employers must adhere to include, but are not limited to, not using high-speed abrasive disc saws and similar abrasive power equipment unless such equipment has the appropriate engineering controls to minimize emissions and to meet the PEL. Materials containing cadmium shall not be applied by spray methods, if exposures are above the PEL, unless employees are protected with certain specified respirators and measures are taken to limit overspray and prevent contamination of adjacent areas.

Written Compliance Program

A written compliance program must be established and implemented that describes how the employer will reduce employee exposure to the PEL or below by the use of engineering and work practice controls and by the use of respiratory protection where permitted.

The written compliance program must be reviewed and updated as often and as promptly as necessary to reflect any significant changes in the employer's compliance status. A designated "competent person" shall review the compliance program, initially and after each change, to ensure that the written program offers adequate employee protection from occupational exposure to cadmium.

Upon request, the written compliance program must be made available for examination and copying to the Assistant Secretary for OSHA, the Director of the National Institute for Occupational Safety and Health (NIOSH), and affected employees and their designated representatives.

Medical Surveillance

All construction employees are automatically covered by the medical surveillance provisions if, for 30 days or more per year,

they perform any of the tasks, operations, or jobs for which employers are required to establish regulated areas (see section on **Regulated Areas** for a listing of these construction activities).

Employers also must provide medical surveillance to all employees who might have been exposed to cadmium by the same employer prior to the effective date of the standard in any of the tasks, operations, and jobs previously listed under **Regulated Areas**. Otherwise, the current employer must demonstrate that the employee did not, in the years prior to the effective date of the standard, work for the employer in those tasks for an aggregated total of more than 12 months prior to the effective date of this standard. If biological monitoring results are abnormal, employers must, among other things, reassess employee exposures within 30 days.

Employers must temporarily remove employees from jobs with exposure to cadmium at or above the action level on each occasion that a physician determines in a written medical opinion that the employee should be removed from cadmium exposure or in cases where the employee's biological monitoring results are so high as to require mandatory medical removal. The physician may determine the need for medical removal based on biological monitoring results, evidence of illness, inability to wear a respirator, signs or symptoms of cadmium-related dysfunction or disease, or any other reason deemed medically sufficient. When the removal is due to the employee's inability to wear a respirator, the removal need only be from jobs with exposure to cadmium above the PEL.

Where an employee temporarily is medically removed from a job for reasons related to cadmium exposure, the employer must remove the employee from any job where exposure is at or above the action level and must provide medical removal benefits such as normal earnings, seniority, and employee rights for a maximum of 18 months.

Cadmium Hazard Communication

Employers in the construction industry must communicate to employees the hazards of occupational exposure to cadmium. In a multi-employer workplace, however, an employer who produces, uses, or stores cadmium in a manner that may expose the employees of other employers to cadmium is required to notify the other employers of the potential hazard in accordance with the

provisions outlined in the hazard communication standard for construction in 29 CFR 1926.59.

The cadmium standard requires regulated areas to be posted with appropriate warning signs. Because the nature of construction work and the hazards often associated with it often change dramatically in the course of completing a project, regulated areas also may need to be established on a temporary basis. Therefore, using warning signs is especially important because employees who are regularly scheduled to work in or near these areas need to be warned about exposure to cadmium at or above the PEL.

Recordkeeping

Recordkeeping provisions in the cadmium standard for construction require employers to establish and keep an accurate record of all air monitoring for cadmium in the workplace. The employer must maintain this record for at least 30 years in accordance with the requirements for access to employee exposure and medical records (29 CFR 1910.20). In addition, under the cadmium standard, employers must provide a copy of the employee's air monitoring results to an industry trade association and to the employee's union or a comparable organization that is competent to maintain such records and is reasonably accessible to employers and employees in the industry.

The employer also must establish and maintain an accurate record for each employee covered by the medical surveillance provisions of the cadmium standard (29 CFR 1926.63 (l)(1)(i)). The employer must maintain these records for the duration of employment plus 30 years in accordance with 29 CFR 1910.20. The cadmium standard also requires that the employer, at the employee's request, provide a copy of the employee's medical record or update, as appropriate, to a medical doctor or union specified by the employee.

These provisions help ensure that workers in an industry with short-term employment, relatively high rates of turnover, and mobile job sites have a stable backup source for obtaining these records, if needed.

Effective Dates

The cadmium standard is effective as of December 14, 1992. All requirements of the standard begin on the effective date unless otherwise noted. Small businesses, however, frequently have fewer resources for interpreting and implementing complex requirements to protect their workers. To implement an outreach program and to provide technical assistance to employers with small businesses (19 or fewer employees), start-up dates for certain provisions of the construction standard are later for these establishments. In general, the effective dates for implementing the requirements of the cadmium standard are as follows:

- For completing initial exposure monitoring and establishing hygiene facilities, employers have no later than 2/14/93 (4/14/93 for small businesses);
- For determining PELs and establishing regulated areas, employers have no later than 3/14/93 (5/14/93 for small businesses);
- For conducting initial medical examinations, establishing written compliance programs, and training employees, employers have until 3/14/93 (6/14/93 for small businesses); and
- For setting engineering and work practice controls, employers have until 4/14/93 (8/14/93 for small businesses).

Conclusion

OSHA has determined that cadmium in any form poses a significant threat to the health of workers and can result in kidney damage, lung cancer, or respiratory diseases. OSHA expects that this standard will reduce workers' potential risk of serious health effects from cadmium exposure.

Sources of OSHA Assistance

OSHA program services and assistance that are available to employers include state plan programs, consultation services, voluntary protection programs, safety and health management programs, and training and education.

State Programs

States administering their own occupational safety and health programs through plans approved under section 18(b) of the OSH Act of 1970 must adopt standards and enforce requirements that are at least as effective as federal requirements. There are 23 states and 2 territories with their own OSHA-approved occupational safety and health plans; 23 cover the private and public (state and local government) sectors and 2 cover the public sector only. The states and territories that operate their own OSHA-approved job safety and health programs are listed at the end of this booklet.

Consultation Services

Employers who want help in recognizing and correcting safety and health hazards and in improving their safety and health programs can obtain free consultation funded mainly by OSHA. A professional staff administers the service through the state governments. Onsite consultation, among other things, helps employees recognize hazards in the workplace, suggests approaches or options for solving safety or health problems, identifies available sources of help, assists employers in developing or maintaining an effective safety and health program, and offers training and education for employers and employees at the workplace.

The service is given primarily at the work site, but limited services may be provided away from the work site. The service is provided *on request* mainly to smaller companies in high-hazard industries and will not result in citations or penalties for violations found. The states with OSHA consultation projects are listed at the end of this booklet.

Voluntary Protection Programs

Voluntary protection programs (VPPs) and onsite consultation services, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the OSH Act. The three levels of VPPs—Star, Merit, and Demonstration—are designed to recognize outstanding achievement by companies that have successfully incorporated comprehensive safety and health programs into their total management system. They motivate others to achieve excellent safety and health results in the same outstanding way and establish a cooperative relationship among employers, employees, and OSHA.

For additional information on VPPs and how to apply, contact the appropriate regional OSHA office listed at the end of this booklet.

Safety and Health Program Management Guidelines

OSHA's recommended *Safety and Health Program Management Guidelines*[6] issued in 1989 provide a blueprint for employers who seek guidance on how to effectively manage and protect worker safety and health. The four main elements of an effective occupational safety and health program are (1) management commitment and employee involvement, (2) work site analysis, (3) hazard prevention and control, and (4) safety and health training. These elements encompass principles such as establishing and communicating clear goals of a safety and health management program; conducting work site examinations to identify existing hazards and the conditions under which changes might occur; effectively designing the job site or job to prevent hazards; and providing essential training to address the safety and health responsibilities of both management and employees. Instituting these practices, along with providing the correct methods of compliance, can help improve workplace safety and health.

Training and Education

The OSHA Training Institute in Des Plaines, IL, provides basic and advanced training and education in safety and health for federal and state compliance officers; state consultants; other federal agency personnel, and private sector employers, employees and their representatives. Institute courses cover areas such as electrical hazards, machine guarding, ventilation, and ergonomics. The Institute facility includes classrooms, laboratories, a library, and an audiovisual unit. The laboratories contain various demonstrations and equipment, such as power presses, woodworking and welding shops, a complete industrial ventilation unit, and a sound demonstration laboratory. More than 70 courses are available for personnel in the private sector dealing with subjects such as safety and health in the construction industry and methods of voluntary compliance with OSHA standards.

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[6] *Federal Register* 54 (18): 3096-3916 on January 26, 1989. A single free copy of the guidelines is available by contacting the OSHA Publications Office at 200 Constitution Avenue, N.W., Room N-3101, Washington, DC 20210, (202)-4667

OSHA also provides funds to nonprofit organizations to conduct workplace training and education in subjects where OSHA believes there is a current lack of workplace training. OSHA identifies areas of unmet needs for safety and health education in the workplace annually and invites grant applications to address these needs. Organizations awarded grants use funds to develop training and educational programs, reach out to workers and employers for whom their program is appropriate, and provide these programs to workers and employers. Grants are awarded annually, with a 1-year renewal possible. Grant recipients are expected to contribute 20 percent of the total grant cost.

Related Publications

Single free copies of the following publications can be obtained from the OSHA Publications Office, 200 Constitution Avenue, N.W., Washington, DC 20210. Please send a self-addressed mailing label with your request.

Access to Medical and Exposure Records - OSHA 3110

All About OSHA - OSHA 2056

Chemical Hazard Communication - OSHA 3084

Consultation Services for the Employer - OSHA 3047

Employee Workplace Rights - OSHA 3021

How to Prepare for Workplace Emergencies - OSHA 3088

Occupational Exposure to Cadmium - OSHA 3136

OSHA Inspections - OSHA 2098

Personal Protective Equipment - OSHA 3077

Respiratory Protection - OSHA 3079

The following publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 783-3238 or (202) 512-2250 (fax). Include GPO Order No. and make checks payable to Superintendent of Documents.

Hazard Communication—A Compliance Kit - OSHA 3104. (A reference guide to step-by-step requirements for compliance with the OSHA standard.) Order No. 929-022-00000-9; $18.00 domestic; $22.50 foreign.

Hazard Communication Guidelines for Compliance - OSHA 3111. Order No. 029-016-00127-1; $1.00.

Job Hazard Analysis - OSHA 3071. Order No. 029-016-00142-5; $1.00.

Principal Emergency Response and Preparedness Requirements in OSHA Standards and Guidance for Safety and Health Programs - OSHA 3122. Order No. 029-016-00136-1; $2.50.

Training Requirements in OSHA Standards and Training Guidelines - OSHA 2254. Order No. 029-016-00137-9; $4.25.

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Telephone: (404) 347-3573

Region V
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230 South Dearborn Street
Room 3244
Chicago, IL 60604
Telephone: (312) 353-2220

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525 Griffin Street
Room 602
Dallas, TX 75202
Telephone: (214) 767-4731

Region VII
(IA,* KS, MO, NE)
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Kansas City, MO 64106
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Region VIII
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Denver, CO 80294
Telephone: (303) 844-3061

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Suite 715
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*These states and territories operate their own OSHA-approved job safety and health programs (Connecticut and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.

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