

# Concrete and Masonry Construction



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

OSHA 3106  
1998 (Revised)



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This informational booklet is intended to provide a generic, non-exhaustive overview of a particular standards-related topic. This publication does not itself alter or determine compliance responsibilities, which are set forth in OSHA standards themselves and the *Occupational Safety and Health Act*. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

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# Concrete and Masonry Construction

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Occupational Safety and Health Administration  
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OSHA 3106  
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The Occupational Safety and Health Administration's standard for concrete and masonry construction— *Subpart Q, Concrete and Masonry Construction, Title 29 of the Code of Federal Regulations (CFR), Part 1926.700 through 706*—sets forth requirements with which construction employers must comply to protect construction workers from accidents and injuries resulting from the premature removal of formwork, the failure to brace masonry walls, the failure to support precast panels, the inadvertent operation of equipment, and the failure to guard reinforcing steel.

Subpart Q prescribes performance-oriented requirements designed to help protect all construction workers from the hazards associated with concrete and masonry construction operations at construction, demolition, alteration, or repair worksites. Other relevant provisions in both general industry and construction standards (29 CFR Parts 1910 and 1926) also apply to these operations.



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OSHA's concrete and masonry standard includes the following important changes:

- Expands and toughens protection against masonry wall collapses by requiring bracing and a limited access zone prior to the construction of a wall;
- Permits employers to use several more recently developed methods of testing concrete instead of just the one currently recognized method; and
- Sets and clarifies requirements for both cast-in-place concrete and precast concrete during construction.



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Subpart Q is divided into the following major groups each of which is discussed in more detail in the following paragraphs:

- Scope, application, and definitions (29 CFR 1926.700);
- General requirements (29 CFR 1926.702);
- Equipment and tools (29 CFR 1926.702);
- Cast-in-place concrete (20 CFR 1926.703);
- Precast concrete (29 CFR 1926.704);
- Lift-slab construction (29 CFR 1926.705); and
- Masonry construction (29 CFR 1926.706).



### **Construction Loads**

Employers must not place construction loads on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the intended loads.

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### **Reinforcing Steel**

All protruding reinforcing steel, onto and into which employees could fall, must be guarded to eliminate the hazard of impalement.

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### **Post-Tensioning Operations**

Employees (except those essential to the post-tensioning operations) must not be permitted to be behind the jack during tensioning operations.

Signs and barriers must be erected to limit employee access to the post-tensioning area during tensioning operations.

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### **Concrete Buckets**

Employees must not be permitted to ride concrete buckets.

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### **Working Under Loads**

Employees must not be permitted to work under concrete buckets while the buckets are being elevated or lowered into position.

To the extent practicable, elevated concrete buckets must be routed so that no employee or the fewest employees possible are exposed to the hazards associated with falling concrete buckets.

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## **Personal Protective Equipment**

Employees must not be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless they are wearing protective head and face equipment.

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## **Equipment and Tools**

The standard also includes requirements for the following equipment and operations:

- Bulk cement storage,
- Concrete mixers,
- Power concrete trowels,
- Concrete buggies,
- Concrete pumping systems,
- Concrete buckets,
- Tremies,
- Bull floats,
- Masonry saws, and
- Lockout/tagout procedures.

### **General Requirements for Formwork**

Formwork must be designed, fabricated, erected, supported, braced, and maintained so that it will be capable of supporting without failure all vertical and lateral loads that might be applied to the formwork. As indicated in the Appendix to the standard, formwork that is designed, fabricated, erected, supported, braced, and maintained in conformance with Sections 6 and 7 of the *American National Standard for Construction and Demolition Operations—Concrete and Masonry Work* (ANSI) A10.9-1983 also meets the requirements of this paragraph.

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### **Drawings or Plans**

Drawings and plans, including all revisions for the jack layout, formwork (including shoring equipment), working decks, and scaffolds, must be available at the jobsite.

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### **Shoring and Reshoring**

All shoring equipment (including equipment used in reshoring operations) must be inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings.

Damaged shoring equipment must not be used for shoring. Erected shoring equipment must be inspected immediately prior to, during, and immediately after concrete placement. Shoring equipment that is found to be damaged or weakened after erection must be immediately reinforced.

The sills for shoring must be sound, rigid, and capable of carrying the maximum intended load. All base plates, shore heads, extension devices, and adjustment screws must be in firm contact and secured, when necessary, with the foundation and the form.

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Eccentric loads on shore heads must be prohibited unless these members have been designed for such loading.

If single-post shores are used one on top of another (tiered), then additional shoring requirements must be met. The shores must be as follows:

- Designed by a qualified designer and the erected shoring must be inspected by an engineer qualified in structural design,
- Vertically aligned,
- Spliced to prevent misalignment, and
- Adequately braced in two mutually perpendicular directions at the splice level. Each tier also must be diagonally braced in the same two directions.

Adjustment of single-post shores to raise formwork must not be made after the placement of concrete.

Reshoring must be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

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### **Vertical Slip Forms**

The steel rods or pipes on which jacks climb or by which the forms are lifted must be (1) specifically designed for that purpose and (2) adequately braced where not encased in concrete. Forms must be designed to prevent excessive distortion of the structure during the jacking operation. Jacks and vertical supports must be positioned in such a manner that the loads do not exceed the rated capacity of the jacks.

The jacks or other lifting devices must be provided with mechanical dogs or other automatic holding devices to support the slip forms whenever failure of the power supply or lifting mechanisms occurs.

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The form structure must be maintained within all design tolerances specified for plumbness during the jacking operation.

The predetermined safe rate of lift must not be exceeded.

All vertical slip forms must be provided with scaffolds or work platforms where employees are required to work or pass.

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### **Reinforcing Steel**

Reinforcing steel for walls, piers, columns, and similar vertical structures must be adequately supported to prevent overturning and collapse.

Employers must take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or turning over the roll.

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### **Removal of Formwork**

Forms and shores (except those that are used for slabs on grade and slip forms) must not be removed until the employer determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Such determination must be based on compliance with one of the following:

- The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or
- The concrete has been properly tested with an appropriate American Society for Testing and Materials (ASTM) standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.

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Reshoring must not be removed until the concrete being supported has attained adequate strength to support its weight and all loads placed upon it.

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### **Precast Concrete**

Precast concrete wall units, structural framing, and tilt-up wall panels must be adequately supported to prevent overturning and to prevent collapse until permanent connections are completed.

Lifting inserts that are embedded or otherwise attached to tilt-up wall panels must be capable of supporting at least two times the maximum intended load applied or transmitted to them; lifting inserts for other precast members must be capable of supporting four times the load. Lifting hardware shall be capable of supporting at least five times the maximum intended load applied or transmitted to the lifting hardware.

Only essential employees are permitted under precast concrete that is being lifted or tilted into position.

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### **Lift-Slab Operations**

- Lift-slab operations must be designed and planned by a registered professional engineer who has experience in lift-slab construction. Such plans and designs must be implemented by the employer and must include detailed instructions and sketches indicating the prescribed method of erection. The plans and designs must also include provisions for ensuring lateral stability of the building/structure during construction.
- Jacking equipment must be marked with the manufacturer's rated capacity and must be capable of supporting at least two and one-half times the load being lifted during jacking operations and the equipment must

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not be overloaded. For the purpose of this provision, jacking equipment includes any load bearing component that is used to carry out the lifting operation(s). Such equipment includes, but is not limited to, the following: threaded rods, lifting attachments, lifting nuts, hook-up collars, T-caps, shearheads, columns, and footings.

- Jacks/lifting units must be designed and installed so that they will neither lift nor continue to lift when loaded in excess of their rated capacity; and jacks/lifting units must have a safety device which will cause the jacks/lifting units to support the load at any position in the event of their malfunction or loss of ability to continue to lift.
- No employee, except those essential to the jacking operation, shall be permitted in the building/structure while any jacking operation is taking place unless the building/structure has been reinforced sufficiently to ensure its integrity during erection. The phrase “reinforced sufficiently to ensure its integrity” as used in this paragraph means that a registered professional engineer, independent of the engineer who designed and planned the lifting operation, has determined from the plans that if there is a loss of support at any jack location, that loss will be confined to that location and the structure as a whole will remain stable.
- Under no circumstances shall any employee who is not essential to the jacking operation be permitted immediately beneath a slab while it is being lifted.

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## **Masonry Construction**

Whenever a masonry wall is being constructed, employers must establish a limited access zone prior to the start of construction. The limited access zone must be as follows:

- Equal to the height of the wall to be constructed plus 4 feet (1.2 meters), and shall run the entire length of the wall;

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- On the side of the wall that will be unscaffolded;
  - Restricted to entry only by employees actively engaged in constructing the wall; and
  - Kept in place until the wall is adequately supported to prevent overturning and collapse unless the height of the wall is more than 8 feet (2.4 meters) and unsupported, in which case it must be braced. The bracing must remain in place until permanent supporting elements of the structure are in place.



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## **Safety and Health Program Management Guidelines**

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. To assist employers and employees in developing effective safety and health programs, OSHA published recommended *Safety and Health Program Management Guidelines* (*Federal Register* 54(18):3908-3916, January 26, 1989). These voluntary guidelines apply to all places of employment covered by OSHA.

The guidelines identify four general elements that are critical to the development of a successful safety and health management program:

- management commitment and employee involvement,
- worksite analysis,
- hazard prevention and control, and
- safety and health training.

The guidelines recommend specific actions under each of these general elements to achieve an effective safety and health program. A single free copy of the guidelines can be obtained from the U.S. Department of Labor, OSHA/OICA Publications, P.O. Box 37535, Washington, DC 20013-7535, by sending a self-addressed mailing label with your request.

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## **State Programs**

The *Occupational Safety and Health Act of 1970* encourages states to develop and operate their own job safety and health plans. States administering occupational safety and health programs through plans approved under section 18(b) of the *Act*, must adopt standards and enforce requirements that are “at least as effective” as federal requirements. There are currently 25 State Plan states: 23 cover the private and public sector (state and local governments) and 2 cover the public sector

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only. For more information on state plans, see the list of states with approved plans at the end of this publication.

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### **Free Onsite Consultation**

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state government agencies or universities employing professional safety consultants and health consultants. Comprehensive assistance includes an appraisal of all work practices and environmental hazards of the workplace and all aspects of the employer's present job safety and health program.

The program is separate from OSHA's inspection efforts. No penalties are proposed or citations issued for any safety or health problems identified by the consultant. The service is confidential.

For more information concerning consultation assistance, see the list of consultation projects at the end of this publication.

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### **Voluntary Protection Programs (VPPs)**

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 *Act*. The three 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

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the same outstanding way as they establish a cooperative relationship among employers, employees, and OSHA.

For additional information on VPPs and how to apply, contact the OSHA area or regional offices listed at the end of this publication.

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## **Training and Education**

OSHA area offices offer a variety of information services, such as publications, audiovisual aids, technical advice, and speakers for special engagements. The OSHA Training Institute in Des Plaines, IL, provides basic and advanced courses in safety and health for federal and state compliance officers, state consultants, federal agency personnel, and private sector employees, and their representatives.

OSHA also provides funds to nonprofit organizations, through grants to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually and grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, IL 60018; telephone: (847) 297-4810.

For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.

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## **Electronic Information**

Internet—OSHA standards, interpretations, directives, technical advisors, compliance assistance, and additional information are now on the World Wide Web at <http://www.osha.gov>.

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CD-ROM—A wide variety of OSHA materials, including standards, interpretations, directives, and more, can be purchased on CD-ROM from the U.S. Government Printing Office. To order, write to the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or telephone (202) 512-1800. Specify OSHA Regulations, Documents, and Technical Information on CD-ROM (ORDT), GPO Order No. S/N 729-013-00000-5. The price is \$38 per year (\$47.50 foreign); \$15 per single copy (\$18.75 foreign).

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## **Emergencies**

For life-threatening situations, call (800) 321-OSHA. Complaints will go immediately to the nearest OSHA area or state office for help.

For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.

**Bull Float.** A tool used to spread out and smooth concrete.

**Formwork.** The total system of support for freshly placed or partially cured concrete, including the mold or sheeting (form) that is in contact with the concrete as well as all supporting members including shores, reshores, hardware, braces, and related hardware.

**Jacking Operation.** Lifting vertically a slab (or group of slabs) from one location to another—for example, from the casting location to a temporary (parked) location, or from a temporary location to another temporary location, or to the final location in the structure—during a lift-slab construction operation.

**Lift Slab.** A method of concrete construction in which floor and roof slabs are cast on or at ground level and, using jacks, are lifted into position.

**Limited Access Zone.** An area alongside a masonry wall, that is under construction, and that is clearly demarcated to limit access by employees.

**Precast Concrete.** Concrete members (such as walls, panels, slabs, columns, and beams) that have been formed, cast, and cured prior to final placement in a structure.

**Reshoring.** The construction operation in which shoring equipment (also called reshores or reshoring equipment) is placed, as the original forms and shores are removed in order to support partially cured concrete and construction loads.

**Shore.** A supporting member that resists a compressive force imposed by a load.

**Tremie.** A pipe through which concrete may be deposited under water.

**Vertical Slip Forms.** Forms that are jacked vertically during the placement of concrete.

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Single free copies of the following publication(s) can be obtained from the U.S. Department of Labor, OSHA/OICA Publications, P.O. Box 37535, Washington, DC 20013-7535. Send a self-addressed mailing label with your request.

***Asbestos Standard for Construction Industry*** — OSHA 3096

The following publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 512-1800. Include GPO Order No. And make checks payable to the Superintendent of Documents.

***Construction Industry Digest*** — OSHA 2202  
Order No. 029-016-00151-4. Cost \$2.25.

***Excavations*** — OSHA 2226.  
Order No. 029-016-00176-1. Cost \$1.25.

***Title 29 CFR Part 1926 (Construction)*** —  
Order No. 029-016-00122-1. Cost \$30.00.

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1111 West 8th Street  
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Juneau, AK 99801  
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Licensing and Regulation  
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**Director**

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4th Floor, Law Building  
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Lansing, MI 48909  
(517) 373-7230

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Albany, NY 12240  
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319 Chapanoke Road  
Raleigh, NC 27603  
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South Carolina Department  
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Koger Office Park, Kingstree  
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P.O. Box 11329  
Columbia, SC 29210  
(803) 896-4300

**Commissioner**

Tennessee Department  
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Attention: Robert Taylor  
710 James Robertson  
Parkway  
Nashville, TN 37243-0659  
(615) 741-2582

**Commissioner**

Industrial Commission  
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160 East 300 South, 3rd Floor  
P.O. Box 146650  
Salt Lake City, UT 84114-  
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(801) 530-6898

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Vermont Department of Labor  
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National Life Building -  
Drawer 20  
120 State Street  
Montpelier, VT 05620  
(802) 828-2288

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Virgin Islands Department  
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Christiansted  
St. Croix, VI 00820-4666  
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Richmond, VA 23219  
(804) 786-2377

**Director**

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P.O. Box 44001  
Olympia, WA 98504-4001  
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Worker's Safety  
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Wyoming Department  
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Cheyenne, WY 82002  
(307) 777-7786

**State**

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**Telephone**

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Harrisburg, PA .....	(717) 782-3902
Hartford, CT .....	(860) 240-3152
Hasbrouck Heights, NJ .....	(201) 288-1700
Guaynabo, PR .....	(787) 277-1560
Honolulu, HI .....	(808) 541-2685
Houston, TX .....	(281) 286-0583
Houston, TX .....	(281) 591-2438
Indianapolis, IN .....	(317) 226-7290
Jackson, MS .....	(601) 965-4606
Jacksonville, FL .....	(904) 232-2895
Kansas City, MO .....	(816) 483-9531
Lansing, MI .....	(517) 377-1892
Little Rock, AR .....	(501) 324-6291
Lubbock, TX .....	(806) 743-7681
Madison, WI .....	(608) 264-5388
Marlton, NJ .....	(609) 757-5181
Methuen, MA .....	(617) 565-8110
Milwaukee, WI .....	(414) 297-3315
Minneapolis, MN .....	(612) 348-1994
Mobile, AL .....	(334) 441-6131
Nashville, TN .....	(615) 781-5423
New York, NY .....	(212) 466-2482
Norfolk, VA .....	(804) 441-3820
North Aurora, IL .....	(630) 896-8700
Oklahoma City, OK .....	(405) 231-5351
Omaha, NE .....	(402) 221-3182
Parsippany, NJ .....	(201) 263-1003
Peoria, IL .....	(309) 671-7033
Philadelphia, PA .....	(215) 597-4955
Phoenix, AZ .....	(602) 640-2007
Pittsburgh, PA .....	(412) 644-2903

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<b>Area</b>	<b>Telephone</b>
Portland, OR .....	(503) 326-2251
Providence, RI .....	(401) 528-4669
Raleigh, NC .....	(919) 856-4770
Salt Lake City, UT .....	(801) 487-0073
Sacramento, CA .....	(916) 566-7470
San Diego, CA .....	(619) 557-2909
Savannah, GA .....	(912) 652-4393
Smyrna, GA .....	(770) 984-8700
Springfield, MA .....	(413) 785-0123
St. Louis, MO .....	(314) 425-4249
North Syracuse, NY .....	(315) 451-0808
Tampa, FL .....	(813) 626-1177
Tarrytown, NY .....	(914) 524-7510
Toledo, OH .....	(419) 259-7542
Tucker, GA .....	(770) 493-6644
Westbury, NY .....	(516) 334-3344
Wichita, KS .....	(316) 269-6644
Wilkes-Barre, PA .....	(717) 826-6538
Wilmington, DE .....	(302) 573-6115

**Region I****(CT,\* MA, ME, NH, RI, VT\*)**

JKF Federal Building  
 Room E-340  
 Boston, MA 02203  
 Telephone: (617) 565-9860

**Region II****(NJ, NY,\* PR,\* VI\*)**

201 Varick Street  
 Room 670  
 New York, NY 10014  
 Telephone: (212) 337-2378

**Region III****(DC, DE, MD,\* PA, VA,\* WV)**

Gateway Building, Suite 2100  
 3535 Market Street  
 Philadelphia, PA 19104  
 Telephone: (215) 596-1201

**Region IV****(AL, FL, GA, KY,\* MS, NC, SC,\* TN\*)**

Atlanta Federal Center  
 61 Forsyth Street, SW,  
 Room 6T50  
 Atlanta, GA 30303  
 Telephone: (404) 562-2300

**Region V****(IL, IN,\* MI,\* MN,\* OH, WI)**

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

**Region VI****(AR, LA, NM,\* OK, TX)**

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

**Region VII****(IA,\* KS, MO, NE)**

City Center Square  
 1100 Main Street, Suite 800  
 Kansas City, MO 64105  
 Telephone: (816) 426-5861

**Region VIII****(CO, MT, ND, SD, UT,\* WY\*)**

1999 Broadway, Suite 1690  
 Denver, CO 80202-5716  
 Telephone: (303) 844-1600

**Region IX****(American Samoa, AZ,\* CA,\* Guam,****HI,\* NV,\* Trust Territories of the Pacific)**

71 Stevenson Street  
 Room 420  
 San Francisco, CA 94105  
 Telephone: (415) 975-4310

**Region X****(AK,\* ID, OR,\* WA\*)**

1111 Third Avenue  
 Suite 715  
 Seattle, WA 98101-3212  
 Telephone: (206) 553-5930

\*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.

