

# The Day Laborers' Health and Safety Workbook

UIC  
Edition

Written and Produced by



The Rutgers Occupational Training and Education Consortium (OTEC)  
and New Labor



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## **The Latino Occupational Safety and Health Initiative**

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The Latino Occupational Safety and Health Initiative (LOSHI) was established by New Labor and the Rutgers Occupational Training and Educational Consortium (OTEC). Through partnerships with employers, staffing firms, unions and community and faith based organizations LOSHI has developed a series of comprehensive site-specific safety and health training programs, trained over 100 worker-trainers and delivered thousands of hours of training to Latino workers throughout New Jersey.

### **Day Laborers in the Construction Industry**

In the U.S. Latino workers are an essential component of the construction industry. In fact since 1980, the number of Latinos employed in construction has quadrupled—from 342,000 to more than 1.4 million. The distribution of Latinos in the construction industry is highly concentrated among the laborer/helper occupations. In 2004, construction laborers accounted for one out of every four construction fatalities. Because of their concentration in the most dangerous jobs, language barriers, lack of training and other factors, the fatality rate for immigrant Latinos in construction is 44 percent higher than for construction workers as a whole and 20 percent higher than that for all Latinos.

Immigrant Latino day laborers in construction are in desperate need of information and training that will enable them to recognize the myriad hazards they encounter moving from jobsite to jobsite, to protect themselves from these hazards, and where possible work with co-workers, supervisors, and contractors to make their jobs safer.

The goal of the Day Laborers Health and Safety Training Program is to provide high quality Spanish language occupational safety and health training that addresses the needs of Latino immigrant day laborers in construction.

## About This Book

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Development of the activities for *The Day Laborers' Health and Safety Workbook* was informed by a series of focus groups in which day laborers described their working conditions and health and safety experiences. Drafts of these activities were then tested in a series of trainings with day laborers in New Brunswick, Red Bank, Lakewood, Dover and Orange and their feedback helped shape the versions included in this book. Insight into the experience of immigrant day laborers would not have been possible without the extraordinary efforts of the New Labor members who have worked as peer organizers/trainers/researchers on this project.

This work has been funded through a three year grant from the Center to Protect Workers Rights National Institute for Occupational Safety and Health (NIOSH) Research Consortium.

## **Organizations**

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### **Occupational Training and Education Consortium**

The Occupational Training and Education Consortium (OTEC) partners with unions, employers and other organizations to develop innovative training programs that work toward strengthening the existing systems of safety in the workplace. Relying on participatory educational models, OTEC is committed to building a lasting “culture of safety” in workplaces in New Jersey and around the country.

### **For more information about OTEC’s programs and services, contact:**

Occupational Training and Education Consortium  
The Labor Education Center  
Rutgers, The State University of New Jersey  
50 Labor Center Way  
New Brunswick, NJ 08901-8553  
Phone: (732) 932-1740

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Chicago, IL 60608  
312-491-9044  
[info@latinounion.org](mailto:info@latinounion.org)

### **Chicago Interfaith Committee on Worker Issues**

1020 W. Bryn Mawr, 3rd Floor  
Chicago, IL 60660  
773-728-8400  
For general inquiries e-mail [info@iwa.org](mailto:info@iwa.org)

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## **New Labor**

New Labor is an alternative model of worker organization that combines new and existing strategies to improve working conditions and provide a voice for immigrant workers in central New Jersey. Adapting to changes in the economy, New Labor strategically utilizes worker advocacy, customized training, and grassroots enterprises to leverage members' interests at work and in their communities. Since its founding in January of 2000, New Labor has grown to over 900 dues paying members and provides important solutions to the challenges faced by low-wage workers in today's economy.

**Visit New Labor's website at [www.newlabor.net](http://www.newlabor.net)**

For more information about New Labor contact:

New Labor  
103 Bayard Street  
Second Floor  
New Brunswick, NJ 08901  
Phone: (732) 246-2900  
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# The Small Group Activity Method

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## Basic Structure

The Small Group Activity Method is based on activities. An activity can take from 45 minutes to an hour. Each activity has a common basic structure:

- **Small Group Tasks**
- **Report-Back**
- **Summary**

**1. Small Group Tasks:** Activities include tasks (problems), or sets of tasks, for the groups to work on. Each task asks that groups use their experience and the factsheets to solve problems and make judgements on key issues.

**2. Report-Back:** For each task, groups select scribe's that take notes on the small group discussions and report back to the class as a whole. During the report-back, the scribe informs the entire class as to how his or her group solved the particular problem. The trainer records each scribes report-back on large pads of paper in front of the class so that everyone can refer to them.

**3. Summary:** Before the discussion drifts too far, the trainer needs to bring it all together during the summary. Here, the trainer highlights the key points of the activity and brings up any problems or points that may have been overlooked during the report-back.

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### **Three Basic Learning Exchanges**

The Small Group Activity Method is based on the idea that every training is a place where learning is shared. With SGAM, learning is not a one-way street that runs from trainer to worker. Rather SGAM is a structured procedure that allows us to share information. It is based on three learning exchanges:

- **Worker-to-Worker**
- **Worker-to-Trainer**
- **Trainer-to-Worker**

**Worker-to-Worker:** Most of us learn best from each other. SGAM is structured so that the worker-to-worker exchange is a key element of the training. The worker-to-worker exchange allows participants to learn from each other by solving problems in their small groups.

**Worker-to-Trainer:** Lecture-style training assumes that the trainer knows all the answers. With SGAM it is understood that the trainers also have a lot to learn and this is the purpose of the worker-to-trainer exchange. It occurs during the report-back and it is designed to give the trainer an opportunity to learn from the participants.

**Trainer-to-Worker:** This is the trainer's opportunity to clear up confusion and make points they think are key. By waiting until the summary section, trainers know better what people need to know.



# Activity 1: Job Fear

## **Purpose**

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To learn more about why Latinos have higher job fatality rates and what we can do to make our workplaces safer.

This Activity has two tasks.

## Task 1

---

In your groups, review the factsheets on pages 4-12. Then based on your own experience and the factsheets, answer the questions below.

### Questions:

**A. Why should Latino workers be concerned about their health and safety at work and why are more Latinos killed on the job? (Please make a list)**

1.

2.

3.

4.

5.

6.

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**B. In addition to health and safety, what other problems do you face on the job?**

1.

2.

3.

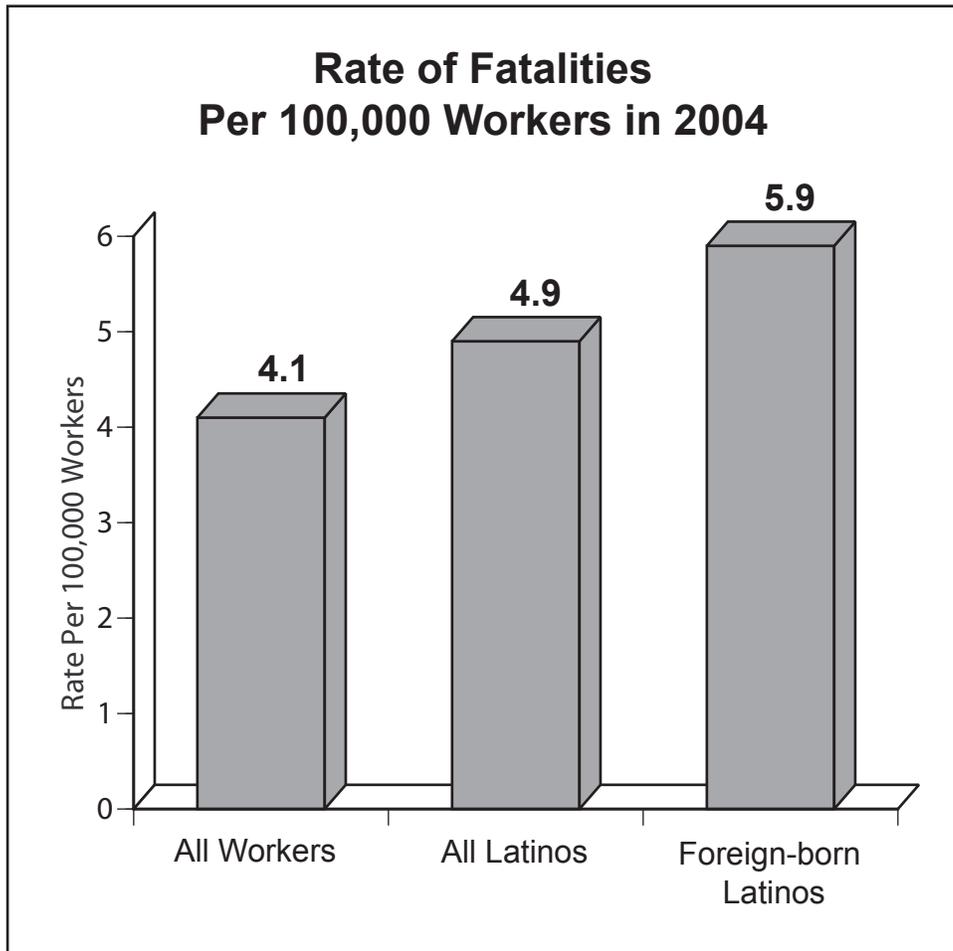
4.

5.

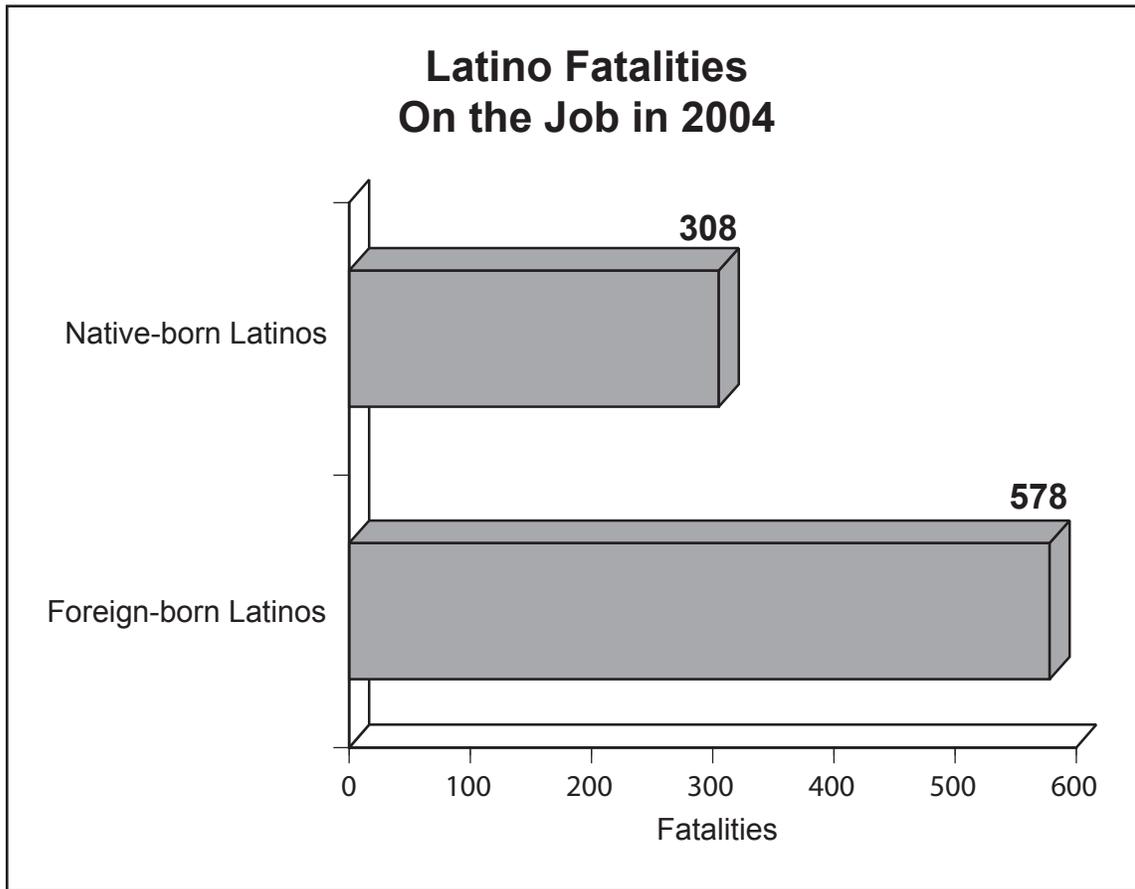
6.

# 1. Worker Fatalities

In 2004, there were 5,703 worker fatalities in the U.S. The fatality rate for all workers was 4.1. That means, for every 100,000 workers on the job, 4.1 died in a work related accident. The fatality rate for Latino workers was 4.9. Even more disturbing, the fatality rate for foreign-born Latinos was 5.9, and that's 44% higher than the rate for all workers.



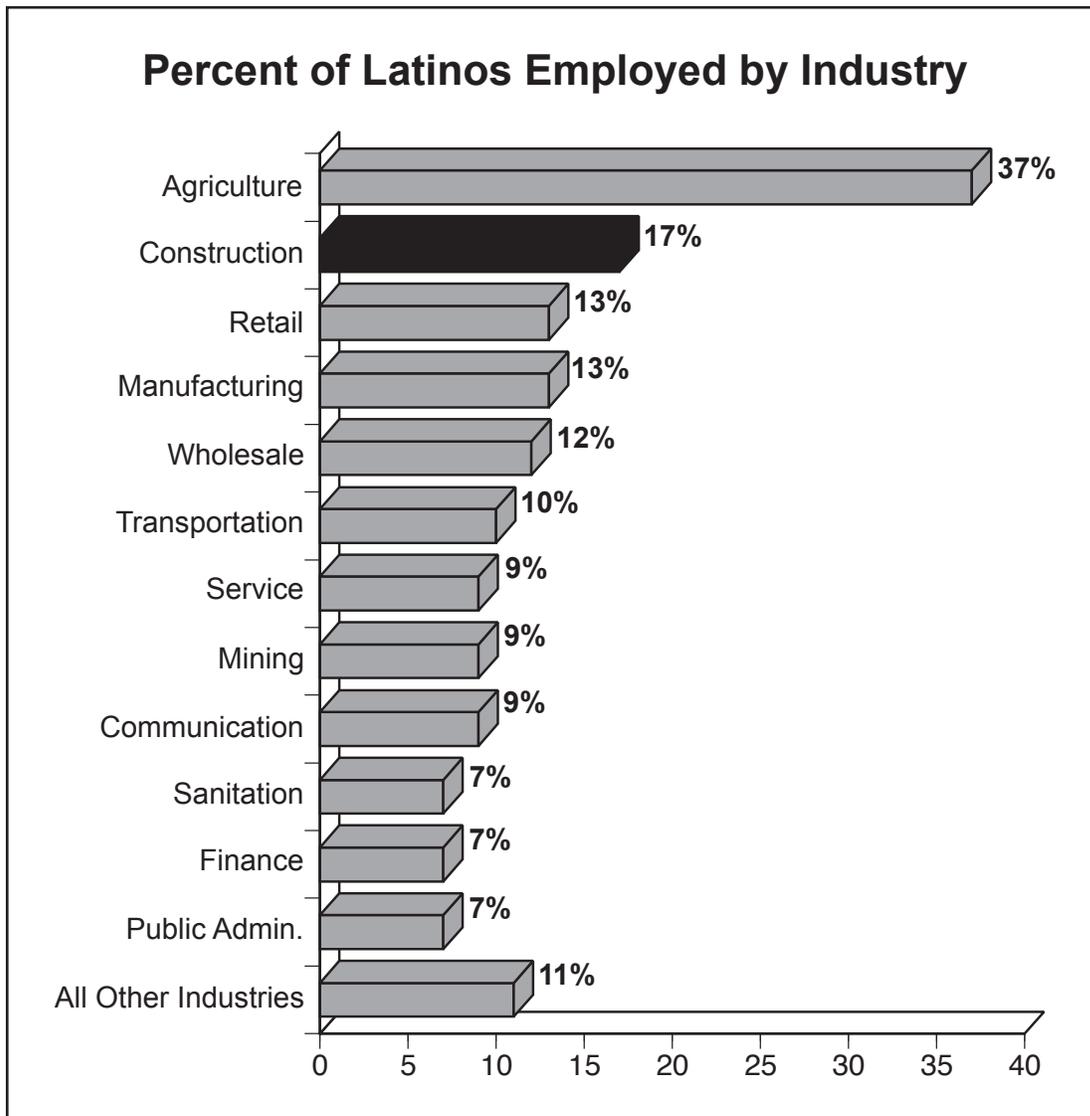
Of the 5,703 workers who died on the job in 2004, 883 were Latinos and of this group 578 were foreign born.



Sources: U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries*, 2005. Monthly Labor Review, *Visual Essay: Hispanic Worker Fatalities*, October 2005.

## 2. Many Latinos Work in Construction

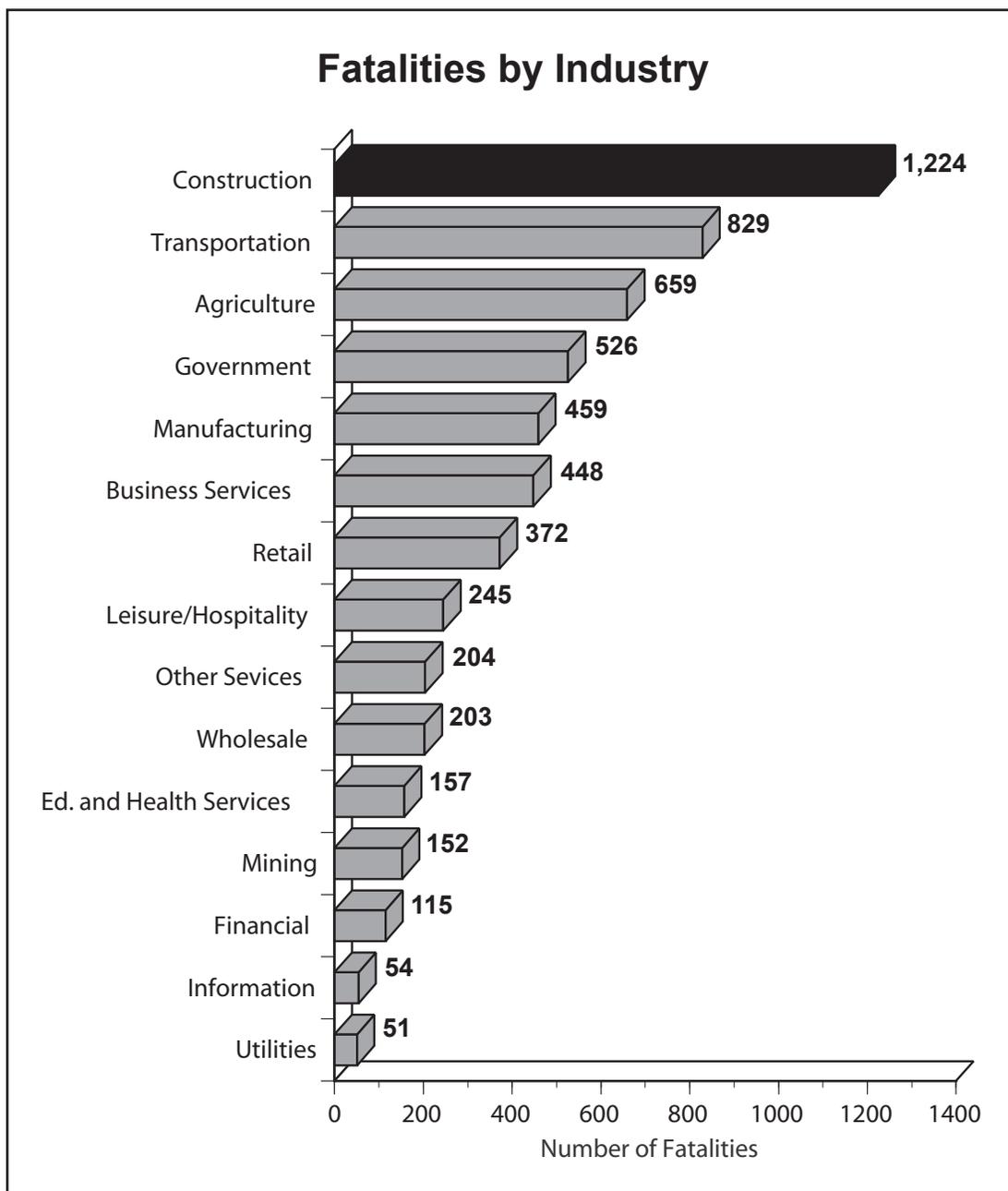
Approximately 14.7 million Latinos are employed in the U.S. They represent nearly 11 percent of the total workforce. A large percentage of Latinos are employed in the construction industry.



Source: Center to Protect Workplace Rights (CPWR), *The Construction Chart Book, Hispanics in the Workplace*, 2002.

### 3. Construction Work is Dangerous

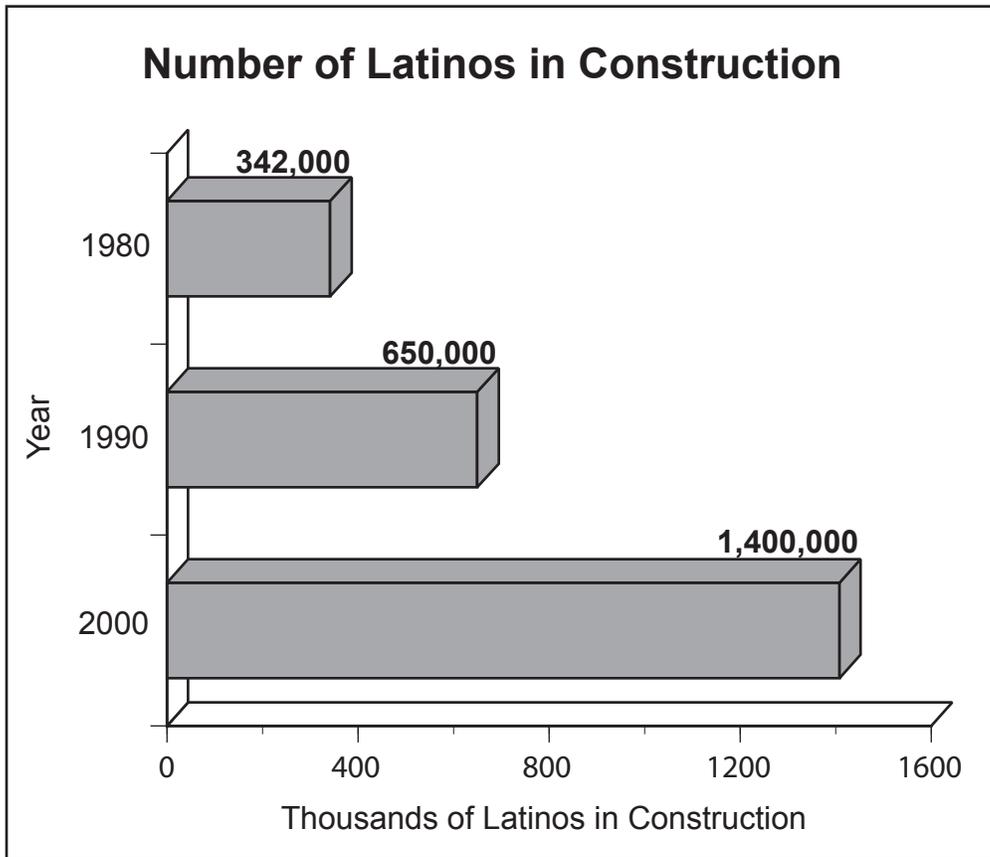
In 2004, 1,224 construction workers died on the job. In other words, one out to every 5 workers who died on the job in the U.S. worked in the construction industry.



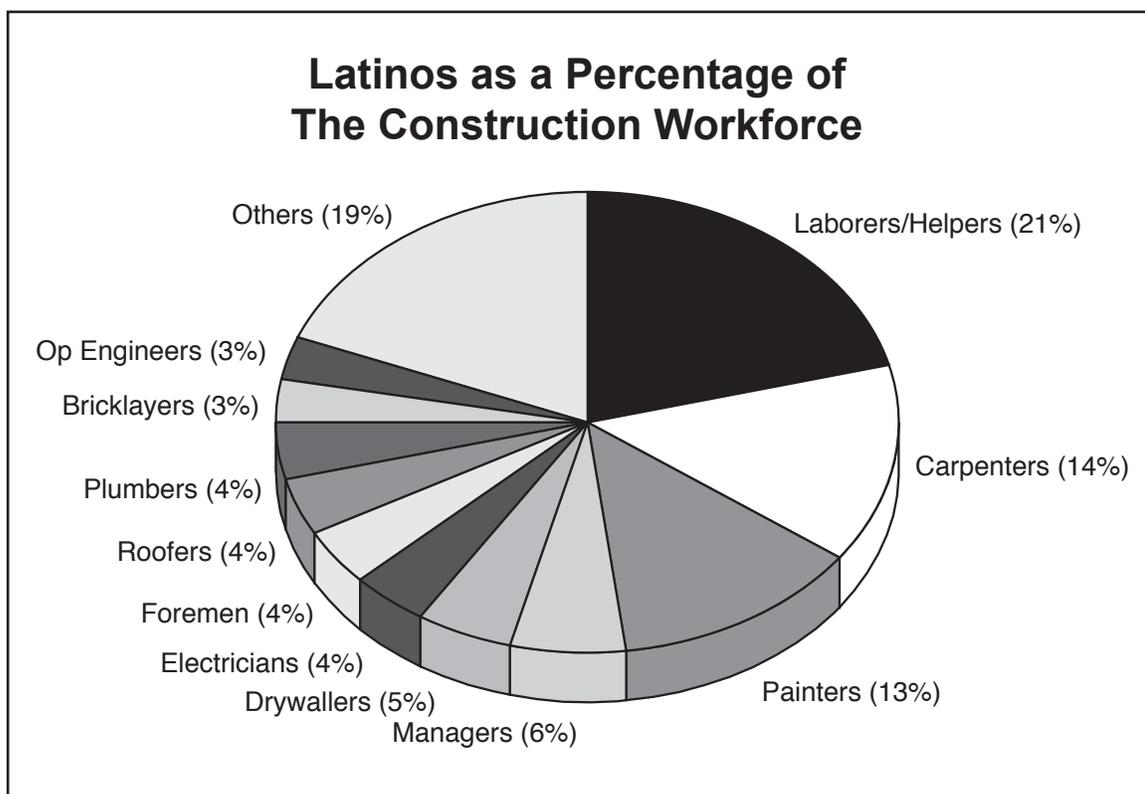
Source: Bureau of Labor Statistics, *Census of Fatal Occupational Injuries*, 2004.

## 4. Latinos in Construction

From 1980 to 2000, the portion of Latinos in the workforce grew from 5 percent to 11 percent. Over the same period of time the number of Latinos working in the construction industry grew from 6 percent to 15 percent. In short, since 1980 the number of Latinos in the construction industry has quadrupled.



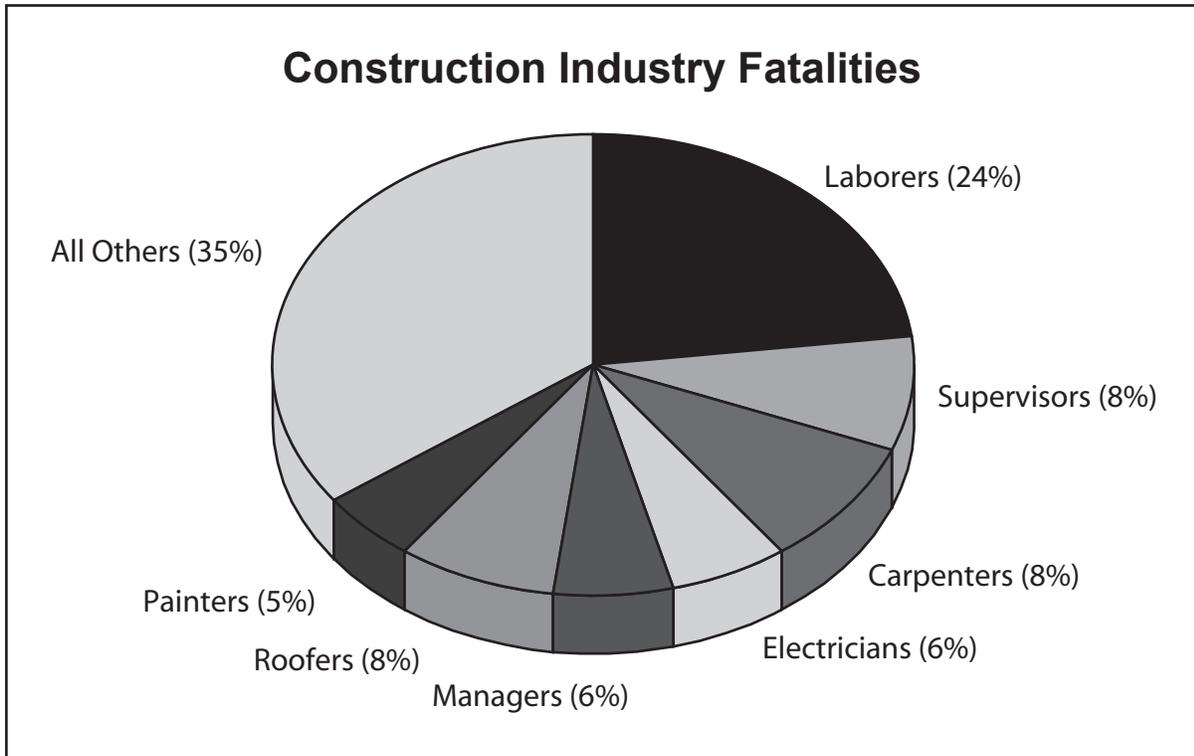
In the entire U.S. construction industry ten percent of all workers are laborers, but of the 1.4 million Latinos in construction, 21% are laborers. Thus, the distribution of Latinos in the construction industry is highly concentrated among the laborer/helper occupations.



Source: Center to Protect Workplace Rights (CPWR), *The Construction Chart Book, Hispanics in the Workplace*, 2002.

## 5. Construction Laborers Have the Most Fatalities

Of the 1,224 construction workers who died in 2004, nearly one out of every four was a laborer. Working as a laborer in the construction industry is a dangerous job.



Source: Bureau of Labor Statistics, *Census of Fatal Occupational Injuries*, 2004.

## 6. Injury and Illness Rates

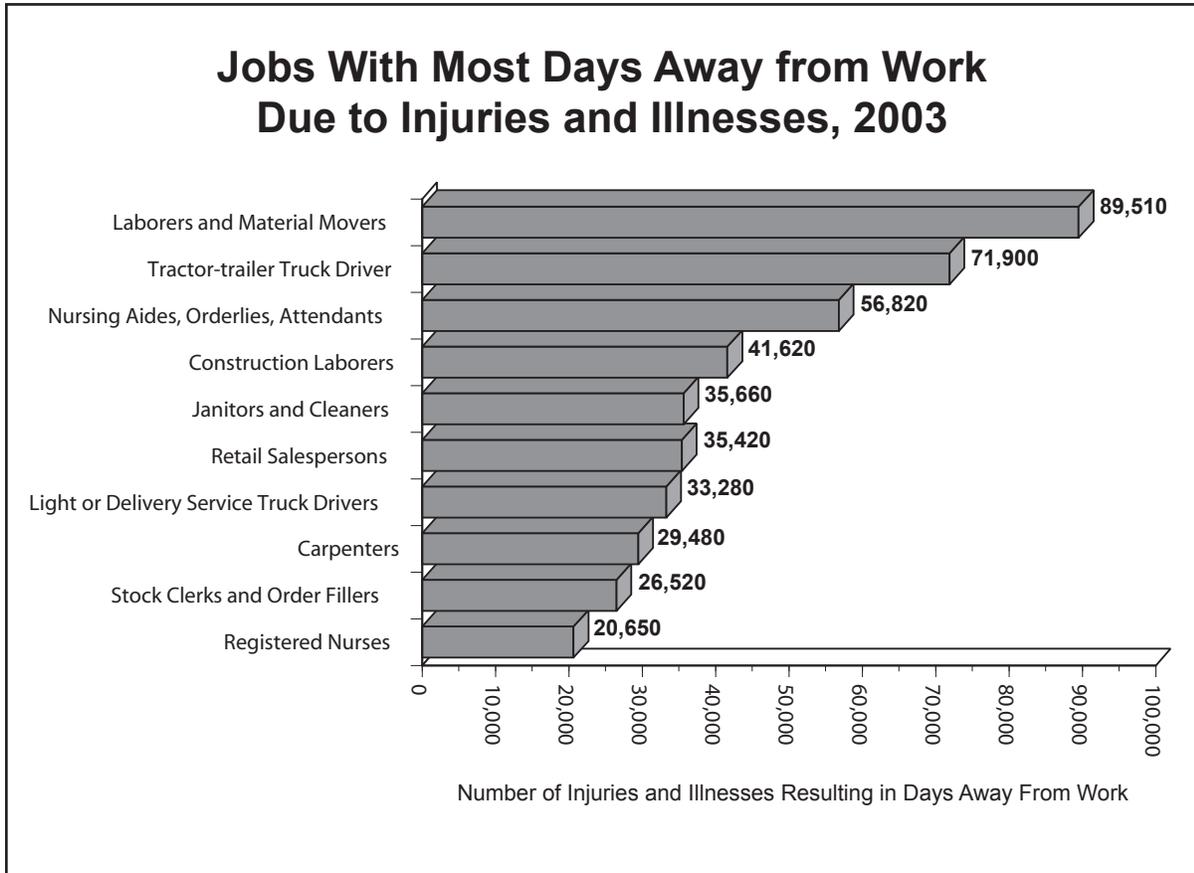
In addition to fatalities, workers employed in the construction industry are also more likely to suffer injuries and illnesses on the job. In 2004, for every 100 workers in construction, there were 6.4 injuries and illnesses reported.

<b>Industry</b>	<b>Non Fatal Injuries and Illnesses Reported Per 100 Workers</b>
Construction	6.4
Manufacturing	6.6
Transportation	5.5
Retail	5.3
Agriculture	6.4
Finance and Insurance	0.9
Education	2.5
Health Care	6.2
Professional and Business Services	2.4
Leisure and Hospitality	4.7

Source: Bureau of Labor Statistics, *Census of Fatal Occupational Injuries*, 2004.

## 7. Injuries, Illnesses and Lost Work Days

In 2003, laborers and material movers suffered the most injuries and illnesses with days away from work. Construction laborers were also among the top ten occupations that suffered the most injuries and illnesses with lost work days.



Source: Bureau of Labor Statistics, *Survey of Occupational Injuries and Illnesses*, 2003.



## Task 2

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In your groups, review the factsheets on pages 16-27. Then working together, using the factsheets and your own experience, decide how you would respond to the statement below.

**Statement:**

I have come to this country to work and send badly needed money home to my family. So finding work is my only concern. Sometimes the conditions are harsh and sometimes I don't get paid for the work I do. But what options do I have? I am an undocumented day laborer, I have no rights and there is little I can do to change that. At the start of each day I have only two choices, I can take the job that is offered to me and hope for the best or I can refuse the job and go home.

I would like to do something but what can I do?

---

**How would you respond? Please make a list.**

**1.**

**2.**

**3.**

**4.**

**5.**

**6.**

## **8. We Work to Live!**

Latinos suffer more deaths at work than any other group. The jobs we take as day laborers are also more likely to cause injuries and illnesses that result in more lost work days. So we have good reasons to be concerned about health and safety. Unfortunately, too many of us are unaware or unsure of the hazards we face on the job. As workers we must earn a living in order to provide for our families and ourselves. So we cannot afford to take chances or make assumptions about the hazards we face each day based solely on what employers or contractors tell us.

### **Health & Safety: A Basic Human Right**

At the same time we need to remind ourselves every day that a safe and healthy workplace is a basic human right that belongs to all of us, regardless of who we are, where we come from, or what kind of jobs we have. It is important to constantly remind ourselves that we work to live and take care of our families, not to die or be injured on the job!

### **The Day-Laborers Project**

And that is why you are being asked to assist New Labor in trying to learn more about the health and safety of Latino day laborers that work in residential construction. Your efforts will lead to improved conditions of work for thousands of day laborers who work in poorly equipped, highly hazardous situations.

## 9. You Must Be Paid for the Work You Do

Wage and hour laws protect the rights of all workers to be paid for their work. These laws apply to both documented and undocumented workers. You may be protected by these laws even if you are an independent contractor.

### **Illinois' Minimum Wage Is \$7.75**

As of July 1, 2008, the Illinois minimum wage was \$7.75 per hour. The minimum wage will increase by an additional 25 cents in each of the next two years. On July 1, 2009 the new rate will be \$8.00 per hour. On July 1, 2010 the rate will increase to \$8.25.

### **Your Right to Overtime Pay**

If you work over 40 hours in one work week, your employer must pay an overtime rate of one and a half times your regular rate of pay for every additional hour.

**Example:** If your regular rate is \$8.00/hr., your employer should pay you \$12.00/hr. for each hour over 40 hours that you worked that week. Therefore, if you worked 50 hours in one week, you should earn:  
 $(\$8.00 \times 40 \text{ hours}) + (\$12.00 \times 10 \text{ hours}) = \$320.00$  for a 50-hour week

### **Your Right to the Prevailing Wage Rate on Government Jobs**

If you are performing construction or maintenance on a government building or structure, you are generally entitled to earn the "prevailing wage." Put simply, prevailing wages are union wages. You are covered under prevailing wage laws even if you are not a member of a union.

### **Your Right to Be Paid On Time**

You have the right to be paid on time. In Illinois you must be paid at least twice during each calendar month, on regular pay days designated in advance by the employer. You must be paid in lawful money of the United States or with checks. Employers should make arrangements with banks so that the checks can be cashed by employees without difficulty and for the full amount for which they are drawn.

*(continued)*

## **9. You Must Be Paid for the Work You Do** *(continued)*

### **Your Right to Wages for All the Hours You Work, Even If You Quit the Job**

You are entitled to wages for all of the hours worked prior to leaving a job. Your employer must pay you any outstanding wages no later than the next regular pay day. You may also request to have your wages sent to you in the mail.

### **Your Right to File a Claim for Unpaid Wages**

Does a contractor owe you money? If so, you can file a claim for unpaid wages with the United States Department of Labor or the wage claim division of the Illinois Department of Labor.

If you would like assistance in filing a claim, or if you need more information, you can contact one of the following organizations:

#### **Chicago Workers' Legal Clinic**

The Clinic provides workers with representation from Pro Bono attorneys in labor-related legal matters such as workers compensation, wage violations, and discrimination. The clinic organized more than 30 suits during 2004, including major precedent-setting litigation against two day labor agencies.

#### **The Chicago Workers' Collaborative**

Located in the Little Village neighborhood of Chicago.  
Send mail to:

Chicago Workers' Collaborative  
P.O. Box 08048  
Chicago, IL 60608

#### **Miriam Perez**

Lead Organizer for Day Labor  
(773) 230 -0331  
gricemiriam@yahoo.com

**Felipa Mena**

Coordinator, Chicago Workers' Legal Clinic and Workers' Cooperative  
(312) 543-8245  
lotus1403@yahoo.com.mx

**Tim Bell**

Executive Director  
(773) 230-0351  
timobell@yahoo.com

**Chicago Area Workers Rights Initiative**

**Rob Lisek**

Chicago District Office  
US Dept. of Labor  
ESA Wage & Hour Division  
230 S. Dearborn Street  
Room 412  
Chicago, IL 60604-1591

Phone:

(312) 596-7230  
1-866-4-USWAGE  
(1-866-487-9243)

Thomas Gauza  
District Director

## **10. You Have a Right to a Safe and Healthy Workplace**

Regardless of your immigration status, you have a right to a safe and healthy workplace.

### **Employers Must Provide You With a Safe Place to Work**

In the U.S. a government agency called the Occupational Safety and Health Administration (OSHA) is responsible for ensuring that all employers provide all of their employees with “a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm.”

### **What Is OSHA?**

OSHA is an agency of the U.S. Department of Labor. Congress created OSHA under the Occupational Safety and Health Act of 1970. OSHA’s sole responsibility is to develop mandatory job safety and health standards and enforce them through workplace inspections, employer assistance, and by imposing citations and financial penalties.

## **You Can File a Complaint With OSHA**

If you think a jobsite where you are working isn't safe you can file a complaint with OSHA. Staff are available in both the Chicago North and Calumet City OSHA Area Offices to respond to persons speaking Spanish. Please contact each office directly and ask for the Spanish-speaking representative to respond to your request.

### **Calumet City Area Office**

1600 167th Street, Suite 9  
Calumet City, Illinois 60409  
(708) 891-3800  
(708) 862-9659 FAX

### **Chicago North Area Office**

701 Lee Street - Suite 950  
Des Plaines, Illinois 60016  
(847) 803-4800  
(847) 390-8220 FAX

### **OSHA in Espanol:**

<http://www.osha.gov/as/opa/spanish/index.html>  
Spanish Option on OSHA's 800 Number. OSHA provides Spanish-speaking operators on its 800 Number. 1-800-321-OSHA (6742).

## **11. Your Right to Workers' Compensation if Injured on the Job**

If you get hurt or sick because of your job, you have the right to be compensated. *Workers' Compensation* pays for medical treatment of work related injuries and illnesses. It may also provide cash benefits if your injury or illness prevents you from working. Death benefits are provided for surviving spouses and dependent children of workers who are killed on the job.

### **Immigrant Eligibility**

In Illinois both documented and undocumented workers are eligible for benefits—you should not have to provide information about your status.

### **Who is covered by Workers' Compensation?**

Most full-time and part-time employees are eligible for Workers' Compensation. Even if your employer paid you in cash, paid you off the books, or treated you as an independent contractor you may still be eligible for Workers' Compensation benefits.

### **Workers' Compensation Benefits**

Workers' Compensation benefits include: compensation for medical care and treatment, wage loss benefits and death benefits. Benefits can continue even if you change jobs or lose health insurance.

### **Workers' Compensation is a "No-Fault" Benefit**

This means that eligibility for workers' compensation benefits does not depend on whether your injury was your employer's fault or your fault.

### **Workers' Compensation and Your Right to Sue**

Workers' Compensation benefits are meant to provide benefits for job injuries without having to pursue your claim in court. In most cases, you will not be able to sue your employer but you have a right to file a workers' compensation claim for medical treatment and in some instances, cash benefits.

### **What Should I Do If I Am Injured On The Job?**

You must inform your employer that you were injured on the job and want to seek Workers' Compensation benefits as soon as possible. It is a good idea to do this in writing and keep a copy for your records. When you seek medical treatment, you should also inform the treating physician that you were injured on the job.

## **12. Your Rights Under the United Nations**

On December 10, 1948 the General Assembly of the United Nations adopted and proclaimed the Universal Declaration of Human Rights. It applies to all people and is recognized by the U.S. and nearly every other country throughout the world.

The declaration includes the following articles:

### **Article 1.**

All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

### **Article 2.**

Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. Furthermore, no distinction shall be made on the basis of the political, jurisdictional or international status of the country or territory to which a person belongs, whether it be independent, trust, non-self-governing or under any other limitation of sovereignty.

### **Article 3.**

Everyone has the right to life, liberty and security of person.

### **Article 4.**

No one shall be held in slavery or servitude; slavery and the slave trade shall be prohibited in all their forms.

### **Article 5.**

No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment.

**Article 6.**

Everyone has the right to recognition everywhere as a person before the law.

**Article 7.**

All are equal before the law and are entitled without any discrimination to equal protection of the law. All are entitled to equal protection against any discrimination in violation of this Declaration and against any incitement to such discrimination.

**Article 23.**

(1) Everyone has the right to work, to free choice of employment, to just and favorable conditions of work and to protection against unemployment.

(2) Everyone, without any discrimination, has the right to equal pay for equal work.

(3) Everyone who works has the right to just and favorable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection.

(4) Everyone has the right to form and to join trade unions for the protection of his interests.

## **13. You Can Organize!**

The history of working people in the United States is full of hard fought struggles for equal rights. All too often laws have been used to deny workers, especially newly arrived immigrants, of their basic rights to a good job with favorable pay and conditions of work. In response, workers have used strikes, boycotts, protests, and marches, to secure and maintain their rights at work and in their communities.

### **The United Farm Workers in the 1960s**

Farm workers are excluded from the federal laws that protect the rights of most workers to organize unions in the United States. But this did not deter the farm workers in the 1960s when they created The United Farm Workers (UFW) and built coalitions with unions, churches, and other community based organizations at the local, state and national levels. Working together they used strikes, pickets, marches, fasts, and an international grape boycott to gain union contracts for more than 50,000 farm workers. The farm workers used their collective power to succeed and received the dignity and respect that they deserved.

### **The Immigrant Workers Freedom Ride 2003**

More recently, immigrant workers and their allies throughout the country organized a caravan of “Freedom Riders” that made their way across the country in an effort to raise public awareness about immigrant rights and the injustices of current immigration policies. They met with members of Congress in Washington D.C. and ended their journey in New York City where over 100,000 workers were on hand to greet the Freedom Riders and support new immigration policy.

### **Immigration Reform 2006**

In December 2005, the United States House of Representatives approved HR 4437, a proposal that would criminalize undocumented immigrants and basically make it a crime for churches or community based organizations to work with the undocumented. The proposal also called for building more walls at the border. In response, millions of immigrants and their allies have mobilized to demand fair and comprehensive immigration reform. Immigrants are participating in marches and educational forums, and signing petitions to win this fight.

## 14. Day Laborers Organizing

Day labor is a global phenomenon. In the United States day laborers face many problems including unpaid wages, job discrimination, harassment, and other abuses. On the job, day laborers rarely receive proper training or personal protective equipment and as a result, they have the highest fatality rates in the country.

### **Day Laborers Are Organizing**

Day laborers are organizing throughout the U.S. At state and local levels, day laborer organizations have successfully fought to protect the right to wait at corners for work; created hiring sites that are enforcing minimum standards and conditions of work for day laborers; and have won back thousands of dollars in unpaid wages from fraudulent contractors and employers. In Long Island, New York, the Workplace Project succeeded in passing state legislation that increases fines on employers and contractors that fail to pay the workers they employ.

### **New Labor and the Day Laborers Organizing Project**

New Labor is a membership-based organization with over 1,000 dues paying members. The goal of New Labor is to improve working conditions and provide a voice for low-wage, immigrant workers in New Jersey. The health and safety training that you are participating in today is part of a wide range of training and educational programs that New Labor offers to all of its members.

### **Day Laborers In Chicago**

#### **Latino Union of Chicago**

1619 W. 19th St.  
Chicago, IL 60608  
312-491-9044  
info@latinounion.org

#### **Chicago Interfaith Committee on Worker Issues**

1020 W. Bryn Mawr, 3rd Floor  
Chicago, IL 60660  
773-728-8400  
For general inquiries e-mail info@iwa.org

## Summary

1. Each year thousands of workers die on the job. In 2004, the fatality rate for Latino workers was 4.9. The fatality rate for all other workers in the U.S. was 4.1.
2. Of the 5,703 workers who died on the job in 2004, 883 were Latinos and of this group 578 were foreign born.
3. Approximately 14.7 million Latinos were employed in the U.S. They represent nearly 11 percent of the total workforce and a large percentage are employed in the construction industry. Since 1980, the number of Latinos in the construction industry has quadrupled.
4. Of the 1.4 million Latinos working in construction, 21% are laborers. The distribution of Latinos in the construction industry is highly concentrated among the Laborer/helper occupations.
5. In 2004, 1,224 construction workers died on the job.
6. Laborers account for 24% of all the fatalities in the construction industry.
7. Workers employed in the construction industry are also more likely to suffer injuries and illnesses on the job.
8. In 2003, nearly 42,000 construction laborers reported injuries on the job that required days off from work in order to recuperate.
9. It is important to constantly remind ourselves that we work to live and take care of our families, not to die or be injured on the job!
10. Wage and hour laws protect the rights of all workers to be paid for their work. These laws apply to both documented and undocumented workers.

11. Regardless of your immigration status, you have a right to a safe and healthy workplace.
12. If you get hurt or sick because of your job, you have the right to be compensated. Workers' Compensation pays for medical treatment of work related injuries and illnesses. In New Jersey both documented and undocumented workers are eligible for benefits.
13. The Universal Declaration of Human Rights applies to all people and is recognized by the U.S. and nearly every other country throughout the world.
14. The history of working people in the United States is full of hard fought struggles for equal rights. Workers have used strikes, boycotts, protests, and marches, to secure and maintain their rights at work and in their communities.
15. Day laborers are organizing throughout the U.S. At state and local levels, day laborer organizations have successfully fought to protect the right to wait at corners for work; created hiring sites that are enforcing minimum standards and conditions of work for day laborers; and have won back thousands of dollars in unpaid wages from fraudulent contractors and employers.



# Evaluation

## Activity 1: Job Fear

1. How important is this Activity for day laborers?

**Please circle one number.**

<b>Activity Is Not Important</b>			<b>Activity Is Very Important</b>	
1	2	3	4	5

2. Please **put an “X”** by the factsheets you feel are the most important.

	1. Worker Fatalities		8. We Work to Live!
	2. Many Latinos Work in Construction		9. You Must Be Paid For the Work You Do
	3. Latinos in Construction		10. You Have a Right to a Safe and Healthy Workplace
	4. Construction Work Is Dangerous		11. Your Right to Workers' Compensation if Injured on the Job
	5. Construction Laborers Have the Most Fatalities		12. Your Rights Under the United Nations
	6. Injury and Illness Rates		13. You Can Organize!
	7. Injuries, Illnesses and Lost Work Days		14. Day Laborers Organizing

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.

4. What would you suggest be done to improve this Activity?

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# Activity 2: Excavations

## **Purpose**

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To learn more about the OSHA regulations that must be followed for excavations and how we can reduce the risks of cave-ins.

This Activity has two tasks.

## Task 1

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A contractor has hired Juan and Carlos to dig a sewer pipe trench that will extend 35 feet from a residential house to the main sewer line out in the street. Juan and Carlos have agreed to dig the trench for \$250 and they will be paid when the job is completed. At the jobsite the contractor hands them shovels and states the following:

“The width of the trench will be 3.5 feet and the depth will be 6 feet. The first couple of feet will be hard to get through, but after that the rest of it will be like beach sand.

Please try to keep the dirt as close to the trench as you can so we don’t have to kill ourselves filling it back in.

There are no markouts but I have a good idea where all the wires and pipes are and we won’t have to worry about them.

A subcontractor will cut through the asphalt out in the street and when we get to that point I’ll be sure to redirect the traffic around the trench while you are digging around the street sewer line.

The contractor concludes by saying “I did my first excavation last week and everything went pretty well, so I don’t think we’ll have any problems today. And if you have any questions please don’t hesitate to ask.

In addition to what the contractor has stated Juan notices that there are no protective systems on the jobsite and no ladders that could be used to enter and exit the trench.”

**In your groups review the factsheets on pages 38-53. Then based on the information provided by the contractor, Juan’s observations, the factsheets and your own experience, make a list of reasons why you would or why you would not take this job. For each point you list try to identify a factsheet that supports the position.**

---

**We would take this job for the following reasons:**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**We would not take this job for the following reasons:**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

## Task 2

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You are part of a newly created Day Laborers Health and Safety Committee and you have been asked to create a *checklist* for an Excavations Health and Safety Factsheet that you will distribute to all day laborers on your corner.

**Working together in your groups use the factsheets on pages 38-53 and your own experience to determine the eight most important points you would include in the Excavations Checklist.**

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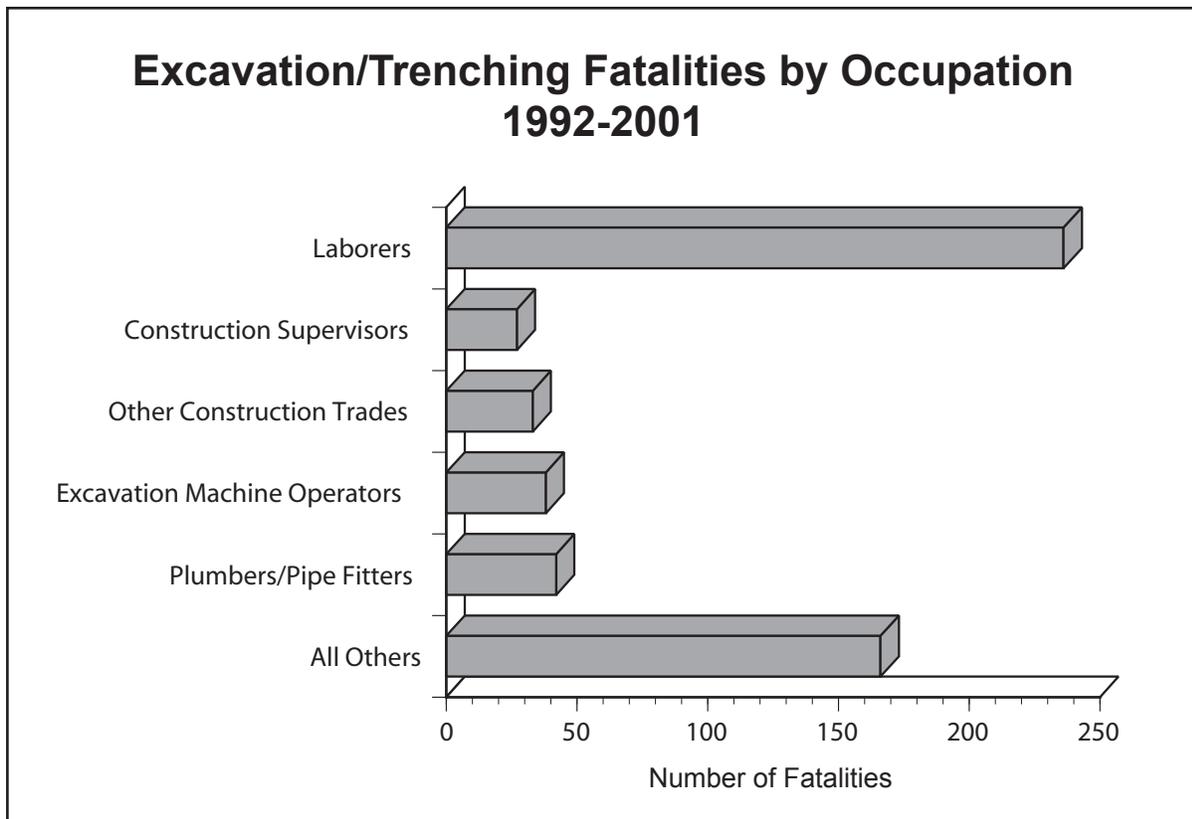
## Day Laborers Excavations Checklist

1.	✓	
2.	✓	
3.	✓	
4.	✓	
5.	✓	
6.	✓	
7.	✓	
8.	✓	

# 1. Excavation Fatalities

Excavations are man-made cuts, cavities, trenches, or depressions formed by earth removal and they are among the most hazardous construction operations. Excavations prepare the ground for construction and the installation of underground pipes and wires.

Laborers account for nearly 44% of all excavation and trenching fatalities. Most excavation accidents occur in trenches 5-15 feet deep. A trench is a narrow excavation where the depth is greater than the width, but not wider than 15 feet.



Sources: Centers for Disease Control and Prevention (CDC), Morbidity and Mortality Weekly Report, Occupational Fatalities During Trenching and Excavation Work --- United States, 1992--2001. OSHA Office of Training and Education, Excavations.

## 2. Cave-ins

Cave-ins account for nearly 76% of all excavation and trenching fatalities.

### **Why Do Cave-ins Occur?**

Undisturbed soil is kept in place by natural horizontal and vertical forces of the nearby soil. When we dig in the earth, these natural forces are no longer able to hold back the soil left behind. With no support, eventually the laws of gravity take over, and the soil from the excavation walls moves downward and inward into the excavation. The result is a cave-in.

Cave-ins are more likely to occur in unprotected excavations where:

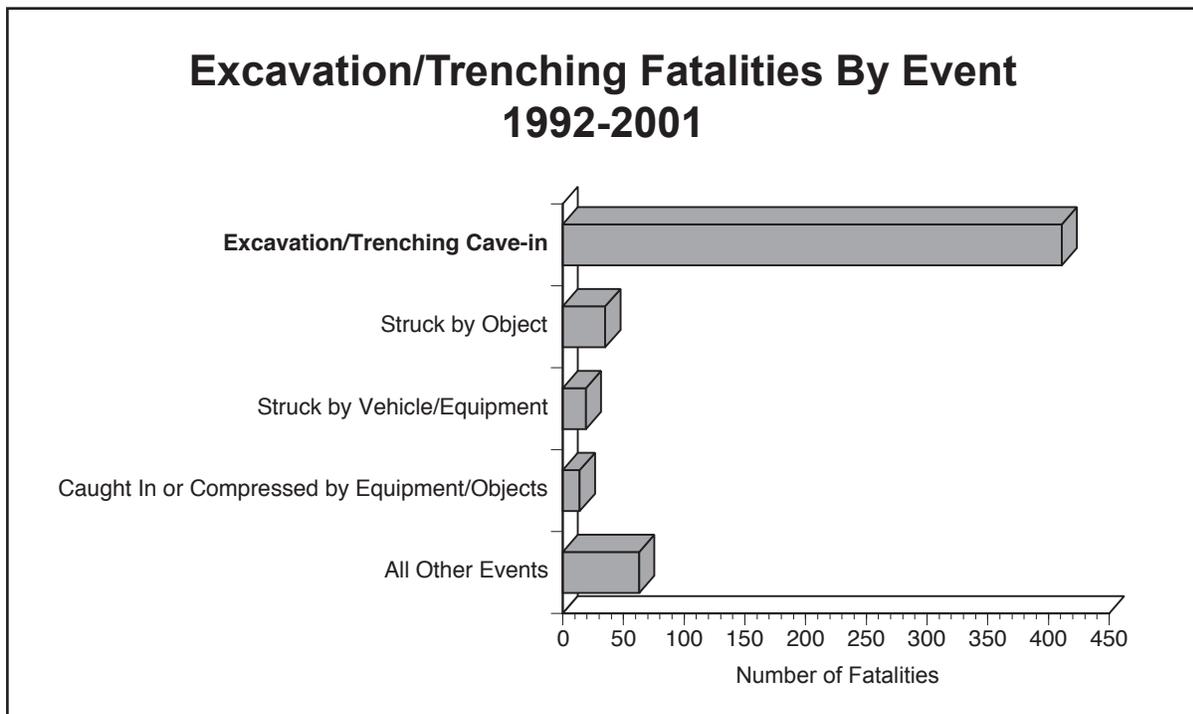
- The excavation is dug in unstable soil, or in soil that has been dug in before
- There is excessive vibration from construction equipment or vehicle traffic around the excavation
- Too much weight near the sides of an excavation, most frequently from equipment or the excavated material (spoil pile) too near to the edge
- Water has collected in the excavation
- Changes in weather conditions (freezing, melting, sudden heavy rain, etc.)

*(continued)*

## 2. Cave-ins *(continued)*

In most cases, cave-ins are the result of unstable soil and there is often very little warning. However, in some situations you can identify signs that will tell you that the soil is under stress. These signs include:

- Ground settlement or narrow cracks in sidewalls, slopes, or surfaces next to the excavation
- Changes or bulges in wall slope
- Flakes, pebbles, or clumps of soil separating and falling into the excavation
- Sidewalls or trench bottom softening



Sources: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

### **3. Soil Stability**

Soil is a mixture of sand, gravel, silts, clay, water, and air. The amounts of each will determine soil “cohesiveness”, or how well it will hold together. Cohesive soil does not crumble. It can be molded easily when wet, and is hard to break up when dry. Clay is a very fine grained soil, and is very cohesive. Sand and gravel are coarse grained soils, having little cohesiveness and often called granular. Generally speaking, the more clay that is in the soil being excavated, the better the trench walls will hold up.

#### **Water Affects Soil Stability**

Another factor in soil cohesiveness is water. Soil that is filled with water is termed saturated. Saturated soil does not hold together well, and is particularly dangerous in excavation work. However, the opposite can also be true. Soil that has little or no water in it, or is oven-dry, can crumble easily, and will not hold together when excavated.

#### **Soil Is Heavy!**

A cubic foot can weigh as much as 114 pounds, and a cubic yard can weigh over 3,000 lb. — as much as a pick-up truck! Most workers don’t realize the force that will hit them when a cave in occurs. A person buried under only a few feet of soil can experience enough pressure in the chest area to prevent the lungs from expanding. Suffocation can take place in as little as three minutes. Heavier soils can crush the body in a matter of seconds.

#### **Types of Soil**

OSHA classifies soils into four categories: Solid Rock, Type A, Type B, and Type C. Solid Rock is the most stable, and Type C soil is the least stable. Soils are typed not only by how cohesive they are, but also by the conditions in which they are found. Although solid rock is considered the most stable, it should be noted that maintaining stable rock is practically unachievable in the excavation of a trench. This is because the excavation of rock typically requires drilling and blasting, which fractures the rock, making it less stable.

Sources: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 4. Types of Soil

### Type A

Type A soil can be clay, silty clay, or sandy clay. A soil cannot be considered Type A if it is fissured (cracks) or other conditions exist that can adversely affect it, such as:

- Vibration from heavy traffic, pile driving, or similar effects
- Having been previously disturbed/excavated
- Where it is part of a layered system, where less stable soil is near the bottom of the excavation, with the more stable soils on top
- Factors that would make it unstable-such as the presence of ground water, or freezing and thawing conditions

### **Beware of Vibrations**

Many OSHA compliance personnel believe that construction equipment at the site create enough vibrations to prevent any soil from being classified as Type "A". If vibrations can be felt while standing next to an excavation, the soil should be downgraded from Type A soil to Type B or C.

### Type B

Type B soils include both cohesive and non-cohesive soils. They include silts, sandy loams, medium clays, and unstable rock. Soils that might be classified as A, but have fissures, or are subject to vibration, may also be classified as "B" soils.

## Type C

Type C soils are the most unstable and dangerous of the four soil types. They are easily recognized by the continual sloughing of the sides of the walls of excavation. If soil is submerged, or water is seeping from the sides of an excavation, it's probably "C" soil. Soil may be classified as Type C if an excavation is dug in "layered" soils, where different soil types lay on top of each other. When an unstable soil type is underneath a stable soil type in an excavation, the "weakest link" will soon give way.

<b>Soils</b>	
<b>Type</b>	<b>Characteristics</b>
<b>Solid Rock</b>	Excavation walls stay vertical as long as the excavation is open
<b>Type A</b>	Fine-grained, cohesive: clay, hardpan, and caliche, particles too small to see by naked eye
<b>Type B</b>	Angular rock, silt, and similar soil
<b>Type C</b>	Coarse-grained, granular: sand, gravel and loamy sand, particles are visible to the naked eye

Regardless of the methods used, the typing of soils must be done by the competent person prior to anyone entering the excavation. The weaker the soil, the greater the need for protective systems.

**Note:** If you are uncertain of the soil type, ALWAYS assume Type C soil!

Sources: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 5. OSHA Requirements for Excavations

The standard covering excavation safety is Title 29 Code of Federal Regulations, Part 1926.650-652, (Subpart P), OSHA's Rules and Regulations for Construction Employment. The standard covers all excavations made in the earth's surface, including trenches, and the requirements for protective systems to be used.

### OSHA Defines an Excavation

OSHA defines an excavation as any man-made cut, cavity, trench, or depression in the earth's surface as formed by earth removal. This can include anything from excavations for home foundations to a new highway. A trench refers to a narrow excavation made below the surface of the ground in which the depth is greater than the width-and the width does not exceed 15 feet.

If an excavation is more than 5 feet in depth, there must be a protective system in place while workers are in the excavation. Excavations more than 4 feet in depth must have a way to get in and out (*a means of egress*), usually a ladder, for every 25 feet of horizontal travel.

### A "Competent Person" Must Be In Charge

OSHA says no matter how deep the excavation is, a competent person must inspect conditions at the site on a daily basis and as frequently as necessary during the progress of work to make sure that the hazards associated with excavations are eliminated before workers are allowed to enter. A competent person should have the following qualifications:

- Thorough knowledge of the OSHA standard 29 CFR 1926.650-652 /Subpart P
- Know how to classify soil types
- Know the different types and proper use of excavation safety equipment (e.g. protective systems.)
- The knowledge to recognize unsafe conditions and the authority to stop the work and correct the problems.

## Daily Inspections

It is the responsibility of the competent person to conduct daily inspections prior to the start of any work and as needed throughout the shift. Part of this inspection process must include determining the soil classification. Inspections are also required:

- After every rain, snow, windstorm, thaw, and other events that could increase the risks of an accident
- When there are nearby sources of vibration, such as roadways, train tracks, or pile driving
- If excavation walls sag or crack, the trench bottom bulges, or water seeps in
- If the spoil pile changes size, location or placement

## Protective Systems

A protective system must be used if an excavation is 5 feet or greater in depth. The three most commonly used kinds of protective systems are shoring, shielding, and sloping. Each of these protective systems are acceptable to OSHA. It is up to the competent person to determine which method will be most effective for the job. The competent person must inspect these systems regularly to ensure that they are functioning properly. (*For more information on shoring, shielding and sloping see Factsheets 6 and 7.*)

## 6. Protection From Cave-ins: Shoring and Shielding

Protective systems protect workers from cave-ins of material that can fall or roll into an excavation, or from the collapse of nearby structures.

### Shoring

Shoring systems are structures of timber, mechanical, or hydraulic systems that support the sides of an excavation and are designed to prevent cave-ins. Sheeting is a type of shoring system that keeps the earth in position. It can be driven into the ground or work in conjunction with a shoring system. Driven sheeting is most frequently used for excavations open for long periods of time.

### When Are Protective Systems Required?

If an excavation is less than 5 feet deep, OSHA does not require a protective systems unless the competent person sees signs of a potential cave-in. (It is important to remember that a wall collapse in a trench four and 1/2 feet deep can still have serious results!)

For trenches between 5 feet and 20 feet deep, shoring and sheeting, shielding, sloping and benching are all acceptable protective measures. It is up to the planners of the construction project and the competent person on site to determine which systems will work best. If an excavation is greater than 20 feet deep, a registered professional engineer must design the protective system.

Another type of sheeting utilizes plates or shoring grade plywood (sometimes called Finland form) in conjunction with strutted systems such as hydraulic or timber shoring. These strutted systems are also referred to as active systems. The most frequently used strutted system involves aluminum hydraulic shores which are lightweight, re-usable and installed and removed completely from above ground.

## Shielding

A shield, also known as a trench box, is another common protective system used by contractors. Trench boxes are not designed to prevent cave-ins, but rather serve to “shield” workers within the structure if a cave-in occurs. This is an excellent choice when placing continuous installations, as in pipe laying. The box is placed in the trench and dragged along with the progress of the work.

**Note:** With both shoring and shielding systems workers are only protected as long as they stay within the confines of the system.

<b>Important Points About Shields</b>	
✓	Personnel should be out of the box and above ground when the shield is being moved. You could be caught between the moving box and fixed object(s)
✓	The top of the shield should extend at least eighteen (18) inches above the level of any materials that could cave or roll into the trench
✓	Some shields are designed to be stacked, one on top of another. <b>Never stack shields that are not designed for that purpose, and do not stack shields from different manufacturers—they may not be compatible</b>
✓	The forces of a cave-in can literally push a box sideways, causing a crushing hazard. <b>After a box is positioned for the work, the voids between the box and the trench wall should be filled with excavated material to prevent displacement caused by a cave-in</b>
✓	Shielding should always be used according to manufacturer’s design recommendations

Source: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 7. Protection From Cave-ins: Sloping and Benching

Sloping and benching are another means of protection from cave-in hazards. Sloping is a method of cutting back the trench walls at an angle that leaves little chance of collapse. Benching is a process of stepping off the earthen walls of an excavation. Sloping can be used as a system by itself or in conjunction with benching.

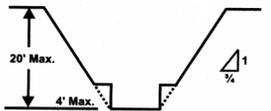
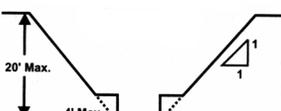
### **Sloping and Benching Not Often Utilized**

In the real world, there are very few applications where sloping and/or benching can be used. Why? Most often, the luxury of available space is the first consideration. Many excavations are dug in right-of-ways where the presence of other utilities and traffic become major considerations. Moreover, for every cubic yard of soil that is removed, it is very likely that nearly the same amount of material must be put back, and compacted as well.

If the location to be excavated has been previously disturbed, as it frequently is along a right-of-way, the soil type will very likely be classified as “C”. With Type C soil, the excavation walls must be sloped back on each side of the excavation one and one half feet for every foot of depth. When you add all these factors up its obvious that sloping, even in conjunction with benching, may be desirable-but not always very practical and economical.

### **Beware of Weakest Link in Soil**

In sloping and benching, you need to be aware of the “weakest link.” For example, a hazardous situation exists if Type B soil is being supported below the surface by Type C soil. In all cases the sloping and benching configuration chosen must be in accordance with the OSHA standard and it’s up to the designated *competent person* to make that determination.

Sloping and Benching		
Soil	Simple Slope	Slope/Single Bench
Type A		
Type B		
Type C		Not Applicable

### Residential Construction

If the job is for a house foundation and the excavation is greater than 7.5 feet deep, it should be benched at least 2 feet horizontally for every 5 feet or less of vertical height. The only exception is where property lines, adjacent structures, utilities, sidewalks, streets and similar obstructions prevent sloping or benching. Keep the bottom between the formwork and excavation wall at least 2 feet wide.

Source: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 8. Atmospheric Hazards

The OSHA standard says that when working in trenches deeper than four feet that are dug in locations where hazardous atmospheres are likely to be present, atmospheric testing, ventilation, and respiratory protection, must be provided. **Locations such as landfills, sewer or hazardous waste sites, chemical plants, refineries, or areas where underground storage tanks are present are all locations which may produce hazardous atmospheres.**

Hazardous atmospheres include:

- oxygen deficient environments
- flammable/combustible/explosive environments
- toxic environments

### **Atmospheric Hazards Can Be Deadly**

An oxygen-deficient atmosphere means there is not enough oxygen in the space. Normal air has 20.8% oxygen. Levels below 19.5% are considered oxygen-deficient. Oxygen deficient atmospheres are dangerous and can cause unconsciousness, brain damage, and death. Flammable/combustible/explosive atmospheres contain gases or vapors in concentrations that can catch fire or explode if there is an ignition source. Toxic atmospheres contain gases or vapors which, if breathed in, can make you sick, or worse kill you.

### **Monitoring Is Important**

When dealing with potential hazardous environments, early recognition is very important. Years ago, miners had to rely on canaries to tell them if the air they were breathing was hazardous. Today, testing equipment for atmospheric hazards are compact and easy to use. One instrument can be purchased to detect the three most common atmospheric hazards found in excavation. The competent person understands and uses these direct reading instrument(s) that can detect the most common atmospheric hazards found in excavations. Continuous air monitoring is always a good idea because of changing conditions that can occur at a construction site.

<b>Hazardous Atmospheres In Excavations</b>	
<b>Atmosphere</b>	<b>Description</b>
Oxygen Deficient	In an open excavation, rain water passing over limestone, causes an acidity reaction, and in turn produces carbon dioxide. Carbon dioxide is a simple asphyxiant which replaces oxygen in the air we breath and can result in death.
Flammable/Combustible/Explosive	<p>Volatile organic compounds found in petroleum products can move through small spaces in soils and accumulate in excavations. This can create both a fire and toxic hazard. Buried tanks next to an excavation site are a common source of these compounds.</p> <p>Another common flammable gas is Methane. Methane occurs naturally from the breakdown of organic materials, such as sewage, leaves or weeds.</p>
Toxic	Carbon monoxide from vehicles or equipment too near the excavation can accumulate and create a toxic environment for the workers.

### **Toxics Can Accumulate In Trenches**

A trench is a narrow excavation made below the surface of the ground in which the depth is greater than the width-and the width does not exceed 15 feet. In other words, because they may have limited exits and air circulation, trenches can be confined spaces. In fact, trenches that are greater than 4 feet deep are confined spaces and should be tested and monitored to insure safety.

Source: Excavation, Trenching and the Shoring Safety and the OSHA Excavation Standard, AFSCME Training and Education Institute Manual, [www.afscme.org/health/excav02.htm](http://www.afscme.org/health/excav02.htm) Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 9. Other Excavation Hazards

### Water Hazards

Water in excavations can cause undermining and cave-ins. Standing water at the bottom of the trench absorbs upward and saturates the trench sidewalls. The trench wall will fall apart when there is too much saturation. Rain can also fill surface cracks at the edge of the trench leading to wedge failure.

You must be properly protected when working in excavations where water has accumulated or is accumulating. Control measures can include diversion, dewatering (well pointing) systems, special supporting systems, or water removal equipment. A competent person must monitor water removal equipment.

### Vehicle Hazards

If you are working on an excavation site that exposes you to vehicle traffic, you must be provided with highly visible warning vests or other suitable garments. Reflectorized material must be worn when lighting is poor.

### Underground Utility Line Hazards

Digging into utilities can cause fire, flooding, electrical shock or inhalation of gases. It is the contractor's responsibility to make sure the estimated location of utility installations, such as sewer, telephone, fuel, electric, gas, etc. is done prior to starting an excavation. A properly marked out job will have red marks for power lines, blue for water, orange for communications and yellow for gas.

### Spoil Material and Equipment Hazards

Weight and vibration at or near the excavation will increase the risk of a cave-in. OSHA regulations require you to scale back all loose material from the edge of the trench and place all material, equipment, and spoils at least two feet from the edge.

In addition, workers are not allowed under machinery or heavy excavation equipment loads handled by lifting or digging equipment. All workers must either stand away or otherwise be protected from any vehicle being loaded or unloaded to avoid spilling or falling material.

## **10. Safe Exits**

A safe means of entering and leaving excavations must be provided for workers. A stairway, ladder, ramp, or other means of egress must be located in trench excavations that are four feet or more in depth and there must be an exit (usually a ladder) for every 25 feet of trench length.

### **Secure Ladders**

When a ladder is used as a means of entering and leaving an excavation it should be secured at the top and bottom. The ladder should extend 3 feet above the landing (top of the excavation) and it should be angled at 75 degrees. You should only use metal ladders when there are no electrical hazards present.

## Summary

1. Excavations are man-made cuts, cavities, trenches, or depressions formed by earth removal and they are among the most hazardous construction operations.
2. Cave-ins account for nearly 76% of all excavation and trenching fatalities.
3. In most cases, cave-ins are the result of unstable soil and there is often very little warning.
4. Soil is a mixture of sand, gravel, silts, clay, water, and air. The amounts of each will determine soil “cohesiveness”, or how well it will hold together. Clay is a very fine grained soil, and is very cohesive. Sand and gravel are coarse grained soils, having little cohesiveness and often called granular. The more clay that is in the soil being excavated, the better the trench walls will hold up.
5. There are four types of soil including: 1. solid rock; 2. Type A soils consist of clay, silty clay, or sandy clay and are very cohesive; 3. Type B soils consist of silts, sandy loams, medium clays, and unstable rock and can be both cohesive and non-cohesive; and 4. Type C soils consist of grainy sandy soils—they are the most unstable and dangerous of the four soil types.
6. If an excavation is more than 5 feet in depth, there must be a protective system in place while workers are in the excavation. Excavations more than 4 feet in depth must have a way to get in and out (*a means of egress*), usually a ladder, for every 25 feet of horizontal travel.
7. A protective system must be used if an excavation is 5 feet or greater in depth. Protective systems protect workers from cave-ins of material that can fall or roll into an excavation, or from the collapse of nearby structures. The three most commonly used kinds of protective systems are shoring, shielding, and sloping.

8. Sloping and benching are another means of protection from cave-in hazards. Sloping is a method of cutting back the trench walls at such an angle that there is little chance of collapse. Benching is a process of stepping off the earthen walls of an excavation. Sloping can be used as a system by itself or in conjunction with benching.
9. When working in trenches deeper than four feet that are dug in locations where hazardous atmospheres are likely to be present, atmospheric testing, ventilation, and respiratory protection, must be provided. **Locations such as landfills, sewer or hazardous waste sites, chemical plants, refineries, or areas where underground storage tanks are present are all locations which may produce hazardous atmospheres.**
10. Other excavation hazards that we must be aware include water, vehicles, underground utility lines and pipes, and spoil materials or equipment located too close to the excavation.
11. When a ladder is used as a means of entering and leaving an excavation it should be secured at the top and bottom. The ladder should extend 3 feet above the landing (top of the excavation) and it should be angled at 75 degrees. You should only use metal ladders when there are no electrical hazards present.



# Evaluation

## Activity 2: Excavations

1. How important is this Activity for you and your co-workers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an "X"** by the factsheets you feel are the most important.

1.	Excavation Fatalities	6.	Protection From Cave-ins: Shoring and Shielding
2.	Cave-ins	7.	Protection From Cave-ins: Slopping and Benching
3.	Soil Stability	8.	Atmospheric Hazards
4.	Types of Soil	9.	Other Excavation Hazards
5.	OSHA Requirements for Excavations	10.	Safe Exits

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.				

4. What would you suggest be done to improve this Activity?

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# Activity 3: Ladder Safety

## Purpose

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To learn more about how we can reduce the risks of falls from ladders and stairways.

This Activity has one task.



## Task

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Juan has been hired to work as a helper for a contractor. The job will last several days and Juan will be paid \$12.00 per hour. The contractor drops Juan off at the job site and tells him to ask for the foreman.

The foreman tells Juan that he will be doing a variety of tasks, from carrying materials up and down a ladder to cleaning up inside and outside a partially finished home. By the end of his first day Juan is very concerned about some of the working conditions on the job. His concerns include:

- 1. The extension ladder is barely touching the bottom edge of the roof (it is not fully extended) and Juan is having a difficult time keeping his balance each time he gets on and off the roof.**
- 2. The upper section of the ladder is laying up against the house behind the bottom section of the ladder.**
- 3. The ladder feels shaky and is not secured.**
- 4. The base of the ladder (the bottom of the lower section) is less than 2 feet away from the house wall (note that the ladder extends approximately 12 feet).**
- 5. The step ladder positioned on the other side of the house is located in a muddy area where the ground is soft and not compacted.**

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6. The step ladder is labeled “Grade 3” and Juan is using it to hand materials up over his head to workers through a second story window. In order to reach the second floor he has to stand on the top step.
  7. Several of the steps on the step ladder are covered with mud.
  8. A temporary stairrail system has been installed on the open staircase leading up to the second floor but the ends of the rails are sticking out. Juan ran into them and nearly fell several times during the course of the day.

*(continued)*

## Task (continued)

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In your groups review the factsheets on pages 64-79. Then using the factsheets and your own experience, list the things Juan can do to improve the ladder and stairway safety on this job.

For each concern write your recommendations:

1. *The extension ladder is barely touching the bottom edge of the roof (it is not fully extended) and Juan is having a difficult time keeping his balance each time he gets on and off the roof.*

**What should Juan do about the extension ladder that is barely touching the bottom edge of the roof?**

2. *The upper section of the ladder is laying up against the house behind the bottom section of the ladder.*

**How should the ladder be resting against the house?**

3. *The ladder feels shaky and is not secured.*

**Should the ladder be secured? If so, how? What would you recommend if it is not possible to secure the ladder?**

4. *The base of the ladder (the bottom of the lower section) is less than 2 feet away from the house wall (note that the ladder extends approximately 12 feet).*

**How far should the base of the ladder (the lower section) be extended away from the house?**

- 
5. *The step ladder positioned on the other side of the house is located in a muddy area where the ground is soft and not compacted.*

**What should Juan do to secure the step ladder?**

6. *The step ladder is labeled “Grade 3” and Juan is using it to hand materials up over his head to workers through a second story window. In order to reach the second floor he has to stand on the top step.*

**Is this the proper grade step ladder for the job and is Juan using it properly?**

7. *Several of the steps on the step ladder are covered with mud.*

**What can happen if the rungs on the step ladder aren’t properly cleaned and maintained?**

8. *A temporary stairrail system has been installed on the open staircase leading up to the second floor but the ends of the rails are sticking out. Juan ran into them and nearly fell several times during the course of the day.*

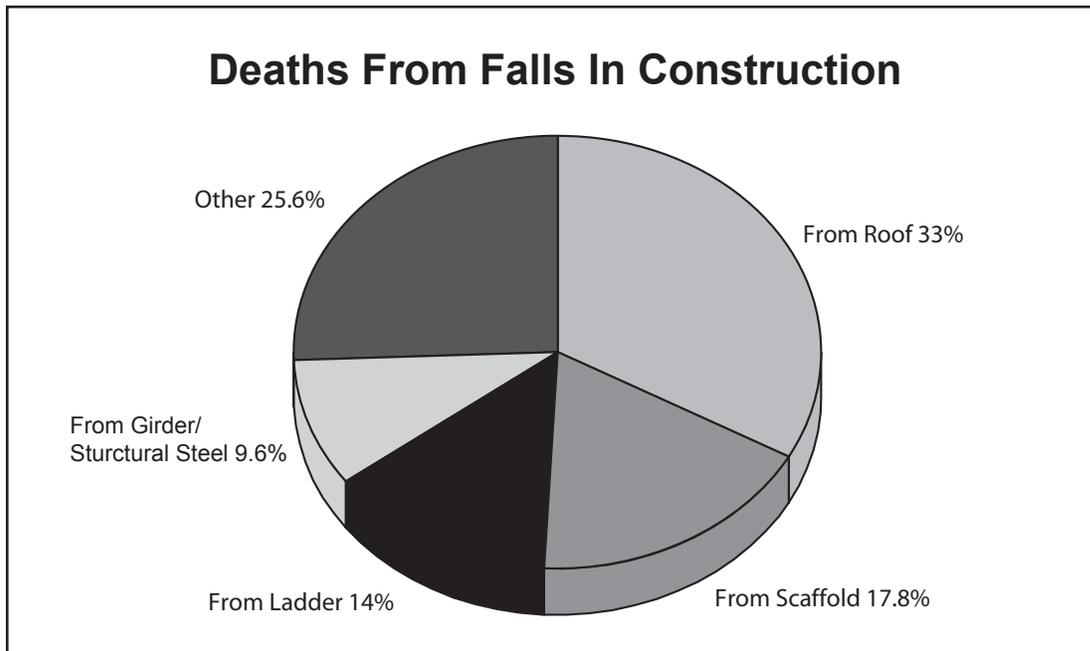
**Are the stairrails in violation of OSHA regulations? What would you recommend that Juan do? How would you handle the situation?**

# 1. Ladder Injuries and Fatalities

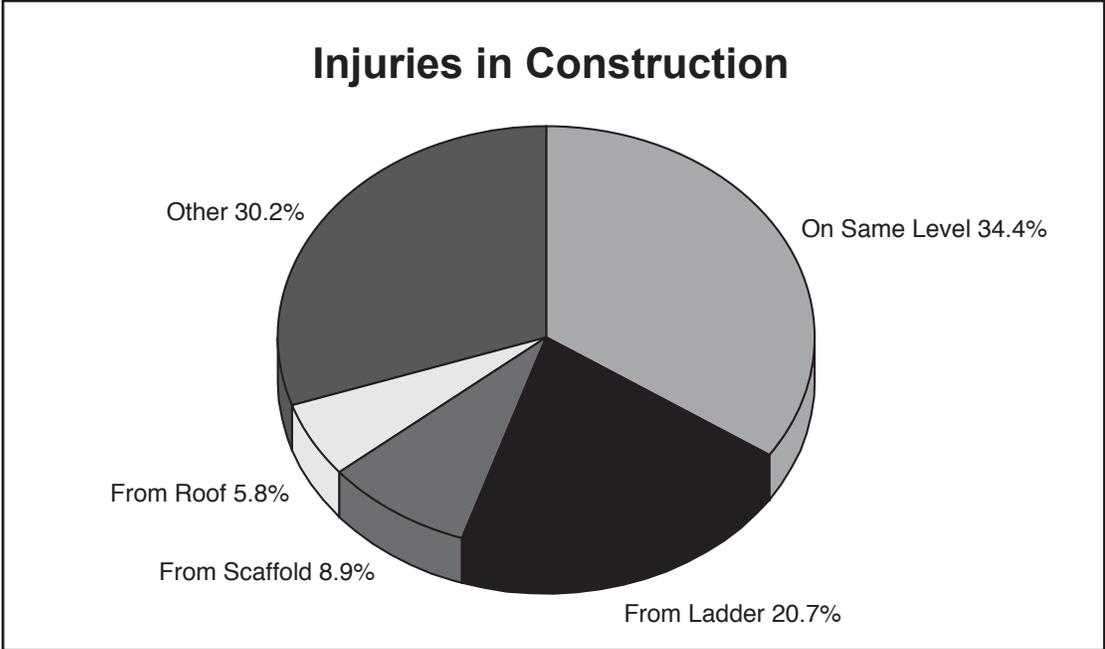
Many day laborer jobs require the use of ladders. In 2004, the number of workers killed as a result of falls from ladders increased from 114 to 133.

Fatal Falls in 2004		
Type of Falls	Number of Fatalities	
	2003	2004
From Ladders	114	133
From Roofs	128	178
From Scaffolds	85	89

Fourteen percent of all construction worker fatalities are the result of falls from ladders. Most deaths from falls off ladders occur at heights below 10 feet.



Over 20 percent of construction worker injuries that result in days lost from work are the result of falls from ladders.



Source: The Center to Protect Workers' Rights' (CPWR), *The Construction Industry Chart Book*, 2002. Bureau of Labor Statistics (BLS), National Census of Fatal Occupational Injuries Summary 2004, <http://stats.bls.gov/news.release/foi.nr0.htm>

## 2. What Are the Hazards?

In addition to ladders, stairways used during construction and stairways temporarily installed during construction can also be hazardous if they fail to meet OSHA guidelines. The table below lists some of the most often cited hazards associated with working on or around stairways and ladders.

<b>Stairway and Ladder Hazards</b>	
✓	No handrails or guardrails on stairs
✓	Uneven risers (steps)
✓	Unsecured portable ladders
✓	Ladders that are not extended 3 feet above the landing (roof)
✓	Defective ladders
✓	Ladders located within 10 feet of power lines
✓	Fixed ladders that do not have the required fall protection

Source: The Occupational Safety and Health Administration (OSHA), *Stairways and Ladders, A Guide to OSHA Rules*, Publication 3124, 2003.

### 3. Types of Ladders

The many types of ladders used on construction sites range from portable, to fixed (permanently mounted on equipment) to job-built wooden ladders.

#### Portable Ladders

Portable ladders are available in various grades: light duty or grade 3; medium duty or grade 2; heavy duty or grade 1. For general construction applications, heavy duty portable ladders are recommended.

Ladder Grade	Capacity (pounds)	Comment
IAA	375	Special Duty
IA	300	Extra Heavy Duty
I	250	Heavy Duty
II	225	Medium Duty (light commercial use)
III	200	Light Duty (household use)

#### Fixed Ladders

Steel ladders permanently fixed to structures such as stacks and silos are designed for service after construction is complete but are often used by work crews during construction. These ladders must have safety cages starting no more than 7 feet from the bottom of the ladder and extending at least 42 inches above the top landing.

#### Job-Built Wooden Ladders

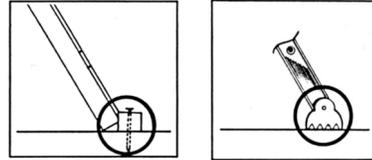
Job-built ladders should be constructed according to good structural carpentry practices. The wood should be straight-grained and free of loose knots, sharp edges, splinters, and shakes. Rungs should be clear, straight-grained, and free of knots. Job-built ladders must be placed on a firm footing and be securely fastened in position.

Source: The Occupational Safety and Health Administration (OSHA), *Stairways and Ladders, A Guide to OSHA Rules*, Publication 3124, 2003. Construction Safety Association of Ontario, *Construction Health and Safety Manual*, 2003, [www.csao.org](http://www.csao.org). The American National Standards Institute, Ladder Classifications, see: [www.sizes.com/tools/ladders.htm](http://www.sizes.com/tools/ladders.htm)

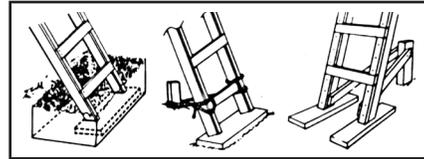
## 4. Proper Ladder Procedures Checklist

- ☑ Check the ladder for defects at the start of a shift, after it has been used in another location by other workers, or after it has been left in one location for a lengthy period of time.
- ☑ Since the risk of falling is greater when getting on and off of a ladder, check to make sure the area surrounding the base and top of the ladder is clear of trash, materials and other obstructions.

- ☑ The base of the ladder should be secured against accidental movement. Use a ladder equipped with non-slip feet appropriate for the situation, nail a cleat to the floor, or otherwise anchor the feet or bottom of the side rails.



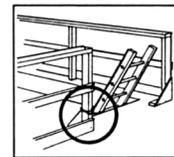
- ☑ The ladder must be set up on a firm level surface. If its base is to rest on soft, uncompacted or rough soil, a mud sill should be used.



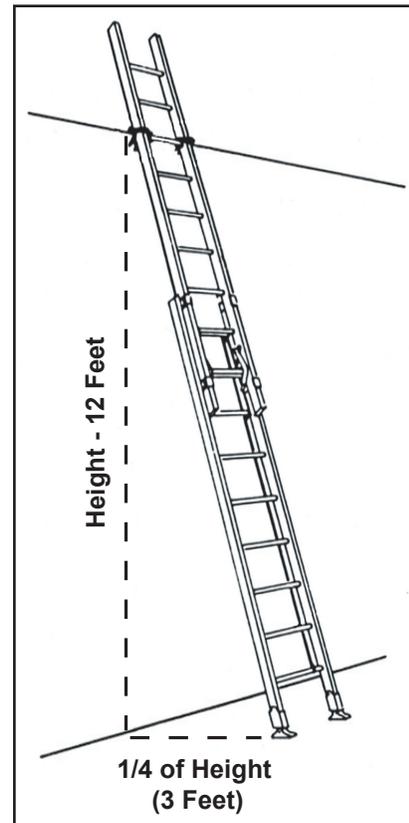
- ☑ The top of the ladder should be tied off or otherwise secured to prevent any movement. If this is not possible, given the type of ladder or circumstances of its use, one worker should hold the base of the ladder while it is being used.



- ☑ If a ladder is used for access from one work level to another, the side rails should extend a minimum of 3 feet above the landing. Grab rails should be installed at the upper landing so that a worker getting on and off the ladder has secure handholds.



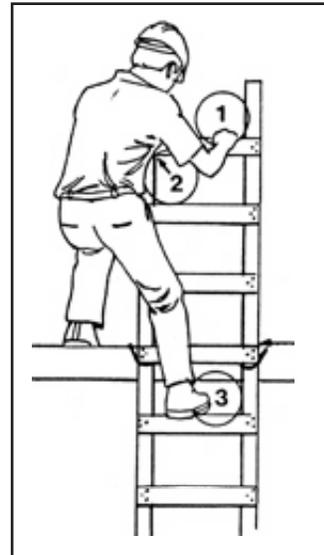
- All straight or extension ladders should be erected at an angle such that the horizontal distance between the top support and the base is one foot out from the wall for every four feet of ladder length (75° pitch).
- Before setting up straight or extension ladders, check the area for overhead power lines. Ladders made of aluminum or other conductive material should never be used near power lines.
- Portable ladders should never be used horizontally as substitutes for scaffold planks, runways, or any other service for which they have not been designed.
- Never use the top or top step of a portable stepladder as a step.
- When a task can only be done while standing on a portable ladder, the length of the ladder must be such that no one stands higher than the fourth rung from the top. The ladder should also be tied off or equipped with a suitable stabilizer.
- Short ladders must never be spliced together to make a longer ladder. Side rails will not be strong enough to support the extra loads.
- Straight ladders should not be used as bracing, skids, storage racks, or guys. They were not designed for these purposes and the damage caused by such abuse can later result in an accident during normal use.



*(continued)*

## 4. Proper Ladder Procedures Checklist *(continued)*

- ☑ Unless suitable barricades have been erected, ladders should not be set up in passageways, doorways, driveways, or other locations where they can be struck or displaced by persons or vehicles using the access route.
- ☑ Only one person at a time should be allowed on a single-width ladder. In the case of a double-width ladder, no more than two people should be allowed on it at one time and each should be on a separate side.
- ☑ Ladders should not be placed against flexible or movable surfaces.
- ☑ Always face the ladder when climbing up or down and when working from it.
- ☑ Maintain 3-point contact when climbing up or down a ladder. That means two hands and one foot or two feet and one hand on the ladder at all times. This is especially important when you get on or off a ladder at heights.
- ☑ When working from a ladder, keep your center of gravity between the side rails. A person's center of gravity is approximately in the center of the body at belt height. The location of your center of gravity can shift when you reach out to either side of a ladder, especially with materials, tools, or equipment in your hands. When the center of gravity of your body and hand-held objects moves beyond the side rails, the ladder's stability is reduced.
- ☑ Do not climb up or down a ladder while carrying anything in your hands. Tools, equipment and materials should be placed in a container and raised or lowered by rope, if necessary.



- ☑ Persons frequently required to use or work from ladders should wear protective footwear with soles and heels made of slip-resistant materials such as soft urethane.
- ☑ Keep boots free of mud, snow, grease, or other slippery materials when using ladders.
- ☑ Always hold onto the ladder with at least one hand. If this is not possible because of the task to be done—and in particular if the work is 10 feet or more above the floor—wear a safety harness and tie the lanyard off to the structure or to a lifeline before beginning work.
- ☑ Never straddle the space between a ladder and another object.
- ☑ Never erect ladders on boxes, carts, tables, or other unstable surfaces.
- ☑ Fall protection should be used when working from long fixed ladders or when climbing vertical fixed ladders.
- ☑ Never rest a ladder on any of its rungs. Ladders must rest on their side rails.
- ☑ When erecting long, awkward, or heavy ladders, two or more persons should share the task to avoid injury from over-exertion.
- ☑ Look for overhead power lines before attempting to erect any ladder. When overhead power lines are in proximity of the work, aluminum ladders must not be used.

## **5. Inspection and Maintenance of Ladders**

Regular inspection and maintenance of ladders will reduce the number of accidents. Repairs should only be carried out by someone competent and familiar with this kind of work. Ladders found to be defective should be taken out of service and either tagged for repair or scrapped.

### **What to Look For**

All the joints between the fixed parts of ladders should be tight and secure. Hardware and fittings should be securely attached and free of damage, excessive wear, and corrosion. Movable parts should operate freely without binding or excessive play. This is especially important for gravity-action ladder locks on extension ladders. Non-skid feet should be checked for wear, imbedded material, and proper pivot action on swivel feet. Deteriorated, frayed or worn ropes on extension ladders should be replaced with a size and type equal to the manufacturer's original rope. The bases, rungs, and steps of all ladders should be examined for grease, oil, caulking, imbedded stone and metal, or other materials that could make them slippery or otherwise unsafe.

### **Aluminum Ladders**

Aluminum ladders should be checked for dents and bends in side rails, steps, and rungs. Repairs should be made only by the manufacturer or someone skilled in good aluminum or metal work practices. Replacing a rung with a piece of conduit or pipe is not good practice and should not be permitted.

### **Wooden Ladders**

Wooden Ladders are susceptible to cracking, splitting, and rot and should be either unpainted or covered with a transparent finish so that cracks, splits, rot, or compression failures can be easily detected. Repairs should be consistent with good woodworking practice. Only wood equal to or better than the wood used by the manufacturer should be used in the repair.

### **Storage and Transportation**

Methods of storage and transportation are important. Storage areas should permit easy access and be cool and dry, particularly if wooden ladders are kept there. Areas where the moving of other materials can damage ladders should be avoided. Ladders should be supported during storage and transportation to prevent sagging or chafing. When being transported, ladders should be “top freight”—nothing should be piled on them. If damage does occur, the condition causing the damage should be corrected and the ladder should be repaired.

*(continued)*

## 5. Inspection and Maintenance of Ladders

(continued)

<b>Ladder Inspection Checklist</b>			
		<b>Yes</b>	<b>No</b>
<b>1.</b>	Are any wooden parts splintered?		
<b>2.</b>	Are there any defects in side rails, rungs, or other similar parts?		
<b>3.</b>	Are there any missing or broken rungs?		
<b>4.</b>	Are there any broken, split, or cracked rails repaired with wire, sheet metal, or other makeshift materials?		
<b>5.</b>	Are there any worn, damaged, or missing feet?		
<b>6.</b>	Are there any worn, damaged, or unworkable extension ladder locks, pulleys, or other similar fittings?		
<b>7.</b>	Is the rope on extension ladders worn, broken, or frayed?		
<b>8.</b>	Has the rope on extension ladder been replaced by material inferior to the ladder manufacturer's original rope?		
<b>9.</b>	Are the spreader arms on step ladders bent, worn, broken, or otherwise rendered partly or totally ineffective?		
<p>If the answer is <b>"YES"</b> to any of the questions on the Inspection Checklist, the ladder should be tagged so that workers will know it is defective and should not be used. It should be taken out of service immediately and placed in a location where it will not be used until repairs are completed. If the ladder is not to be repaired it should be destroyed.</p>			

## 6. Reduce the Risk of Slipping Off Ladders

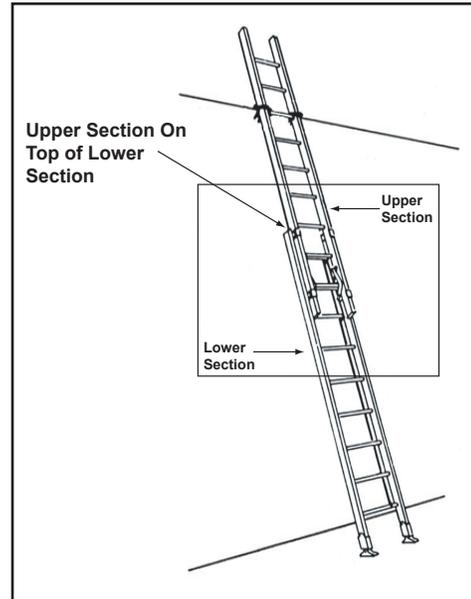
Nearly a third of all ladder accidents are the result of slips. What are some things you can do to keep yourself from slipping?

- Use a ladder with non-skid treads (or a non-skid coating) on the rungs.
- Make sure the rungs are free of mud, grease, and other slippery material.
- Make sure your shoes are free of mud and grease.
- When you're on a ladder, don't lean too far out—never beyond arm's length.
- When going up or down a ladder, always face the ladder and use both hands.
- Don't try to adjust an extension ladder when you're standing on a surface above it.
- Don't stand or work on the top three rungs of a straight ladder unless you're tied off. At the top, there's nothing to grip.
- Don't step on any rung above a ladder's upper support. It may cause the bottom of the ladder to kick out.
- Don't stand or work on the top (cap) of a stepladder.
- If you use a stepladder, always make sure it's fully open and locked.

## 7. Using Extension Ladders

In order to work safely using extension ladders do the following:

- Place ladders on a firm, level surface and ensure the footing is secure.
- Erect extension ladders so that the upper section rests on top of the lower section. The lower section must “face” a wall or other supporting surface. (see diagram).
- Place the ladder feet so that the horizontal distance between the feet and the top support is  $\frac{1}{4}$  of the working length of the ladder. The ladder must be leaning at a  $75^\circ$  angle from the ground.
- Raise and lower ladders from the ground. Ensure that locking ladder hooks are secure before climbing.
- Erect ladders so that a minimum of 3 feet extends above a landing platform. Tie the top at support points.
- Where a ladder cannot be tied off at the top, station a person at the foot to prevent it from slipping. This method is only effective for ladders up to 16 feet long. The person at the foot of the ladder should face the ladder with a hand on each side rail and one foot resting on the bottom rung.
- Leave all tie-off devices in place until the ladder is taken down.
- Maintain the minimum overlap of sections as shown the ladder label. Refer to safety regulations.



What should you avoid when using extension ladders?

- Do not use ladders near electrical wires and power lines.
- Do not set up or take a ladder down when it is extended.

- Do not overextend the ladder. Maintain minimum overlap of sections.
- Do not climb higher than the fourth rung from the top of a ladder.
- Do not use ladders on ice, snow or other slippery surfaces without securing the ladders' feet.
- Do not extend top section of a ladder from above or by "bouncing" on a ladder.
- Do not leave ladders unattended.

### **How to Properly Set Up An Extension Ladder**

When setting up an extension ladder, use the following method to avoid straining muscles or losing control of the ladder. With ladders weighing more than 55 pounds, or where conditions complicate the task, have two persons set up a ladder, step by step, as follows:

1. Lay the ladder on the ground close to the intended location.
2. Brace the ladder base using the helpers' feet.
3. Grasp the top rung with both hands, raise the top end over your head and walk toward the base of a ladder. Grasp the centre of the rungs to maintain stability.
4. Move the erect ladder to the desired location. Lean it forward against the resting point.

One person can erect a short ladder, step by step as follows:

1. Place the bottom of a ladder firmly against the base of a building or stationary object.
2. Lift the top of ladder, and push upwards to raise the ladder to a vertical position.
3. Transfer the ladder to its required position when it is erect.
4. Keep the ladder upright and close to the body with a firm grip.

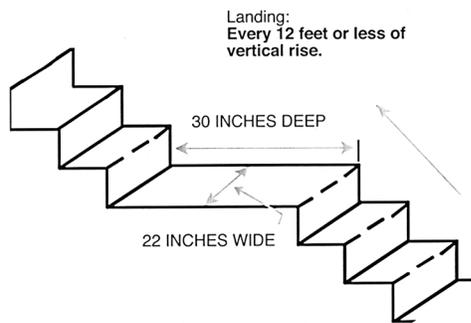
**Note:** The method for lowering any ladder is the reverse procedure of erecting it.

## 8. Stairway Hazards

There are OSHA regulations for stairs used during construction and stairs used temporarily during construction. There are also rules governing stair rails and handrails.

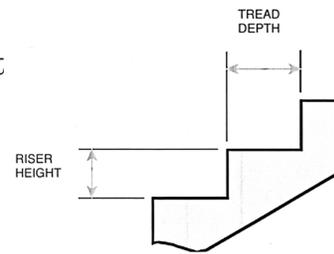
### General Requirements

Stairways that will not be a permanent part of the building under construction must have landings at least 30 inches deep and 22 inches

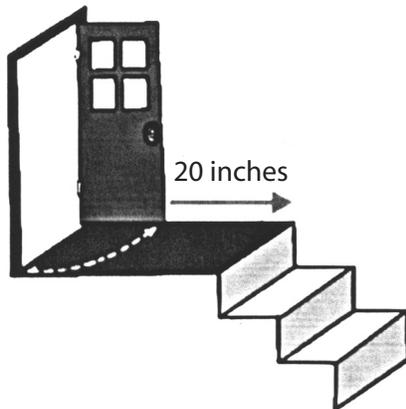


wide at every 12 feet or less of vertical rise. Stairways must be installed at least 30 degrees—and no more than 50 degrees—from the horizontal.

Stairs must have a uniform riser height and tread depth, with less than a  $\frac{1}{4}$  inch variation.



Doors and gates opening directly onto a stairway must have a platform that extends at least 20

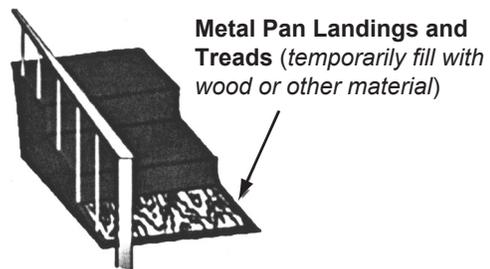


inches beyond the swing of the door or gate. Metal pan landings and metal pan treads must be secured in place before filling.

Stairway parts must be free of dangerous projections such as protruding nails. Slippery conditions on stairways must be corrected. Workers must not use spiral stairways that will not be a permanent part of the structure.

### Stairs Used for Temporary Service

When stairways are used temporarily during construction, metal pan landings and treads must be filled in with concrete or other materials unless the pans of the stairs and/or landings are temporarily filled in with wood or other materials. In addition:

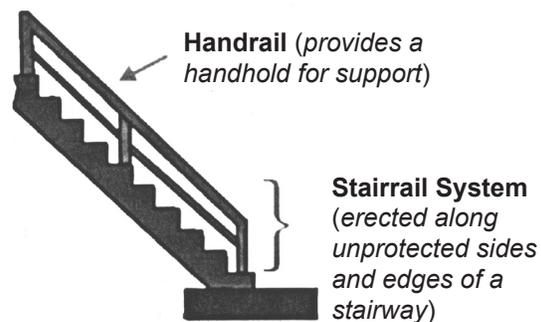


- All treads and landings must be replaced when worn below the top edge of the pan.
- Do not use skeleton metal frame structures and steps (where treads and/or landings will be installed later) unless the stairs are fitted with secured temporary treads and landings.
- Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

### Temporary Stairrail Systems

Stairways with four or more risers or rising more than 30 inches in height must have stairrails installed along each unprotected side or edge. Stairrail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.

Ends of stairrail systems and handrails must be built to prevent dangerous projections, such as rails protruding beyond the end posts of the system. In addition, unprotected sides and edges of stairway landings must have standard 42-inch guardrail systems. Intermediate vertical members, such as balusters used as guardrails, must not be more than 19 inches apart. Other intermediate structural members, when used, must be installed so that no openings are more than 19 inches wide.



### Temporary Handrails

Handrails must be able to withstand a force of at least 200 pounds. The top edge of handrails must be at least 36 inches—but no more than 37 inches—high from the tread. Temporary handrails must have at least 3 inches of clearance between the handrail and other objects. Midrails, screens, mesh, and vertical members must be provided between the top rail and stairway steps.

Source: The Occupational Safety and Health Administration (OSHA), *Stairways and Ladders, A Guide to OSHA Rules*, Publication 3124, 2003.

## Summary

1. Fourteen percent of all construction worker fatalities are the result of falls from ladders. Most deaths from falls off ladders occur at heights below 10 feet.
2. In addition to ladders, stairways used during construction and stairways temporarily installed during construction can also be hazardous if they fail to meet OSHA guidelines.
3. Portable ladders are used most often in construction and are available in various grades including: light duty or grade 3; medium duty or grade 2; heavy duty or grade 1. For general construction applications, heavy duty portable ladders are recommended.
4. Following the proper ladder procedures will significantly reduce the risk of falling.
5. Regular inspection and maintenance of ladders will reduce the number of accidents. Repairs should only be carried out by someone competent and familiar with this kind of work.
6. Nearly a third of all ladder accidents are the result of slips. There are steps you can take to keep yourself from slipping including using a ladder with non-skid treads (or a non-skid coating) on the rungs making sure the rungs are free of mud, grease, and other slippery material.
7. Extension ladders must extend 3 feet above the landing or roof. When using extension ladders never climb higher than the fourth rung from the top of a ladder and never use aluminium ladders near electrical wires and power lines.
8. Stairrail systems and handrails should be installed in all stairways with four or more risers or stairways that rise more than 30 inches in height.

# Evaluation

## Activity 3: Ladder Safety

1. How important is this Activity for day laborers?

Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the factsheets you feel are the most important.

1. Ladder Injuries and Fatalities	5. Inspection and Maintenance of Ladders
2. What Are the Hazards?	6. Reduce the Risk of Slipping Off Ladders
3. Types of Ladders	7. Using Extension Ladders
4. Proper Ladder Procedures Checklist	8. Stairway Hazards

3. Which summary point do you feel is most important?

Please circle one number.

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

4. What would you suggest be done to improve this Activity?

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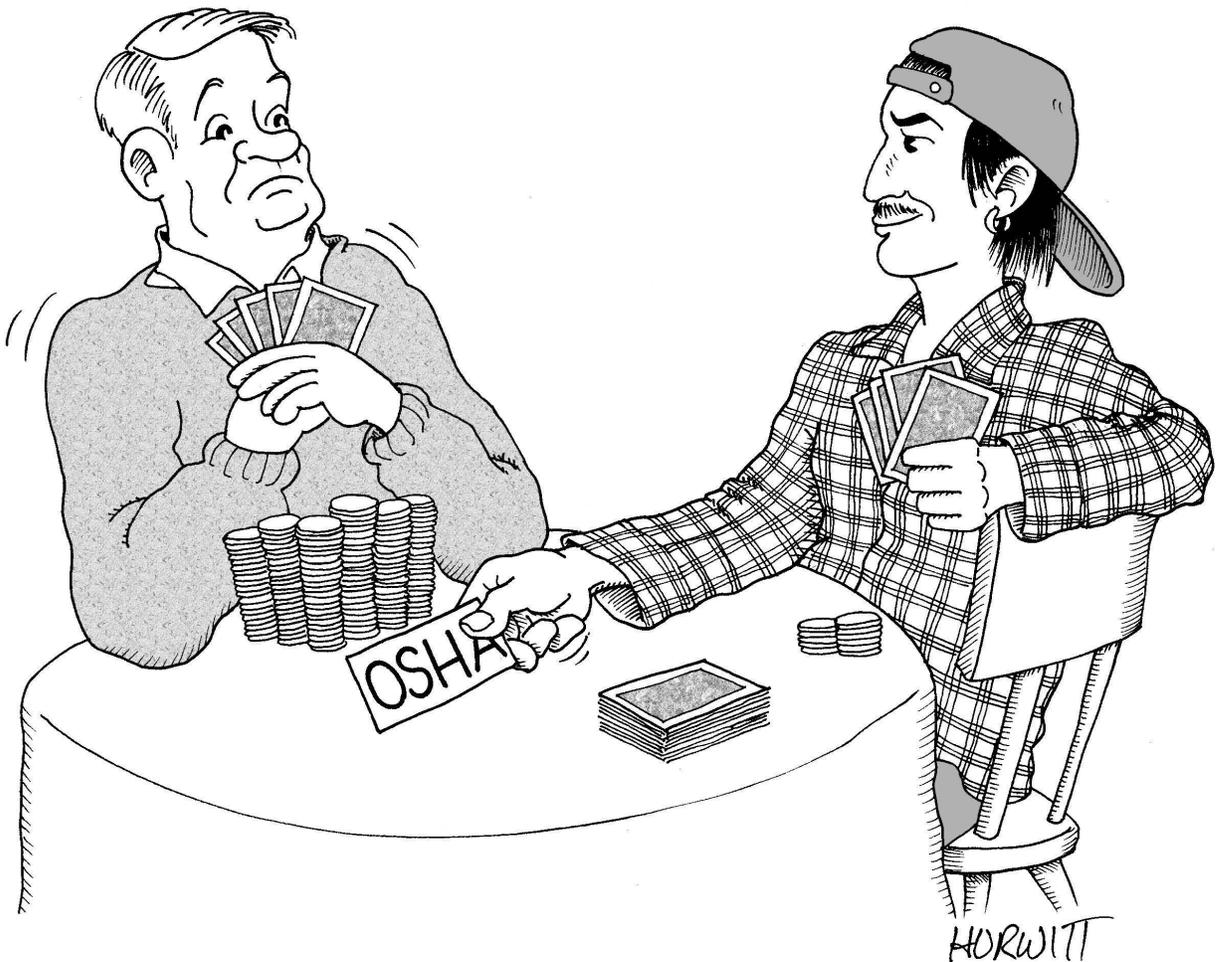


# Activity 4: OSHA Rights and Responsibilities

## Purpose

To learn more about worker/employer rights and responsibilities under OSHA and how we can use OSHA as a tool for eliminating hazards in our workplaces.

This Activity has three tasks.



## Task 1

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### Part A:

New Labor has asked your group to give a *tailgate talk* to day laborers about their rights under OSHA. Review the factsheets on pages 85-93, then working together make a list of key points you will make during the tailgate talk. (Try to support each point with a factsheet.)

### Tailgate Talk—OSHA Rights and Responsibilities Key Points: (Please make a list)

1.

2.

3.

4.

5.

6.



# 1. What Is OSHA and Who Is Covered?

The Occupational Safety and Health Administration (OSHA), is an agency of the U.S. Department of Labor. Congress created OSHA under the Occupational Safety and Health Act of 1970. Prior to 1970, no uniform, comprehensive provisions existed to protect workers against unsafe or hazardous work situations.

**OSHA's sole responsibility is to develop mandatory job safety and health standards and enforce them through workplace inspections, employer assistance, and by imposing citations and financial penalties.**

OSHA covers all private sector employers and employees in manufacturing, construction, long shoring, shipping, agriculture, law, medicine, charity, disaster relief, organized labor, private education, and religious groups who employ workers.

In cases where another federal agency regulates safety and health in a particular industry (e.g., mine workers, certain truckers, rail workers, and atomic energy workers), OSHA standards still apply if the other agency's regulations do not address specific working conditions.

## 2. Contractor/Employer Responsibilities

All contractors/employers covered under the Occupational Safety and Health (OSH) Act must do the following:

- Meet their general duty responsibility to provide a workplace free from recognized hazards
- Keep employees informed about OSHA and safety and health hazards they are exposed to on the job
- Comply in a responsible manner with standards, rules and regulations issued under the OSH Act
- Be familiar with mandatory OSHA standards
- Make copies of standards available to employees for review upon request
- Evaluate workplace conditions
- Minimize and/or eliminate potential hazards
- Ensure that employees have and use safe, properly maintained tools and equipment (including appropriate PPE)
- Educate employees about potential hazards
- Provide medical examinations when required
- Provide training required by OSHA standards
- Report within 8-hours any accident that results in a fatality or the hospitalization of three or more employees
- Keep OSHA-required records of work-related injuries and illnesses

*(continued)*

## 2. Contractor/Employer Responsibilities *(continued)*

- Post a copy of the OSHA 300-Log and Summary of Occupational Injuries and Illnesses for the prior year annually during the entire month of February
- Post, at a prominent location within the workplace, the OSHA poster (OSHA 2203) informing employees of their rights and responsibilities
- Provide current and former employees and their representatives with access to the OSHA-300 Log within a reasonable time and in a reasonable manner
- Provide employees with access to their medical and exposure records
- Post OSHA citations and abatement verification notices at or near the worksite
- Abate cited violations within the prescribed period

### **The OSHA General Duty Clause**

Section 5(a)(1) of the Occupational Safety and Health Act requires that an employer:

*“shall furnish to each of his employees employment and a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”*

This is know as the OSHA “general duty clause.”

### 3. Contractor/Employer Rights

Under the OSH Act contractors/employers can do the following:

- Seek free advice and off-site consultation
- Be involved in job safety and health through industry associations
- Request and receive proper identification from OSHA compliance officers and be advised by the compliance officer of the reason for an inspection
- Have an opening and closing conference with the compliance officer
- Accompany the compliance officer on inspections
- File a *Notice of Contest* to dispute inspection results and request an informal settlement agreement process after an inspection
- Apply for a variance from a standard's requirements when unable to fully comply with the effective date due to lack of technical expertise and materials and when other proven effective means are in place to protect employees
- Take an active role in developing safety and health
- Be assured of the confidentiality of any trade secrets
- Submit a written request to NIOSH for information on whether any substance in your workplace has potentially toxic effects in the concentrations being used
- Submit information or comments to OSHA on the issuance, modification, or revocation of OSHA standards and request a public hearing

## 4. Worker Responsibilities Under OSHA

Workers covered under the OSH Act should do the following:

- Read the OSHA poster at the job site
- Comply with all applicable OSHA standards
- Follow all employer safety and health rules and regulations, and wear or use prescribed protective equipment while engaged in work
- Report hazardous conditions to the appropriate supervisor;
- Report any job-related injury or illness to the employer, and seek treatment promptly
- Cooperate with an OSHA compliance officer conducting an inspection
- Exercise your rights under the OSH Act responsibly

### **Workers Cannot Be Cited For OSHA Violations**

Workers must follow all applicable standards, rules, regulations and orders issued under the OSH Act. However, OSHA cannot cite workers as individuals for violations.

## 5. Worker Rights Under OSHA

Under the OSH Act workers can do the following:

- Review copies of appropriate OSHA standards, rules, regulations and requirements that the employer should have available at the workplace
- Request information (including MSDSs) from the employer on safety and health hazards, precautions and emergency procedures
- Receive adequate training and information
- Request that the OSHA Area Director investigate hazardous conditions or violations of standards in the workplace
- Have names of employees filing complaints withheld from employers
- Be advised of OSHA actions regarding complaints and have an informal review of any decision not to inspect or to issue a citation
- Have authorized employee representatives accompany the OSHA compliance officer
- Observe any monitoring or measuring of hazardous materials and see any related monitoring or medical records
- Review the OSHA 300-Logs at a reasonable time and in a reasonable manner
- Request a closing discussion following an inspection

*(continued)*

## 5. Worker Rights Under OSHA *(continued)*

- Submit a written request to NIOSH for information on whether any substance in the workplace has potentially toxic effects in the concentrations being used and have your name withheld from the employer
- Object to the abatement period set in a citation issued to your employer
- Participate in hearings conducted by the Occupational Safety and Health Review Commission
- Be notified by the employer if they apply for a variance, and testify at a variance hearing and appeal the final decision
- Submit information or comments to OSHA on the issuance, modification or revocation of OSHA standards and request a public hearing

### **Your Immigration Status Is Not an Issue**

All workers are entitled to a safe and healthy workplace regardless of their immigration status. It is the employer's responsibility to provide a safe and healthy workplace as cited in OSHA's General Duty Clause. If the employer doesn't provide a safe and healthy workplace, and it leads to an OSHA investigation, OSHA inspectors will inspect the workplace. But OSHA inspectors are ONLY concerned with workplace health and safety, not a worker's immigration status.

## 6. Workers Have Limited Rights To Refuse Unsafe Work

If you are told to do work you believe could lead to death or serious injury, then you can refuse to do that work. However, you are only protected against termination or discipline by the OSH Act if you can meet the following conditions:

- You must have a reasonable belief that there is real, **imminent danger of death or serious injury**
- You should have followed all the appropriate company rules and procedures in requesting that the danger be eliminated before you start the job
- You must have no reasonable alternative
- There must not be enough time to correct the problem through normal OSHA enforcement procedures

If all the above conditions are met and you are punished for refusing to do the work, then you should immediately file a complaint with OSHA.

<p><b>OSHA Requirements for Imminent Danger:</b> The following conditions must be met before a hazard becomes an imminent danger:</p>
<p>There must be a threat of death or serious physical harm. "<i>Serious physical harm</i>" means that a part of the body is damaged so severely that it cannot be used or cannot be used very well.</p>
<p>For a health hazard there must be a reasonable expectation that toxic substances or other health hazards are present and exposure to them will shorten life or cause substantial reduction in physical or mental efficiency. The harm caused by the health hazard does not have to happen immediately.</p>
<p>The threat must be <i>immediate or imminent</i>. This means that you must believe that death or serious physical harm could occur within a short time, for example before OSHA could investigate the problem.</p>

## Task 2

---

Today is the first of five days of work the contractor has promised Juan and he will be working with the crew that is cutting stones with a band saw. The dust is flying all over and Juan is very concerned because he has recently learned that the stones contain silica and silica dust can have serious long term affects on your health. He's not sure what to do because he regularly works for this landscaping contractor and he's never had a problem getting paid. (*See Factsheet 9 for more information on Silica Dust.*)

What should Juan do?

**Below are four options. Based on the factsheets on pages 98-105 and your own experience, make a list of agreements and disagreements for each option listed below.**

**Option #1:**

Juan should talk to the foreman and tell him that silica dust is dangerous to everyone's health and that it would be much safer to wet-cut the stone pavers.

**Agreements:**

**Disagreements:**

**Option #2:**

Juan should keep his mouth shut and the next day go back to the same job wearing a dust mask to protect himself from the harmful effects of the silica dust.

**Agreements:**

**Disagreements:**

**Option #3:**

Juan should finish the job and get paid for the day. The next day he can find another job and tell all of his friends that they should stay away from that contractor.

**Agreements:**

**Disagreements:**

**Option #4:**

Juan should file an OSHA complaint.

**Agreements:**

**Disagreements:**

*(continued)*

## **Task 2 (continued)**

---

Juan has failed to convince the contractor that he should be wet cutting the stones. He is still very concerned about the risks of being exposed to silica dust and what it might do to his health and that of his co-workers. As a result, Juan is seriously thinking about filing an OSHA complaint but he's not sure how the government agency will respond.

**Based on Factsheet #7 What priority status do you think OSHA would assign to Juan's problem? (Please explain.)**



## **7. How OSHA Prioritizes Complaints**

Because its staff and resources are limited, OSHA spends nearly all of its time on the most hazardous workplaces. If your complaint falls into the category of “imminent danger” OSHA will respond quickly. If your complaint falls into the category of a serious violation where the severity of the hazard could lead to serious injuries or illnesses OSHA will assign your complaint a “higher priority status” and initiate an investigation/inspection process immediately.

If your workplace has a history of serious violations or you work in an industry that OSHA recognizes as highly hazardous, and your complaint is an obvious violation of a standard, a Compliance Officer is likely to conduct a phone/fax investigation (see Factsheet 14 for more information on phone/fax investigations) to quickly solve the problem.

For most of us, it is likely that our complaints will generally be classified by OSHA as something “other than serious.” Most of the time OSHA will try to solve these problems through the phone/fax investigation process. In some situations that might be all that’s necessary.

However, if you have health and safety concerns that are not given high priority status by OSHA and you still want an on site inspection, you could be waiting a while. Getting the agency to conduct an on site inspection could take anywhere from 30 to 60 days. If you can’t wait that long then you might want to think more strategically about how to use OSHA.

**For more information about worker rights and responsibilities under OSHA see <http://www.osha.gov/as/opa/spanish/index.html>.**

<b>OSHA INSPECTION PRIORITIES</b>		
<b>Priority</b>	<b>Category</b>	<b>Definition</b>
<b>First</b>	<b>Imminent Danger</b>	Any condition where there is reasonable certainty a danger exists that can be expected to cause death or serious physical harm immediately or before the danger can be eliminated through normal enforcement procedures.
<b>Second</b>	<b>Fatalities/Catastrophes Investigations</b>	Any situation that results in the death of any employee or the hospitalization of three or more employees.
<b>Third</b>	<b>Complaints/Referrals Investigations</b>	OSHA violations that are not classified as imminent danger and/or situations where the threat of death or serious physical harm is unlikely. And situations where alleged hazards or violations of the Act are given by sources other than employees or concerned citizens (referrals).
<b>Fourth</b>	<b>Follow-ups</b>	Except in unusual circumstances, follow-up inspections will take priority over all programmed inspections and any unprogrammed inspections with hazards evaluated as other than serious.
<b>Fifth</b>	<b>Planned Inspections</b>	Situations involving programmed inspections of high-hazard industries.

Source: OSHA Field Inspection Reference Manual, *Chapter I: Pre Inspection Procedures*.

## **8. Using OSHA Strategically**

So when should you file a complaint with OSHA? It all depends on the severity of your complaint, your immediate and long-term health and safety objectives, or any number of other issues and concerns that have to be factored into your decision.

When most of us reach the point of calling OSHA it's usually because we've exhausted all other available options. However, because of the way the agency handles complaints, we should try to think about OSHA as more than just an option of last resort.

If the hazard you are concerned about isn't covered by a standard or the current standard doesn't offer much protection, you may want to consider developing an action plan that "pressures" your employer into eliminating the hazard before filing a complaint with OSHA. Threatening to call OSHA may provide your employer with enough incentive to correct the problem.

On the other hand, if your employer has had little contact with OSHA in recent years and is ignoring your threats to call the agency, filing an electronic complaint will prompt an immediate call from the agency and that might be enough to get the hazard eliminated.

How and when you use OSHA will ultimately depend on circumstances that are specific to your workplace. You should always make those decisions in consultation with co-workers and New Labor. Working together you should devise a comprehensive plan of action that uses OSHA to your best advantage.

## Things to Consider

- Does the hazard qualify as Imminent danger?
- Does the hazard violate a specific OSHA standard?
- Have you threatened to call OSHA in an effort to get the employer to eliminate the hazard?
- Is the employer refusing to eliminate a known hazard that violates an OSHA standard?
- Is this a situation where employees have been injured and taken to the hospital for treatment?
- Is the employer engaging in activities that endanger co-workers the community and the environment?
- Have you exhausted all your options in trying to get the employer to eliminate the hazard?
- Have all your efforts been documented?
- Is the employer refusing to provide required OSHA compliance training?
- Is the employer knowingly exceeding exposure limits?
- Can it be documented?

*(continued)*

## 8. Using OSHA Strategically *(continued)*

### **Things to Consider** *(continued)*

- Will co-workers support the decision to file a complaint?
- Will co-workers participate in the inspection?
- Is the employer making a good faith effort to remedy the problem and reduce or eliminate the hazard?
- Do your co-workers know and understand the hazards present in the workplace?
- Does the employer have a history of citations, willful exposures, etc.?
- Are you confident that an inspection will result in OSHA issuing a citation?
- Have you considered scheduling a meeting with your co-workers and OSHA staff to review your complaint when you file it?

## 9. Exposure to Silica Dust

Day laborers face a serious workplace hazard when they are exposed to *crystalline silica dust*. Exposures to silica dust can lead to a disease called silicosis—a serious and incurable respiratory disease that occurs when particles of crystalline silica are inhaled and become embedded in the lung. The disease can be fatal. It is estimated that 300 workers die each year from silica exposure.

Jobs that can produce exposure to silica dust include demolition, breaking concrete, drywall installation/removal, insulation installation/removal, and works dealing with cement.

Construction materials that contain silica include:

- many abrasives used for blasting
- brick, refractory brick
- concrete, concrete block, cement, mortar
- granite, sandstone, quartzite, slate
- gunitite
- mineral deposits
- rock and stone
- sand, fill dirt, top soil
- asphalt containing rock or stone
- dry wall

### Exposure Levels

Sand and materials such as concrete contain concentrated amounts of crystalline silica. When concrete products including masonry blocks, bricks, concrete slabs and/or rocks are chipped, hammered, drilled, crushed, hauled, sand blasted, sawed or swept, workers are exposed to crystalline silica dust, and they may develop silicosis. Even materials containing small amounts of crystalline silica may be hazardous if they are used in ways that produce high dust concentrations.

*(continued)*

## 9. Exposure to Silica Dust *(continued)*

### Use Water

Water is the most efficient means of controlling dust from cutting concrete products. Bench saws for blocks and bricks typically have ports on the upper blade guard where water supply lines can be attached. Portable saws may or may not be equipped with water supply ports. If the saw is equipped with wet cutting capability, the mason needs to pre-plan the work to ensure that water will be available at the location while cutting, and that the connections to the water supply are made.

If the saw is not equipped with wet cutting capability, an alternative is to use water supplied by a portable water tank or cart. Two workers may be needed for the task, one to operate the cutting tool, and the other to provide the water supply. Again, the mason must pre-plan the job to ensure that the materials and manpower are available to allow for wet cutting. Some abrasive cutting tools, such as grinders, can be equipped with a self contained pump which collects, filters, and reuses a small amount of water.

### Don't Rely on Respirators

Respirators are often ineffective or not properly used and as a result, they do not provide the same level of protection as wet cutting. However, if exposures to crystalline silica cannot be sufficiently reduced by wet cutting or ventilation, you must wear appropriate respiratory protection.

The choice of respirators depends on the *permissible exposure limit* (PEL) for the job you are doing.

- **For Exposures up to 5 times the PEL:**  
Disposable NIOSH approved particulate respirators  
**Typical jobs**—block running, erecting scaffolds, mortar mixing

- **Exposures up to 10 times the PEL:**  
Half-mask respirators with dust cartridges  
**Typical jobs**—dry cut block saws, dry cut portable saws
- **Exposures up to 50 times the PEL:**  
Full-face piece respirators with dust cartridges,  
quantitatively fit tested, or supplied airline respirators  
**Typical jobs**—when using grinders prior to tuckpointing

### **Dust Masks Are Not Respirators!**

Dust masks should not be regarded as PPE, and if they are “required,” it is due to a lack of understanding of the nature of their function. They can sometimes provide comfort against hot/cold air and nuisance (non-toxic) dusts, fumes, or mists, so you can say they “protect” against discomfort. But they are not respirators and they ARE NOT to be used for protection against airborne toxic particulate matter (such as silica dust) or for gases or vapors. They are never to be used as protection from illness or injury.

#### **Particulate Respirators**

Particulate respirators are the simplest, least expensive, and least protective of the respirator types available. They look similar to dust masks but the difference is they protect against particles. They do not protect against chemicals, gases, or vapors, and are intended only for low hazard levels. Particulate respirators are “air-purifying respirators” because they clean particles out of the air as you breath. Even if you can’t see the particles, there may be too many in the air for this respirator to provide adequate protection.

All particulate respirators must be approved by NIOSH (National Institute of Occupational Safety and Health). Additionally, a respiratory protection program must be implemented, to ensure that respirators are used safely.

Sources: NIOSH, Hazard Review: *Health Effects of Occupational Exposure to Respirable Crystalline Silica*, Publication No. 2002-129, April 2002. Art Wickman, CIH, Georgia Tech’s Safety and Health Consultation Program, *Preventing Silicosis Among Masons*, [www.oshainfo.gatech.edu/silicosis.html](http://www.oshainfo.gatech.edu/silicosis.html). The Center to Protect Workers’ Rights (CPWR) *On Center*, April 2005, Vol. 5, No. 1.





## **10. Contact Your Center For Assistance With Health and Safety Problems**

We suffer more deaths at work than any other group. The jobs we take as day laborers are also more likely to cause injuries and illnesses that result in more lost work days. So we cannot take chances or make assumptions about the hazards we face every day.

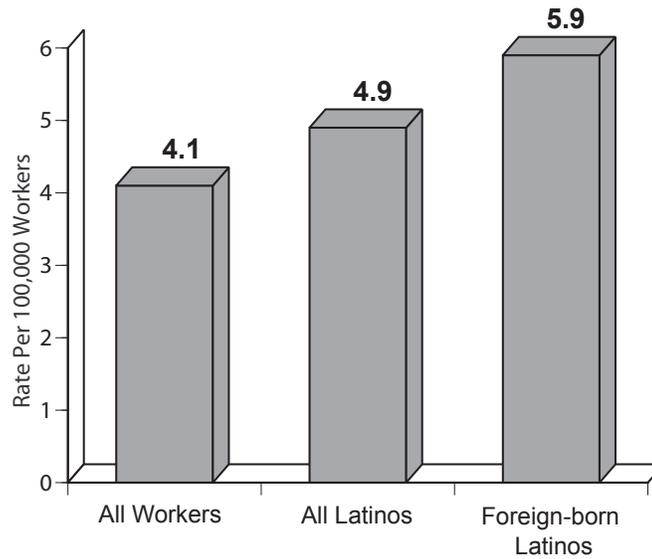
At the same time we must remind ourselves that a safe and healthy workplace is a basic human right that belongs to all of us— regardless of who we are, where we come from, or what kind of jobs we do! Working together we can protect our rights and ensure that our jobsites are safe and healthy places to work.

### **You Can File an OSHA Complaint With New Labor**

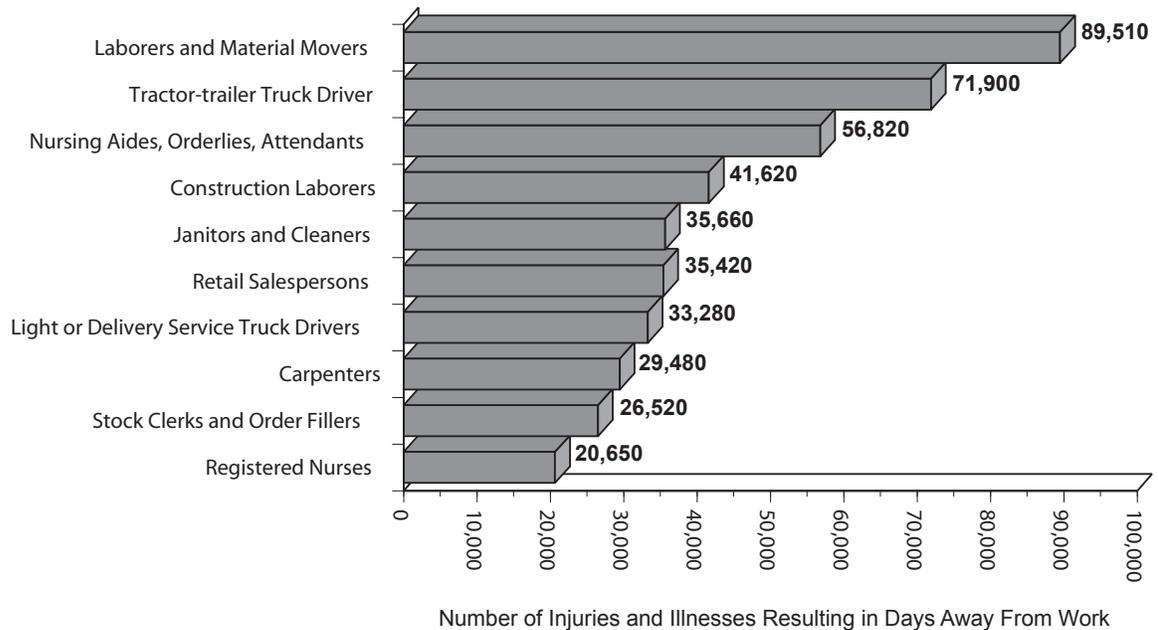
If you think the jobsite where you are working isn't safe, you can contact New Labor and working together we will help you decide how to solve the problem. This may include discussing the problem over the phone with your contractor/employer, visiting the jobsite to observe and talk with the contractor/employer or filing an OSHA complaint using the online complaint form.

**If you have health and safety questions or problems and need assistance, please call New Labor at 732-246-2900 and ask to speak with Lou Kimmel or Jose Villanueva.**

### Rate of Fatalities Per 100,000 Workers in 2004



### Jobs With Most Days Away from Work Due to Injuries and Illnesses, 2003



## 11. Filing An OSHA-7 Complaint

If you file an OSHA complaint you will have to complete an OSHA-7 Complaint Form and it must be faxed, mailed or emailed (*see Factsheet 13 for more information on filing a complaint via email*) to the local OSHA Regional Office.

You can obtain a complaint form by contacting the OSHA area office, going online and downloading the form ([www.osha.gov/oshforms/osh7.pdf](http://www.osha.gov/oshforms/osh7.pdf)) or you can contact New Labor and they will help you complete the form and act as your representative.

If the complaint doesn't meet any of the criteria listed on the next page it will in most cases result in an OSHA investigation (*See Factsheet 15 for more information on OSHA Investigations*). If an OSHA investigation doesn't solve the problem you can still request an OSHA on-site inspection (*See Factsheet 16 for more information on OSHA Inspections*).

If OSHA decides not to inspect, they must notify you in writing and give reasons. You may question this decision with the OSHA area director and regional administrator.

### **Completing the OSHA-7 Complaint Form**

The most important question on the form is titled "Hazard Description/ Location." Your answer should clearly state (describe) the seriousness of each hazard listed. Each hazard should be numbered and organized by type (e.g., chemicals, noise, air quality, etc.) and location (e.g., loading dock, office, photocopy room, etc.). For each hazard include copies of workplace surveys, monitoring data, accident and illness reports, grievances, minutes of safety meetings and anything else that will help explain the situation.

<b>Complaints That Always Result In An OSHA Inspection</b>
1. A written, signed complaint by a current employee or employee representative describing a hazard that is a violation of the law with "reasonable particularity."
2. A complaint (written, e-mailed or telephoned, signed or not) that alleges that physical harm has occurred as a result of the hazard and that it still exists.
3. A complaint (written, e-mailed or telephoned, signed or not) that describes an imminent danger situation.
4. A complaint about a company in an industry covered by one of OSHA's local or national emphasis programs or a hazard targeted by one of these programs.
5. Inadequate response from an employer who has received information on the hazard through a phone/fax investigation.
6. A complaint against an employer with a past history of egregious, willful or failure-to-abate OSHA citations within the past three years.
7. Referral from a whistle blower investigator.
8. Complaint at a facility scheduled for or already undergoing an OSHA inspection.

Sources: U.S. Department of Labor, Occupational Safety and Health Administration, *Federal OSHA Complaint Handling Process*. AFL-CIO Website, Safety and Health on the Job, *How to File an OSHA Complaint*. Protecting Workers Who Exercise Rights, *How To File A Complaint with OSHA*, A Project of the National Committee for Occupational Safety and Health Network, 2000.

## 12. OSHA-7 Complaint Checklist

<b>Checklist for Completing OSHA-7 Complaint Form</b>	
	How many employees work at the site and how many are exposed to the hazard? <b>Note:</b> The form doesn't include a line to indicate your designated employee representative (or their alternates for other shifts). <b>Make sure you provide this information with your complaint form.</b>
	How and when are workers exposed?
	What work is performed in the unsafe or unhealthful area?
	What type of equipment is used? Is it in good condition?
	What materials and/or chemicals are used? ( <b>Attach MSDSs</b> )
	Have employees been informed or trained regarding hazardous conditions?
	What process and/or operation is involved?
	What kinds of work are done nearby?
	How often and for how long do employees work at the task that leads to their exposure?
	How long (to your knowledge) has the condition existed?
	Have any attempts been made to correct the problem?
	How many shifts work in the area and what times do they start? On what shifts does the hazard exist?
	What personal protective equipment is required by the employer? Is the equipment used by the employees?
	Has anyone been injured or made ill as a result of this problem?
	Have there been any "near-miss" incidents?
<b>Questions To Consider for Filing Health Hazard Complaints</b>	
	Has the employer conducted any tests to determine if employees are exposed to the hazardous condition or substance?
	What are these tests and the results of the tests? ( <b>Include reports, test results etc.</b> )
	What steps has the employer taken, if any to control the hazard?
	Do any employees have any symptoms that they think are caused by the hazardous condition or substance?
	Have any employees been treated by a doctor for a work-related disease or condition? What was it?

Source: OSHA, *How To File A Complaint With OSHA*, [www.osha.gov/as/opa/worker/complain.html#what](http://www.osha.gov/as/opa/worker/complain.html#what).



# 14. The Online Complaint Form

Most on line complaints are handled by OSHA using the phone/fax investigation procedures. If you don't have union representation, and you are worried about confidentiality it may make sense to file your complaint electronically.

You can file an online complaint at [www.osha.gov/pls/osha7/eComplaintForm.html](http://www.osha.gov/pls/osha7/eComplaintForm.html). If you need help New Labor can help you complete the online form and act as your representative.

**OSHA** Occupational Safety & Health Administration  
U.S. Department of Labor

Home  
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IQIP | How to File a Complaint

## OSHA 7 online complaint form

Notice of Alleged Safety or Health Hazard  
OMB Approval #: 1218-0064 Expiration Date 9-30-2001

Please fill out sections 1 through 18, but **READ THIS** first.  
Items in red must be completed in order to accept your submission.

**1. Establishment Name:** \_\_\_\_\_  
**NOTE:** In order for OSHA to fully process your complaint, complete and accurate information about the worksite is necessary.

**2. Site Street:** \_\_\_\_\_

**3. Site City:** \_\_\_\_\_

**4. Site State:**

**5. Site ZIP Code:** \_\_\_\_\_

**6. County:** \_\_\_\_\_

**7. Mailing Address (if different):** \_\_\_\_\_

**8. Management Official:** \_\_\_\_\_

**9. Telephone Number:** \_\_\_\_\_

**10. Type of Business:** \_\_\_\_\_

**11. Hazard Description.** Describe briefly the hazards(s) which you believe exist. Include the approximate number of employees exposed to or threatened by each hazard:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**12. Hazard Location.** Specify the particular building or worksite where the alleged violation exists:  
\_\_\_\_\_  
\_\_\_\_\_

**13. This condition has been brought to the attention of:** (Choose all that apply)  
 Employer  
 Other Government Agency (specify) \_\_\_\_\_

**14. I am a(n):**  
 Employee  
 Federal Safety and Health Committee Representative of Employees  
 Other: \_\_\_\_\_

**OPTIONAL**

The OSH Act gives complainants the right to request that their names not be revealed to their employer. Providing your name and address, will only allow OSHA staff to communicate with you regarding your complaint.

**15. Please indicate your desire:**  
Do **NOT** reveal my name to my Employer  
My name may be revealed to my Employer

**16. Complainant Name:** \_\_\_\_\_

**17. Complainant Telephone Number:** \_\_\_\_\_

**18. Complainant Mailing Address:**  
Street: \_\_\_\_\_  
City: \_\_\_\_\_  
State \_\_\_\_\_  
ZIP Code: \_\_\_\_\_

**19. Complainant E-Mail Address:** \_\_\_\_\_

**20. If you are an authorized representative of employees affected by this complaint, please state the name of the organization that you represent and your title:**  
\_\_\_\_\_  
\_\_\_\_\_

**Organization Name:** \_\_\_\_\_  
**Your Title:** \_\_\_\_\_

**SEND**

**Punishment for unlawful statements**  
Potential complainants also should keep in mind that it is unlawful to make any false statement, representation, or certification in any complaint. Violations can be punished under Section 17(f) of the OSH Act by a fine of not more than \$10,000, or by imprisonment of not more than 6 months, or by both.

Public reporting burden for this collection of information is estimated to vary from 15 to 25 minutes per response with an average of 17 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of IRM Policy, Department of Labor, Room N-3101, 200 Constitution Avenue, NW, Washington, DC, 20030, and to the Office of Management and Budget, Paperwork Reduction Project (1218-0064), Wash., D.C. 20503.

DO NOT SEND THE COMPLETED FORM TO EITHER OF THESE OFFICES

USDOL | CONTACT INFORMATION | DISCLAIMER

Source: OSHA, *How to File a Complaint with OSHA*, [www.osha.gov/as/opa/worker/complain.html#happens](http://www.osha.gov/as/opa/worker/complain.html#happens).

## 15. OSHA Investigations

In most cases after OSHA receives a complaint they will conduct a *phone/fax investigation*. The agency will phone the employer, describe the hazard(s) and then follow up with a fax letter. The employer has five days to respond, either by denying the hazard exists, or by stating that the hazard has been eliminated or is in the process of being eliminated.

If OSHA determines that the employer's response is acceptable, there will be no inspection and the person(s) who filed the complaint will receive a copy of the employer's response. **If the person(s) who signed the complaint isn't satisfied, they can still request an on-site inspection.**

An OSHA phone/fax investigation could work to your advantage if the hazard doesn't involve "imminent danger" and isn't covered by an OSHA standard. A call and follow up letter from the agency might shake the employer up enough and get them moving in the right direction.

### **Your Immigration Status Is Not an Issue**

All workers are entitled to a safe and healthy workplace regardless of their immigration status. It is the employer's responsibility to provide a safe and healthy workplace as cited in OSHA's General Duty Clause. If the employer doesn't provide a safe and healthy workplace, and it leads to an OSHA investigation, OSHA inspectors will inspect the workplace. But OSHA inspectors are ONLY concerned with workplace health and safety, not a worker's immigration status.

*(continued)*

## 15. OSHA Investigations *(continued)*

Below is a sample copy of the letter that OSHA will fax or mail to the contractor/employer as part of the investigation.

Re: Complaint No.

Dear: *(Contractor/Employer)*

On *(date)* the Occupational Safety and Health Administration (OSHA) received notice of safety and health hazards at your worksite. We notified you, by telephone of these alleged hazards on *(date)*. The specific nature of the alleged hazards is as follows:

*(List of hazards)*

We have not determined whether the hazards, as alleged, exist at your workplace; and we do not intend to conduct an inspection at this time. However, since allegations of violations have been made, we request that you immediately investigate the alleged conditions and make any necessary corrections or modifications. Please advise me in writing, no later than *(date)* of the results of your investigation. You must provide supporting documentation of your findings, including any applicable measurements of monitoring results, and photographs which you believe would be helpful, as well as a description of any corrective action you have taken or are in the process of taking.

This letter is not a citation or a notification of proposed penalty which, according to the OSHA Act may be issued only after an inspection of the workplace. It is our goal to assure that hazards are promptly identified and eliminated. Please take immediate corrective action where needed. We encourage employee participation in investigating and responding to any alleged hazard. If we do not receive a response from you by *(date)* indicating that appropriate action has been taken or that no hazard exists and why, an OSHA inspection will likely be conducted....

You are requested to post a copy of this letter where it will be readily accessible for review by all of your employees and return a copy of the signed Certificate of Posting (Attached) to this office. In addition, you are requested to provide a copy of this letter and your response to a representative of any recognized union or safety committee if these are at you facility. Failure to do so may result in an on-site inspection.

The complainant has been furnished a copy of this letter and will be provided a copy of your response. Section 11(c) of the OSH Act provides protection for employees against discrimination because of their involvement in protected safety and health activity.

If you have any question concerning this matter, please contact *(Compliance Officer)* at the address in the letterhead. Your personal support and interest in safety and health of your employees is appreciated.

## 16. OSHA Inspections

For serious violations, or situations where the employer has failed to act on an OSHA investigation, the inspection should occur within 30 days.

There are three parts to an OSHA on-site inspection including an Opening Conference, Walkaround and Closing Conference. The whole process can take a few hours or a few weeks. It all depends on the number of hazards, the size of the workplace, the skill and ability of the compliance officer, the previous health and safety track record of the employer, etc.

### **The Opening Conference**

Upon arrival to the worksite the compliance officer will meet with management and employee representatives and briefly explain the purpose of the inspection. The inspection should cover the hazards identified in your complaint. If your representative or your employer object to a joint opening conference, the compliance officer will conduct separate opening conferences.

During the opening conference the compliance officer will determine whether employees of other employers are working at the site. If the inspection affects them, the inspection may include other employee representatives.

At the conclusion of the opening conference the compliance officer will review the employer OSHA 300 Logs. After checking the employer's safety records the compliance officer will begin the inspection accompanied by management and employee representatives.

*(continued)*

## 16. OSHA Inspections *(continued)*

### The Walkaround

After the compliance officer has completed the opening conference and reviewed the employer’s safety records, he/she may decide to check for other hazards or expand the inspection to cover the entire workplace. The check list below includes things you’ll want to keep in mind during the inspection.

<b>Walkaround Checklist</b>	
	Make sure the compliance officer talks to affected employees.
	Inform co-workers that the inspection is in progress and that they have a right to talk privately and confidentially to the compliance officer.
	Encourage co-workers to point out hazards and to describe past accidents, illnesses and worker complaints.
	Make sure that conditions are typical during the inspection. (If management shuts down equipment, opens windows, or changes conditions do not hesitate to tell the compliance officer.)
	If the hazards explained in the complaint are not observed by the compliance officer, explain how employees were or could be exposed.
	If the compliance officer brings equipment to measure noise, dust, fumes, or other hazards, watch the test. And if you don't understand what the compliance officer is doing ask.
	Request summaries of the sampling results. (OSHA must provide them)
	<b>Take notes.</b>

### A Note on Advanced Notice

OSHA rarely gives employers advance notice of an inspection. However, there are four conditions that may result in the agency giving the employer and worker representative prior notice of an inspection:

- In cases of imminent danger OSHA will try to get management to fix the problem immediately.
- When the inspection must be conducted after regular hours or when special preparation is necessary.
- If management and worker representatives are not likely to be on site.
- If other circumstances indicate that a more complete inspection will result (such as a fatality investigation).

## **The Closing Conference**

At the conclusion of the walkaround the compliance officer is required to conduct a closing conference, jointly or separate with the employer and employee representatives. If the employer wants a separate conference the compliance officer will hold the employee conference first to allow for more employee input.

During the closing conference the compliance officer will review “apparent violations” and ways to correct hazards, deadlines, and possible fines.

The compliance officer will advise the employee representative of the following:

- The employer must not discriminate against employees for health and safety activity.
- If the employer contests an OSHA citation, the employees have a right to elect “party status” before the Occupational Safety and Health Review Commission (an independent agency).
- The employee representative must be notified by the employer if the employer files a notice of contest or a petition for modification of an abatement date.
- The employee representative has a right to contest the time OSHA allows the employer for correcting a hazard. (Employees, unlike employers, cannot contest other aspects of the citation before the Review Commission). A contest must be in writing and must be filed within 15 working days after receipt of the citation.

Source: Protecting Workers Who Exercise Rights (PWWER), Fact Sheet, *The OSHA Inspection*, 2000.

## Summary

1. OSHA's job is to develop mandatory job safety and health standards and enforce them through workplace inspections, employer assistance, and by imposing citations and financial penalties.
2. OSHA covers all private sector contractors/employers and employees.
3. All contractors/employers covered under the OSH Act must meet their general duty responsibility to provide a workplace free from recognized hazards. This is known as the *OSHA General Duty Clause*.
4. Under the OSH Act employers can seek free advice and off-site consultation; request and receive proper identification from OSHA compliance officers and be advised by the compliance officer of the reason for an inspection; have an opening and closing conference with the compliance officer; accompany the compliance officer on the inspection; and file a Notice of Contest to dispute inspection results and request an informal settlement agreement process after an inspection.
5. Workers must follow all applicable standards, rules, regulations and orders issued under the OSH Act. However, **OSHA cannot cite workers for violations.**
6. Under the OSH Act workers can request that the OSHA Area Director investigate hazardous conditions or violations of standards in the workplace; have names of employees filing complaints withheld from employers; be advised of OSHA actions regarding complaints; have authorized employee representatives accompany the OSHA compliance officer; observe any monitoring or measuring of hazardous materials and see any related monitoring or medical records; review the OSHA 300-Logs at a reasonable time and in a reasonable manner; and request a closing discussion following an inspection.

7. Because its staff and resources are limited, OSHA spends nearly all of its time on the most hazardous workplaces. If your complaint falls into the category of “imminent danger” OSHA will respond quickly. However, for most of us, it is likely that our complaints will generally be classified by OSHA as something “other than serious.”
8. Don’t exercise OSHA’s “right to refuse “ unsafe work unless you have no alternatives and you know and fear that doing the work could result in death or serious injury. How and when you use OSHA will ultimately depend on circumstances that are specific to your workplace.
9. Day laborers face a serious workplace hazard when they are exposed to *crystalline silica dust*.
10. If you think the jobsite where you are working isn’t safe, you can contact New Labor and working together we will help you decide how to solve the problem. This may include discussing the problem over the phone with your contractor/employer, visiting the jobsite to observe and talk with the contractor/employer or filing an OSHA complaint using the online complaint form.
11. For OSHA to inspect your workplace you must file an OSHA-7 Complaint Form and fax or mail it to your local OSHA Regional Office. The most important question on the form is titled “*Hazard Description/Location.*” Your answer should clearly describe each hazard listed and be numbered and organized by type and location. Most on line complaints are handled by OSHA using the phone/fax investigation procedures. If you don’t have union representation, and you are worried about confidentiality it may make sense to file your complaint electronically.

(continued)

## **Summary** *(continued)*

12. An OSHA phone/fax investigation could work to your advantage if the hazard doesn't involve "imminent danger" and isn't covered by an OSHA standard. A call and follow up letter from the agency might shake the employer up enough and get them moving in the right direction.
  
13. For serious violations, or situations where the employer has failed to act on an OSHA investigation, the inspection should occur within 30 days. There are three parts to an OSHA on-site inspection including an Opening Conference, Walkaround and Closing Conference. The whole process could take a few hours or a few weeks.

# Evaluation

## Activity 4: OSHA Rights and Responsibilities

1. How important is this activity for day laborers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an “X”** by the **one factsheet** you feel is the most important.

1. What Is OSHA and Who Is Covered	9. Exposure to Silica Dust
2. Contractor/Employer Responsibilities Under OSHA	10. Contact New Labor For Assistance With Health and Safety Problems
3. Contractor/Employer Rights Under OSHA	11. Filing an OSHA-7 Complaint
4. Worker Responsibilities Under OSHA	12. OSHA-7 Complaint Checklist
5. Worker Rights Under OSHA	13. OSHA-7 Complaint Form
6. Workers Have Limited Rights to Refuse Unsafe Work	14. The On Line Complaint Form
7. How OSHA Prioritizes Complaints	15. OSHA Investigations
8. Using OSHA Strategically	16. OSHA Inspections

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.		

4. What would you suggest be done to improve this Activity?

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# **Activity 5: Introduction to Ergonomics**

## **Purpose**

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To learn about the symptoms and work situations that are linked to a group of illnesses and injuries known as musculoskeletal disorders (MSDs) and what we can do to reduce the risks of getting injured.

This activity has two tasks.

## **Task 1**

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Juan is suffering from an aching back that seems to be getting worse instead of better. In the past few months he has missed several days of work because of the pain. A co-worker has suggested that Juan's back pain is the result of a Musculoskeletal Disorder (MSD) and that Juan should see a doctor as soon as possible. Juan agrees that he needs to see a doctor but he wants to know more about MSDs.

**In your groups review the factsheets on pages 128-133. Then based on your own experience and the factsheets, answer Juan's questions.**

**1. What are MSDs?**

**2. What are the causes of MSDs?**

**3. Should day laborers be concerned about MSDs? (Please explain)**

# 1. What Is Ergonomics?

Ergonomics is the science of work and the study of how people and jobs fit together. As day laborers we are required to “fit the job.” We are asked to lift heavy loads, use awkward postures, and do repetitive tasks. These demands and other factors can lead to sprained muscles, inflamed tendons and damaged nerves.

Using ergonomic principles, jobs, equipment, work organization and environments can be designed to fit workers.

Ergonomics includes:

- Designing equipment that is easy to use
- Inventing new equipment that will take the strain out of the job
- Organizing work in different ways
- Changing how tasks are done

## 2. What are CTDs, RSIs, and MSDs?

### **What are Cumulative Trauma Disorders?**

A cumulative trauma disorder (CTD) is an injury to the muscles, joints, tendons, nerves or other tissues caused by repetitive motions, forceful exertions, vibrations, or awkward body positioning over an extended period of time.

### **What are Repetitive Strain Injuries (RSIs)?**

Repetitive strain injuries (RSIs) is a general term (like CTD) used to describe a range of symptoms associated with repetitive motion work.

### **What are Musculoskeletal Disorders (MSDs)?**

Musculoskeletal disorders (MSDs) is also a general term that includes conditions such as lower back pain, sciatica, rotator cuff injuries, and carpal tunnel syndrome. These conditions may be associated with or caused by forceful exertions.

CTDs, RSIs, and MSDs are often used to mean the same thing.

### 3. The Three Stages of MSDs Symptoms

MSD symptoms can range from mild aches to disabling pain. Symptoms often appear gradually and become more severe over time. Generally symptoms progress through three stages.

#### Stage 1

Symptoms may appear during periods of activity and may disappear during periods of rest. Symptoms are relatively mild. Early symptoms of MSDs often are mistaken for muscle fatigue.

#### Stage 2

Symptoms are most persistent. They do not disappear completely during periods of rest. Increasingly severe symptoms may interfere with performance of usual work activities.

#### Stage 3

Symptoms are constant. Sleep is often disturbed. Severe pain, limited mobility, loss of sensation or muscle weakness make it impossible to perform most job tasks.

<b>Symptoms of MSDs</b>	
Soreness	✓
A burning sensation	✓
Numbness	✓
Weakness	✓
Tenderness	✓
Swelling	✓
Tingling	✓
Aching	✓
Stiffness	✓

## 4. MSD Risk Factors

Many jobs that day laborers do are associated with *risk factors* such as frequent pushing, pulling, and lifting, doing the same task over and over again or standing on uneven terrain for long periods of time. Risk factors increase the likelihood of getting MSDs.

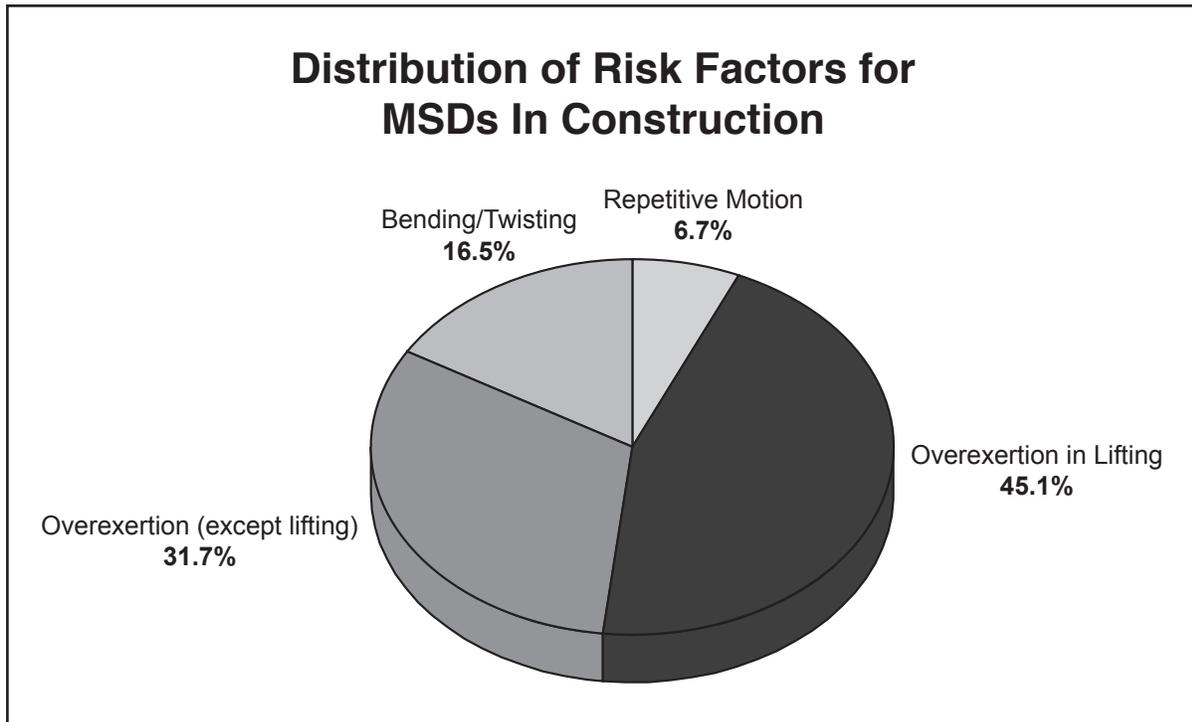
### MSD Risk Factors

<b>Job/Working Conditions</b>	<b>MSD Risk Factor</b>
Moving sheetrock, shingles, cinder-blocks, concrete bags, etc	Heavy lifting, overexertion
Excavations (digging, shoveling, tamping, hauling dirt, etc.)	Frequent bending, twisting, stretching and lifting
Hauling debris in a cart or wheel barrel	Pushing, pulling, carrying and lifting
Removing old shingles from a roof	Awkward standing
Lifting Beams	Sudden load bearing (heavy lifting)
Loading and Unloading	Repetitive work (lifting, bending, twisting, etc.)
Using power tools	Vibration
Long hours of work	Fatigue
Working outside during the winter	Temperature (extreme heat or cold)

*(continued)*

## 4. MSD Risk Factors *(continued)*

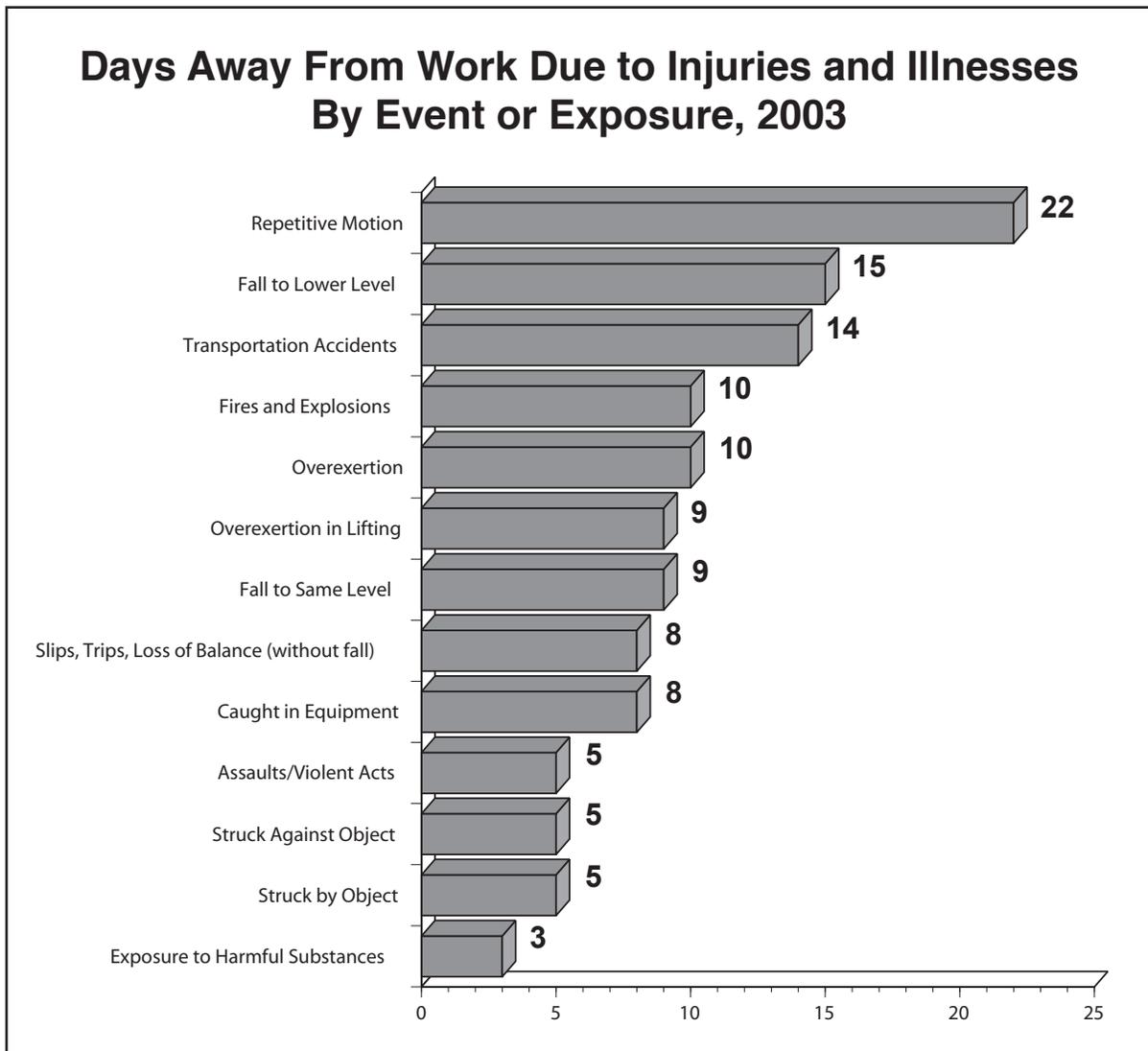
Overexertion in lifting is the cause of 45% of all musculoskeletal disorders in construction.



Sources: Center to Protect Workers' Rights, *The Construction Chart Book, Musculoskeletal Disorders in Construction and Other Industries*, 1999. *Work Risk Analysis*, Hackley Health, 1997.

## 5. MSDs Result in Injuries and Days Away From Work

MSDs that result from repetitive motion or overexertion from lifting can result in injuries and extended periods of time away from work.



Source: Bureau of Labor Statistics, *Survey of Occupational Injuries and Illnesses*, 2003.

## **Task 2**

---

Juan understands why day laborers should be concerned about MSDs. But since lifting, bending, twisting, pushing, and pulling are what day laborers often do in order to get paid, he doesn't think that there's much he can do to reduce the risks, especially when it comes to his aching back.

**In your groups, review the factsheets on pages 136-143 and then working together, make a list of things day laborers can do to reduce the risks of hurting their backs on the job.**

---

**What can day laborers do to reduce the risks of back injuries on the job?**

**1.**

**2.**

**3.**

**4.**

**5.**

**6.**

## 6. Factors Affecting Lifting

The National Institute for Occupational Safety and Health (NIOSH) lists many variables that interact with each other to determine what is a “safe weight” to lift. Some key variables are presented below.

<b>Factors That Determine If a Lift Is Safe</b>	
<b>Distance From Body</b>	The further the load is from your body, the more stress you put on your body.
<b>Height From Floor</b>	The lower the load is to the floor, the more you have to bend, placing more stress on your lower back.
<b>Height of Lift</b>	The higher up you have to lift a load, the greater the stress on your body. People have less lifting strength above their shoulders and below their knuckles at thigh height.
<b>Weight of Load</b>	The greater the weight of the load, the greater your chance for lower back injury.
<b>Angle of Twist</b>	The more the back is twisted, the higher the risk of lower back injury.
<b>Quality of Grip</b>	A grip is considered comfortable when the hand can wrap around the object without excessive wrist deviation or when handles or hand hold cutouts are present.
<b>Frequency of Lifts</b>	If you perform lifts over and over during a work shift, your chance for injury increases because your body does not have enough time to recover.

The chance for injury from all factors listed here increases the more frequently you have to perform lifts.

Source: National Institute for Occupational Safety and Health, Lifting Equation.

## 7. A Guide For Manual Lifting

NIOSH says an acceptable lift is one that does not weigh more than about 51 pounds and is lifted from a position not farther than about 6 to 10 inches from your body. Any weight that is heavier and lifted further from your body increases the risk of injury.

Using the Manual Handling chart below you can estimate the risk involved in lifting objects (from the floor to a waist high table) that weigh 51 pounds or less.

### Manual Lifting Risk Zones

Load Distance From Body	0-4 inches	4-6 inches	10 or more inches
Danger Zone	Greater than 51 pounds	Greater than 35 pounds	Greater than 28 pounds
Caution Zone	17-51 pounds	12-35 pounds	10-28 pounds
Safe Zone	Less than 17 pounds	Less than 12 pounds	Less than 10 pounds

Sources: National Institute for Occupational Safety and Health, *Work Practices Guide for Manual Lifting* and *Manual Handling Worksheet*, OSHA, 1995.

## **8. Lifting Techniques**

Using the lifting techniques listed below will reduce the risk of back injuries.

### Lifting Recommendations:

- Get a good grip on the load and test the weight before trying to move it. If it is too bulky or heavy, use a mechanical lifting aid, a co-worker, or both for help.
- Get the load close to the body, place your feet close to the load, stand in a stable position with your feet pointing in the direction of the movement, and lift mostly by straightening your legs.
- Do not twist or bend sideways.
- Do not lift or lower awkwardly.
- Do not hesitate to get mechanical help or help from another person.
- Do not lift or lower with your arms extended.
- Do not continue heaving when the load is too heavy.

Source: National Institute for Occupational Safety and Health, *Work Practices Guide for Manual Lifting*.

## 9. Stay Away From Back Belts

In 1994, the National Institute for Occupational Safety and Health (NIOSH) issued a report on the use of back belts to prevent work-related back injuries. NIOSH concluded that **the effectiveness of back belts in reducing the risk for back disorder, injuries, or pain “remains unproven.”**

NIOSH formed its conclusions after extensively evaluating back belt studies documented in scientific literature. Back belts include:

- abdominal supports or aids,
- spinal braces,
- corsets,
- weight-lifting belts, and
- other devices that are “designed” to support and protect stomach and back muscles.

While manufacturers contend that back belts prevent back injuries caused by lifting, pushing, pulling, twisting, or bending repetitively, NIOSH did not find any scientific evidence to support this claim. In fact, NIOSH is concerned that back belts may give workers a false sense of security regarding how much they can safely lift.

Workers who wear back belts may be at further risk of injury if they attempt to lift bigger weight loads than they would without the back belt. Furthermore, NIOSH does not consider back belts to be equipment that effectively protects workers from on-the-job hazards.

**The most effective method to eliminate the hazards associated with lifting is to “redesign the work environment and the work tasks.**

Sources: *The American Postal Worker*, American Postal Workers Union, October 1994 and NIOSH Report: *“Workplace Use of Back Belts: Review and Recommendations, 1994.”*

## 10. Tips for Avoiding Back Injuries

### Balance Your Tool Belt

The average tool belt weighs 15 to 20 lbs. If the weight of your tools is unbalanced on your tool belt, your spine is loaded in an awkward manner even before you start to bend, reach, or lift.

- **Balance your tool belt**—if your tools are heavier on one side, fill the other side with materials, such as nails, bolts, or other tools, that will balance the load
- **Use broad-shouldered suspenders**—they will allow the muscles in your upper back and shoulders to bear some of the tool belt load
- **Minimize what you carry in your tool belt**—evaluate what you carry. Store infrequently used items elsewhere, or use them to balance your tool belt
- **Relieve your back of the load**—during breaks, remove your tool belt

### Sit-Down and Do Your Work

When working at lower levels, workers tend to either stoop from the waist or squat. Stooping stretches back ligaments and can place the spine in an unstable position. Squatting is an unbalanced position that can leave you unprepared for a sudden load change such as pulling an object that suddenly moves. Sitting down to perform tasks at low levels can help reduce the physical demands you place on your body.

Sitting will:

- Reduce the strain on your back
- Reduce fatigue
- Allow your feet to be flat on the floor (instead of up on the balls of your feet)
- Provide a solid three-point base of support between your feet and buttocks

When you sit, find a stool that is stable and can support your weight. Position the stool so that you won't have to reach far to complete your task. And don't lift heavy items from a sitting position because the strength of your legs will not contribute to the lift.

### **Reduce the Number of Times You Bend, Twist, and Lift**

Forward bending is an awkward posture that puts a lot of stress on your back. Bending stretches the ligaments and muscles and can pull the joints of the back into unstable positions.

Twisting jams the joints of the back together, while forcing others apart. Tight ligaments and muscles can be pulled excessively. The outer casing of discs can be damaged by constant twisting forces.

Lifting while bending forward or twisting or carrying a heavy load can damage your back. Lifting also becomes a risk if the back is not positioned or moved properly with the load.

There are three ways of reducing the stress on the back at work.

#### **1. Look at your job, equipment, and procedures:**

- Reduce the weights you lift
- Reduce the distance you carry a load
- Reduce the amount you twist
- Reduce the frequency of lifting
- Lift in a safe range

#### **2. Use your body correctly to do the job:**

- Keep the load close to the body
- Keep your feet apart for a stable stance
- Position your feet prior to lifting to reduce twisting
- Don't lift beyond your safe limit
- Get help!

#### **3. Take care of your back by stretching and exercising:**

- Include a brief warm-up as part of your routine
- If you work bent over, stand up and do a "back bend" at least every hour
- If you stand for long periods, or work overhead, squat or bend the spine from time to time

## 10. Tips for Avoiding Back Pain and Injury

*(continued)*

### **Planning, Housekeeping and Job Redesign**

In addition to the hazards that can be caused by lifting, twisting, bending, pushing and pulling, there are other site specific hazards that can contribute to back injuries. For example:

- **Obstacles can cause slips or trips.** Serious back injuries can result when your body tries to recover from a slip or trip while maintaining the load you're carrying. Cluttered, unkempt worksites increase the risk of slips and trips.
- **Cluttered areas make the use of carts and dollies impractical.** Also, stronger push force is needed to move carts over surfaces covered with debris.
- **Materials stored on the floor.** Additional work is created for your muscles each time you bend or crouch to floor level to reach and lift materials. Materials stored flat, as opposed to on end, require further bending to lift.
- **Materials stored in poor locations.** If your body is placed in awkward positions because the location of materials forces you to reach around, above, or below obstacles, you increase the chances of getting hurt. Also, ordering and delivery of too much material at a given time can create unnecessary stacks of stored material. Storing materials also means double handling, once to bring materials to storage and a second time to carry them to the work location.
- **Work done at floor level.** Additional stress on your back and legs is caused by doing prefabrication work at floor level.

These hazards can be avoided through proper job planning, good housekeeping and some job redesign.

In order to reduce the hazards do the following:

**1. Do Your Own Housekeeping:**

- Keep floors and passageways free of obstacles. Remove slip and trip hazards; this allows the use of carts and dollies to move heavy materials.
- Promote the use of carts and dollies. Contractors should make this type of equipment available and accessible.
- Perform a site inspection daily and post a list of housekeeping related problems. This makes everyone responsible for maintaining a clean and safe work area.

**2. Planning:**

- Suggest to the contractor that he plan for materials to be delivered when they are needed and this will reduce the amount of excess stored materials. This will eliminate the need to work around stored materials.
- Suggest to the contractor that materials should be delivered as close to the job as possible. This reduces the distances that materials are carried and the number of times they are handled.

**3. Do Your Own Job Redesign:**

- Raise the work off the floor—set up platforms so that prefabrication work is raised off the floor to a level that is safe and comfortable.

Source: Workers Compensation Board of British Columbia, *Innovative Ideas to Reduce Soft Tissue Injuries in the Construction Industry*.

## Summary

1. Ergonomics is the science of work and the study of how people and jobs fit together. As day laborers we are required to “fit the job.” We are asked to lift heavy loads, use awkward postures, and do repetitive tasks. These demands and other factors can lead to sprained muscles, inflamed tendons and damaged nerves. Using ergonomic principles, jobs, equipment, work organization and environments can be designed to fit workers.
2. Repetitive strain injuries (RSIs), musculoskeletal disorders (MSDs), and cumulative trauma disorders (CTDs) are general terms referring to injuries of the muscles, joints, tendons, nerves or other tissues caused by repetitive motions, forceful exertions, vibrations, or awkward body positioning.
3. RSI symptoms can range from mild aches to disabling pain. Symptoms generally progress through three stages, becoming more and more severe. Early reporting of symptoms is critical for proper medical treatment.
4. Overexertion in lifting is the cause of 45% of all musculoskeletal disorders in construction.
5. MSDs that result from repetitive motion or overexertion from lifting can result in injuries and extended periods of time away from work.
6. The National Institute for Occupational Safety and Health (NIOSH) says an acceptable lift is one that does not weigh more than about 51 pounds and is lifted from a position not farther than about 6 to 10 inches from your body. Any weight that is heavier and lifted further from your body increases the risk of injury.

7. Using proper lifting techniques can reduce the risks of back injuries.
8. Job planning, good housekeeping and keeping yourself physically fit can also help to reduce the risks of back injuries but **the most effective method to eliminate the hazards associated with lifting is to redesign the work environment and the work tasks.**
9. In 1994, the National Institute for Occupational Safety and Health (NIOSH) issued a report on the use of back belts to prevent work-related back injuries. NIOSH concluded that **the effectiveness of back belts in reducing the risk for back disorder, injuries, or pain “remains unproven.”**



**Evaluation**

## Activity 5: Introduction to Ergonomics

1. How important is this activity for you and your co-workers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an “X” by the one factsheet** you feel is the most important.

1. What Is Ergonomics?	6. Factors Affecting Lifting
2. What Are CTDs, RSIs, and MSDs?	7. A Guide for Manual Lifting
3. The Three Stages of RSI Symptoms	8. Lifting Techniques
4. MSD Risk Factors	9. Stay Away From Back Belts
5. MSDs Result in Injuries and Days Away From Work	10. Tips for Avoiding Back Injuries

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

4. What would you suggest be done to improve this Activity?

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# Activity 6: Electrical Safety

## **Purpose**

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To learn more about the OSHA regulations that must be followed for electricity and how we can reduce the risk of electrical shock.

This Activity has two tasks.

## **Task 1**

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In your groups review the factsheets on pages 152-158. Then, using the factsheets and your own experience decide how you would respond to a worker that has made the following statements.

### **Statements:**

“Since I’m not an electrician, electrical safety isn’t that much of a concern to me.

It’s not like somebody dies every day from an electrical shock.

In fact, I’ve gotten zapped a few times myself and it’s not that big a deal. You get just a little tingling feeling in your hand and that’s about it.

A friend of mine said he saw a man get shocked because his clothes were wet. I find that very hard to believe.

He also said the shock was so severe that the man’s heart stopped beating and paramedics had to use a defibrillator to save him. I think my friend was just kidding me.”

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**Please respond to each statement:**

1.

2.

3.

4.

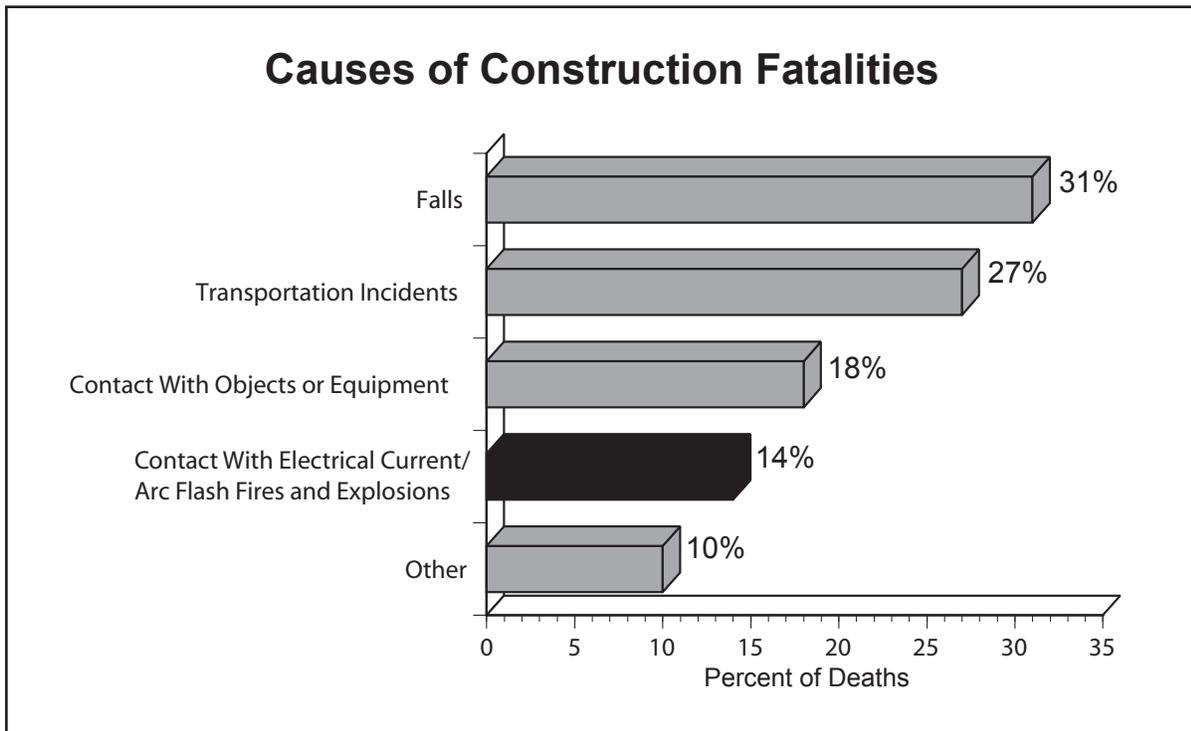
5.

# 1. Electricity and Construction Fatalities

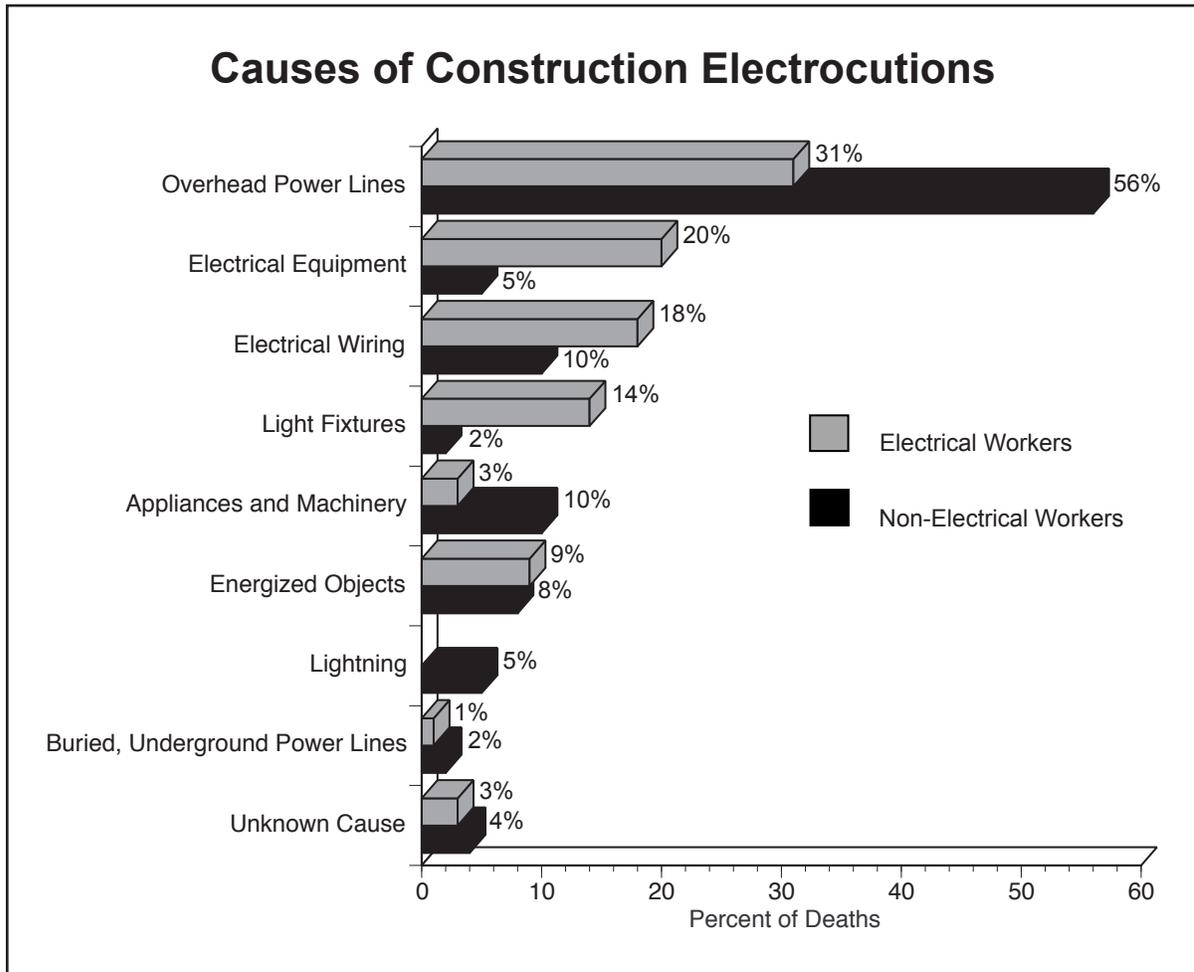
Because electricity is a familiar part of our lives, it often is not treated with enough caution. As a result, an average of one worker is electrocuted on the job every day of every year!

Electrocution is the third leading cause of work related deaths among 16- and 17-year-olds, after motor vehicle deaths and workplace homicide. Electrocution is the cause of 12% of all workplace deaths among young workers.

In the construction industry, electrocution is the fourth leading cause of worker fatalities.



The vast majority of construction workers who die from electrocutions are not electricians.



Source: Michael McCann, PHD, CIH, The Center to Protect Workers Rights, *Why Construction Workers are Getting Electrocuted*, [www.cpwr.org](http://www.cpwr.org)

## 2. Why Is Electricity Dangerous?

Electrical shocks can cause muscular spasms that can cause a person to fall or be thrown resulting in fractures and other injuries. Electricity passing through the body can also cause irregular beats or quivering of the heart (fibrillation) leading to respiratory failure and cardiac arrest (heart attack).

### Other Hazards From Electricity

Electricity creates other dangers. High arcs from short circuits can shatter equipment and send metal fragments flying. Low-energy arcs can cause fires and explosions in atmospheres containing flammable gases, vapors, or dust. Arcs can also generate intense ultraviolet radiation, causing eye injuries.

### Electrical Burns

The most common shock-related injuries are severe burns at points of entry and exit. Tissue damage can run all the way through muscle and bone to the point of exit.

Electricity causes three basic types of burns:

- **Electrical burns** - Current flowing through the body generates heat and burns skin, muscle and bone tissue.
- **Arc or flash burns** - An electric arc or explosion can produce temperatures up to 3,000°C and cause burns to anyone standing nearby.
- **Thermal contact burns** - Accidental contact with the hot surfaces of electrical equipment and conductors can cause burns. Clothing may even be ignited.

### 3. How Do You Get Shocked?

You get shocked when electrical current passes through your body. Current will pass through the body in a variety of situations. For example:

- In most household wiring, the black and red wires are 110 volts. The white wires are at 0 volts because they are connected to ground. The connection to ground is often through a conducting ground rod driven into the earth. The connection can also be made through a buried metal water pipe. **If you come in contact with an energized black wire—and you are also in contact with the neutral white wire—current will pass through your body. You will receive an electrical shock.**
- If you are in contact with a live wire or any live component of an energized electrical device—and also in contact with any grounded object—you will receive a shock.
- If you are standing in a puddle of water and working on or near an electric control you could receive a shock. But you don't even have to be standing in water to be at risk. **Wet clothing, high humidity, and perspiration also increase your chances of being electrocuted.**
- You can even receive a shock when you are not in contact with an electrical ground. Contact with both live wires of a 220-volt cable will deliver a shock.
- You can also receive a shock from electrical components that are not grounded properly. Even contact with another person who is receiving an electrical shock may cause you to be shocked.

## **4. Electricity Basics: Volts and Amps**

The electricity that is supplied to homes is limited to 110 volts. Volts don't flow by themselves—they are drawn from a high point (the line outside the house) to a low point (an appliance such as a toaster) once a switch is closed (turning a switch on) and a circuit is completed. Voltage is mostly a measurement of 'potential' energy available, not necessarily how much is actually used.

### **Amperage (Amps)**

This is where amperage comes in. The toaster, or any other electrical product, needs a certain amount of electrical energy to perform its job. It draws that amount of electricity from the volts in the line. A small electrical appliance like a toaster usually needs less power than a larger appliance such as a refrigerator or power saw. In electrical terms, these appliances work at different amperage rates. A large electric motor may draw 100 amps, while a small heating element may draw only 10 amps. Both tap into the same 110 voltage line, but their amperage needs are different.

### **Controlling Amperage**

Amperage must be controlled in order to protect the electrical lines from overheating or short-circuiting. This is why electricians use fuses and breakers. A 30 amp fuse, for example, will allow smaller appliances to run on the line it protects, but if an electric clothes dryer pulls 60 amps, a metal filament in the fuse will melt and break the circuit immediately. Breaker switches also control amperage through circuit breaking. Larger electrical devices often have their own circuits with higher capacity fuses or breaker switches to avoid such overloads.

## 5. Effects of Electrical Shock

The severity of an injury from electrical shock depends on the amount of amperage and the length of time that it passes through the body. For example, 1/10 of an amp (100 milliamps), of electricity going through the body for just 1 second could cause death. The amount of internal current a person can withstand and still be able to control the muscles of the arm and hand can be less than 10 milliamperes.

<b>Effects of Electrical Current* on the Body</b>	
<b>Current (lasting one second)</b>	<b>Reaction</b>
1 milliamp	Just a faint tingle.
5 milliamps	Slight shock felt. Disturbing, but not painful. Most people can "let go." However, strong involuntary movements can cause injuries.
6-25 milliamps (women)** 9-30 milliamps (men)	Painful shock. Muscular control is lost. This is the range where "freezing currents" start. It may not be possible to "let go."
50-150 milliamps	Extremely painful shock, respiratory arrest (breathing stops), severe muscle contractions. Flexor muscles may cause holding on; extensor muscles may cause intense pushing away. Death is possible.
1,000-4,300 milliamps (1-4.3 amps)	Ventricular fibrillation (heart pumping action not rhythmic) occurs. Muscles contract; nerve damage occurs. Death is likely.
10,000 milliamps (10 amps)	Cardiac arrest and severe burns occur. Death is probable.
15,000 milliamps (15 amps)	Lowest over current at which a typical fuse or circuit breaker opens a circuit!
<p>* Effects are for voltages less than 600 volts. Higher voltages also cause severe burns.  **Differences in body muscle and fat content affect the severity of shock.</p> <p><b>NOTE: 1000 milliamps = 1 amp</b></p>	

*(continued)*

## 5. Effects of Electrical Shock *(continued)*

### **You Can't Let Go**

Currents above 10 milliamps can paralyze or “freeze” muscles. When this “freezing” happens, a person is no longer able to release a tool, wire, or other object. In fact, the electrified object may be held even more tightly, resulting in longer exposure to the shocking current. For this reason, handheld tools that give a shock can be very dangerous. If you can't let go of the tool, current continues through your body for a longer time, which can lead to respiratory paralysis (the muscles that control breathing cannot move). You stop breathing for a period of time. People have stopped breathing when shocked with currents from voltages as low as 49 volts. Usually, it takes about 30 milliamps of current to cause respiratory paralysis.

### **When Your Heart Stops Beating**

Currents greater than 75 milliamps cause ventricular fibrillation (very rapid, ineffective heartbeat). This condition will cause death within a few minutes unless a special device called a defibrillator is used to save the victim. Heart paralysis occurs at 4 amps, which means the heart does not pump at all. Tissue is burned with currents greater than 5 amps.



## Task 2

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In your groups, review the factsheets on pages 162-173. Then based on your own experience and the factsheets answer the questions below.

### Questions:

1. Circuit color coding:

What colors are ground wires?

What colors are neutral wires?

What colors are hot wires?

2. What is *guarding*?

3. What are Lockout/Tagout procedures and how do they protect workers?

### Agree or Disagree

4. A properly grounded system guarantees that you will never get shocked. **(Please explain).**
5. It's okay to use an extension cord with the grounding prong cut off as long as the system you plug it into is properly grounded. **(Please explain.)**

6. Fuses, breakers and GFCIs all serve the same purpose and as long as you've got one of them in the system you are protected from getting an electrical shock. **(Please explain.)**

### **What Would You Do?**

Juan has just finished digging a ditch for a contractor who is operating a backhoe. Juan wants to know what he should do next so he climbs out of the ditch and walks over to where the contractor is operating the backhoe. As Juan approaches (he gets within 6 feet of the backhoe) the contractor accidentally hits and entangles the arm of the backhoe in overhead power lines. Sparks are flying and the contractor “freezes”—seemingly unable to move.

7. What should Juan do?

## 6. Insulated Wires Prevent Shocks, Fires and Short Circuits

Insulators such as rubber or plastic are used to coat metals and other conductors to stop or reduce the flow of electrical current. This helps prevent shock, fires, and short circuits. To be effective, the insulation must be suitable for the voltage used. It must also protect the wire from other environmental factors that could cause the insulator to fail (e.g., temperature, moisture, oil, gasoline, corrosive fumes, or other substances).

### Insulated Wire Color Coding

Insulation on conductors are color coded. Insulated equipment grounding conductors (the ground wires) usually are either solid green or green with yellow stripes. Insulation covering grounded conductors (the neutral wires) are generally white or gray. Ungrounded conductors, or “hot wires,” are usually black or red, although they may be any color other than green, white, or gray.

### Beware of Reverse Polarity

In all electrical systems green wires are always wired as ground, white wires are always wired as neutral, and black or dark colored wires are always wired as hot. If the wires on any electrical system are reversed or placed on the wrong terminals (electricians call it reverse polarity), you are at risk of serious shock or injury. In other words, if a system is fed with the neutral wire as the “hot” wire and the black wire as the neutral, the system is not safe because the system will have live current flowing through it even when the switch is opened and the system is off.

### Always Check for Exposed Wires

Before connecting electrical equipment to a power source, it’s a good idea to check the insulation for any exposed wires for possible defects. Insulation covering flexible cords such as extension cords is particularly vulnerable to damage.

Sources: OSHA Publication 3075, Controlling Electrical Hazards, Revised 2002. Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## **7. Guarding**

Guarding means enclosing electric equipment to make sure people don't accidentally come into contact with its live parts. Effective guarding requires equipment with exposed parts operating at 50 volts or more to be placed where it is accessible only to authorized people qualified to work with it.

### **Warning Signs**

Signs must be posted at the entrances to electrical rooms and similarly guarded locations to alert people to the electrical hazard and to forbid entry to unauthorized people. Signs may contain the word "Danger," "Warning," or "Caution," and beneath that, appropriate wording that alerts people to the hazard or gives an instruction, such as "Danger/High Voltage/Keep Out."

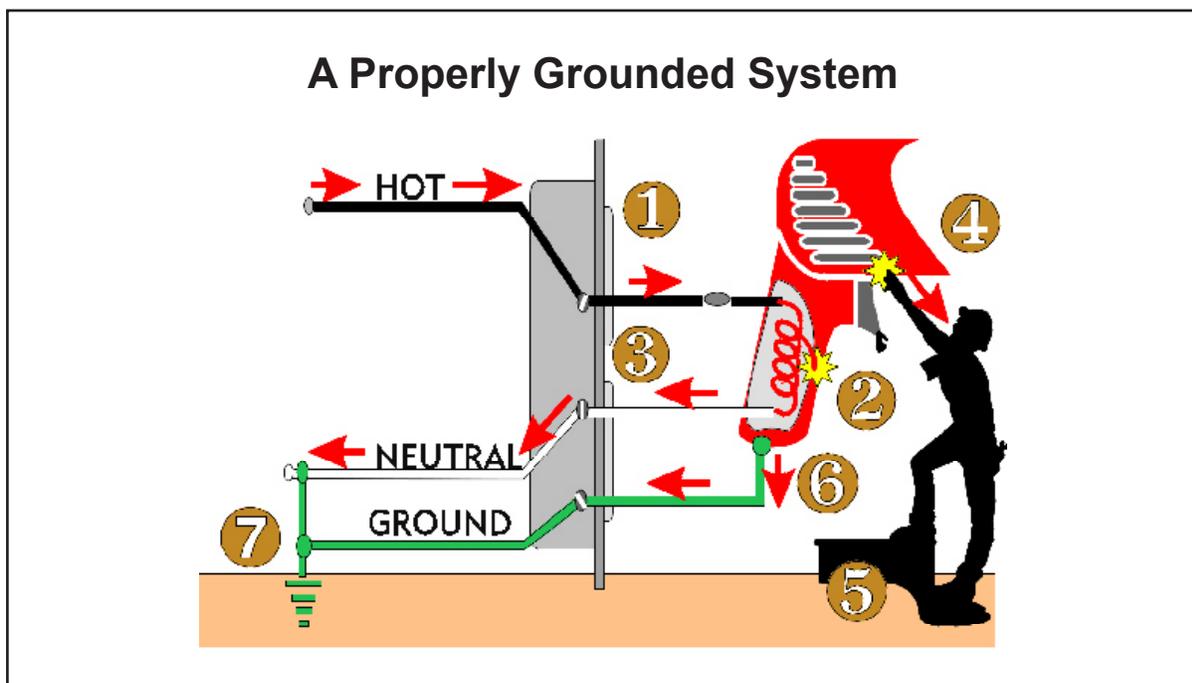
## 8. Grounding

Grounding reduces the risk of getting an electric shock. **It does not guarantee that you won't get a shock or be injured or killed** by an electrical current. However, by preventing the buildup of voltages that could cause an electrical accident, it will substantially reduce the risk.

### For Machines and Equipment

Grounding is designed primarily to protect machines, tools, and insulation against damage. A wire called the “neutral” or “ground” conductor, is grounded (connected) to earth or an isolated path. As long as the neutral wire is properly grounded it will provide a separate low resistance pathway for electricity when it does not flow from hot to neutral.

An equipment ground helps protect the equipment operator. It provides a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the tool's metal frame to become energized. The resulting flow of current may activate the circuit protection devices.



Sources: OSHA Publication 3075, Controlling Electrical Hazards, Revised 2002. Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 9. Circuit Protection Devices

Circuit protection devices limit or stop the flow of current automatically in the event of a ground fault, overload, or short circuit in the wiring system. These devices include:

- fuses and circuit breakers
- ground-fault circuit interrupters
- arc-fault circuit interrupters

### Fuses and Breakers

Fuses and circuit breakers open or break the circuit automatically when too much current flows through them. When that happens, fuses melt and circuit breakers trip the circuit open. Fuses and circuit breakers are designed to protect conductors and equipment. They prevent wires and other components from overheating and open the circuit when there is a risk of a ground fault but **they are not designed to protect workers.**

### **Beware of Oversized Fuses and Breakers**

A circuit with an oversized fuse or breaker is a hazard. If breakers or fuses are too big for the wires they are suppose to protect, an overload in the circuit will not be detected and the current will not be shut off. Overloading leads to overheating of circuit components (including the wires) and could cause a fire.

*(continued)*

## 9. Circuit Protection Devices *(continued)*

### GFCIs

Ground-fault circuit interrupters, or GFCIs, are used in wet locations, construction sites, and other high-risk areas. These devices interrupt the flow of electricity in as little as 1/40 of a second to prevent electrocution. GFCIs compare the amount of current going into electric equipment (the black hot wire) with the amount of current returning along the circuit conductors (the white neutral wire). If the difference exceeds 5 milliamps, the device automatically shuts off the electric power.

GFCI's are designed to provide shock protection for workers (see table below) but are not a substitute for breakers.

<b>Comparing GFCI and Circuit Breaker Shock Protection</b>	
<b>AMPs</b>	<b>Impact On Body</b>
<b>15.000</b>	<b>Circuit Breaker blows</b>
4.000	burns, heart paralysis
0.100	certain heart failure, fatal
0.050	possible heart failure
0.030	temporary lung paralysis
0.015	can't let go of power
<b>0.005</b>	<b>GFCI Opens</b>
0.003	painful shock
0.001	mild shock

### Arc-Fault Devices

An arc-fault is an unintended discharge of electricity that allows current to flow between conductors. Arc-faults will heat up and melt wires and can lead to fires. Arc-fault devices provide protection by recognizing characteristics unique to arcing and by functioning to deenergize the circuit when an arc-fault is detected.

Sources: OSHA Publication 3075, Controlling Electrical Hazards, Revised 2002. Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

## 10. Lockout/Tagout Procedures

Proper lockout/tagout procedures protect you from the dangers of the accidental or unexpected startup of electrical equipment. These procedures ensure that electrical equipment is deenergized before it is repaired or inspected and protects you against electrocution or shock.

### Proper Procedures

After equipment or circuits are shut-off or disconnected from power sources, locks and tags are installed to ensure that circuits or machines cannot be reenergized. Locks must be attached so that excessive force or tools would be needed to reenergize equipment or circuits. After the equipment or circuits have been deenergized and locked out, tags must be attached to identify the work being done.

The tags will have the word DANGER printed on them and will say one or the following:

- **Do Not Start**
- **Do Not Energize**
- **Do Not Open**
- **Do Not Close**
- **Do Not Operate**

**Never ignore, bypass, or remove a lock or tag!**

Only authorized workers are permitted to remove locks and tags.



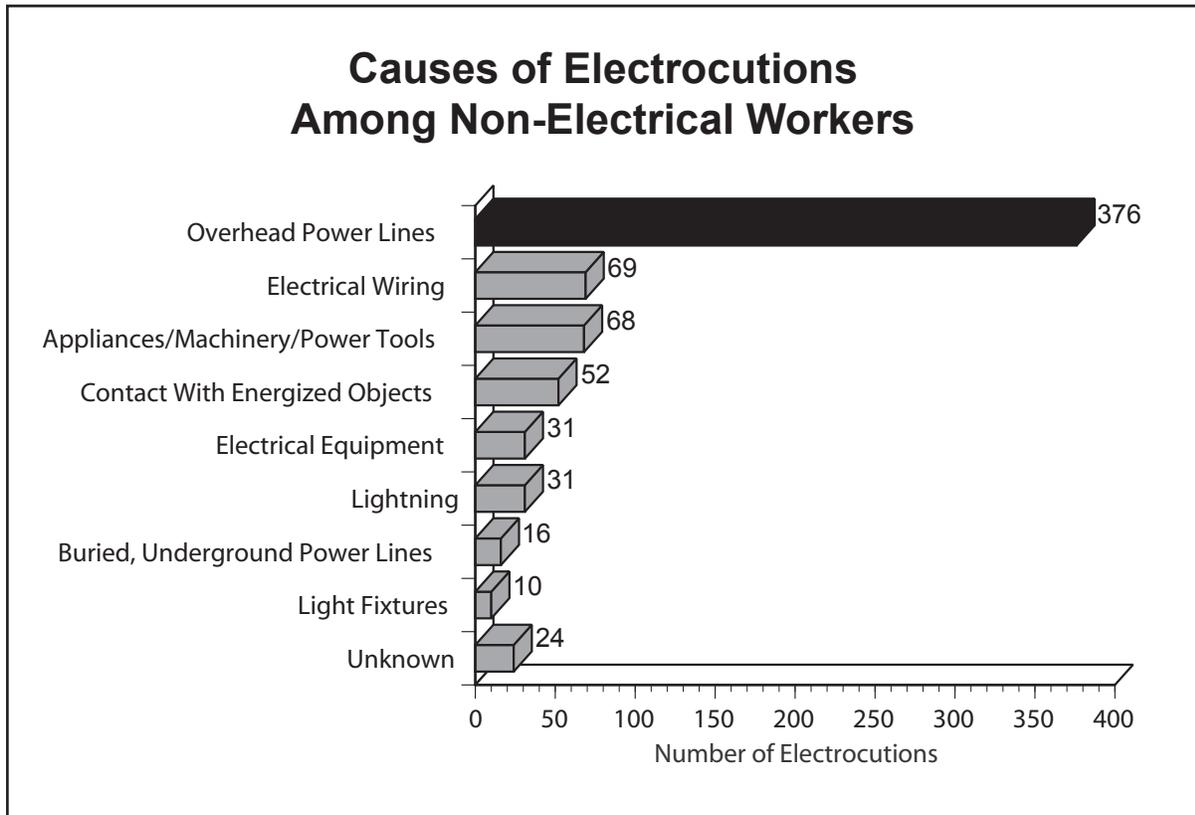
Sources: OSHA Publication 3075, Controlling Electrical Hazards, Revised 2002. Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program. 2000.

# 11. Protection From Overhead Power Lines

Electricity seeks all paths to the ground. The path could include a tree, equipment (e.g., cranes, hoists, backhoes, etc.) or your body. If a part of equipment contacts a live power line, then anything in contact with the equipment will also be energized. The earth around energized equipment will also be energized. The ground could also be energized if a tree makes contact with a power line or if a broken power line falls to the ground.

## Energized Ground Ripples of Current

When the electrical flow reaches the ground, it spreads out like ripples in a pool of water. The voltage is very high where electrical contact is made with the ground. Farther away from the point of contact, the voltage gradually drops off. Wet ground will extend the distance and the danger.

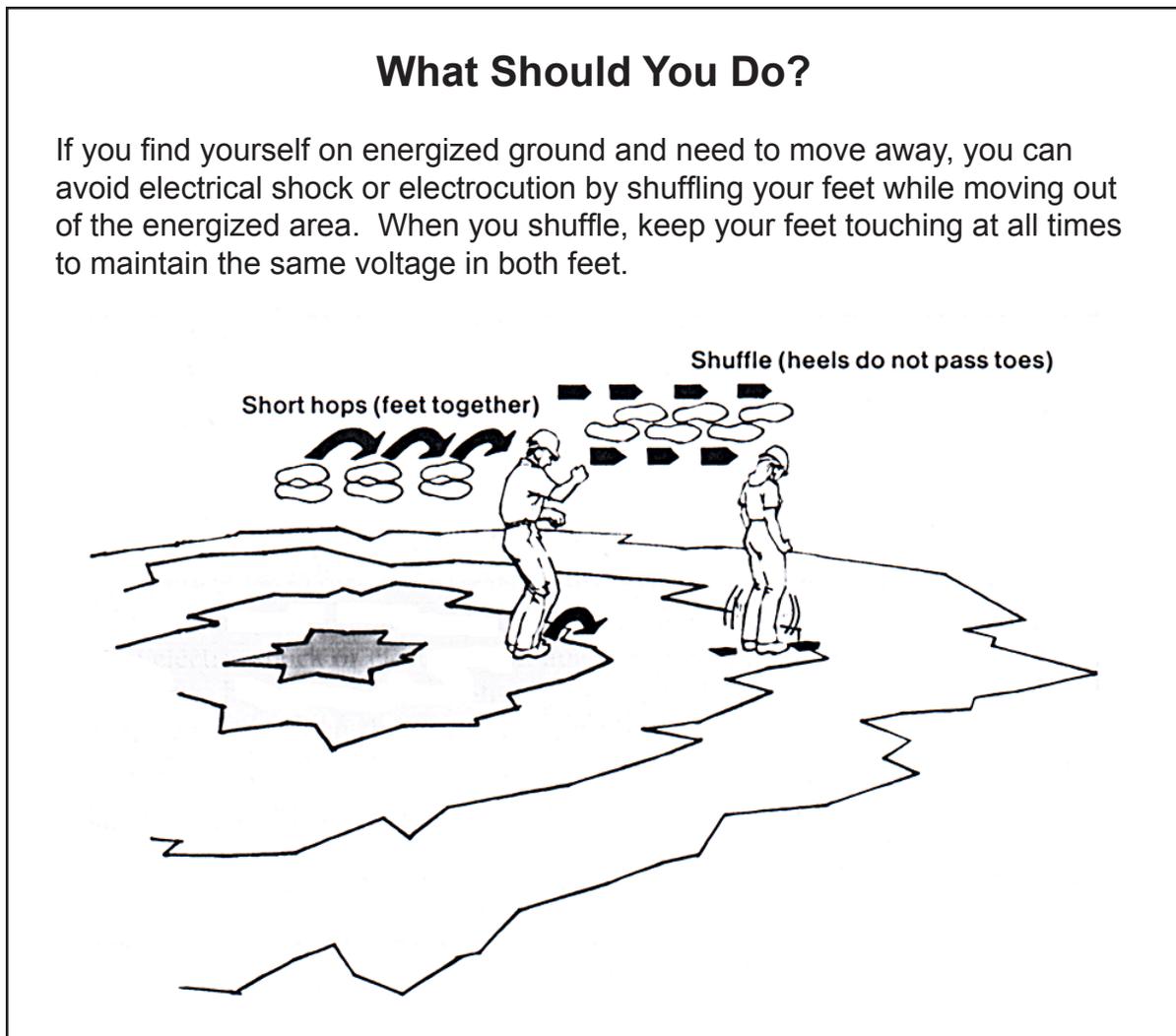


## Step Potential

*Step potential* is the voltage difference between two places that are a step apart on energized ground. For example, if you are standing on energized ground, there could be a significant difference in voltage between where one foot and the other foot are placed, and an electrical current could flow up one leg and down the other. If your feet are close together and touching, your are fairly safe. Since there is almost no voltage difference between the places your feet stand, there is little reason for electricity to seek a path through your body.

### What Should You Do?

If you find yourself on energized ground and need to move away, you can avoid electrical shock or electrocution by shuffling your feet while moving out of the energized area. When you shuffle, keep your feet touching at all times to maintain the same voltage in both feet.



(continued)

# 11. Protection From Overhead Power Lines

*(continued)*

## **Touch Potential**

Touch potential is another danger that also results from the difference in voltage. It occurs when you touch something that is energized while standing on the lower-voltage ground. For example, if a tree or some equipment is in contact with a power line, it will be energized to a lower voltage. If you touch the energized equipment or tree at the same time as you touch the ground with your feet, electricity will flow through your body from the higher voltage tree or equipment to the lower voltage ground.

## **Workers in Vehicles or Mobile Equipment**

If power lines are in contact with a vehicle or mobile equipment you are operating, stay in the vehicle if it is safe to do so. You are safer inside the vehicle as long as you do not touch or step onto anything outside the vehicle that will provide a path for the current to flow to ground. Wait until the power system has verified that the power lines have been de-energized and grounded.

## **If You Must Exit the Vehicle**

If you must abandon your vehicle because of an emergency such as a fire, be aware of the possibility that the ground below your machine is energized and use extreme caution. To make a safe escape, keep both feet together and hands by your side and make a short jump from your vehicle. You must be sure that your entire body clears the vehicle and that you land on your feet without stumbling. **Do not allow any part of your body to touch the vehicle while you are touching the ground. After you land, do not take steps away from the vehicle.** It is safest to shuffle away without moving your feet more than a few inches at a time. Keeping your feet together will ensure that you do not straddle two zones with different voltages.

## Pruning or Cutting Down Trees

Workers have been killed or injured when doing tree care work or cutting down trees near power lines. Before pruning or cutting down trees near power lines, a qualified person must inspect the jobsite to identify any hazards, including situations where any part of a tree is within the general limits of approach or could fall within that distance. Only the owner of the power system can authorize the person doing the inspection and ensure that the person is qualified. Normally, the only person authorized to do this work is a qualified electrician.

<b>Safety Checklist For Overhead Power Lines</b>	
✓	Before working under or near overhead power lines, ensure that you maintain a safe distance from the lines
✓	For very high-voltage lines, ground any equipment such as cranes that can become energized
✓	If working on power lines, ensure that the lines have been deenergized and grounded by the owner or operator of the lines.
✓	Guard or insulate the lines to help prevent accidental contact.
✓	Workers not qualified to work with electricity, as well as mechanical equipment, should remain at least 10 feet (3.05 meters) away from overhead power lines.
✓	If the voltage is more than 50,000 volts, the clearance increases by 4 inches (10 centimeters) for each additional 10,000 volts.
✓	When mechanical equipment is operated near overhead lines, employees standing on the ground should avoid contact with the equipment unless it is located outside the danger zone.
✓	When factoring the safe standoff distance, be sure to consider the equipment's maximum reach.

Sources: Construction Safety Association of Ontario, *Electrical Hazards in Construction*, Revised Edition, 2001, [www.csar.org](http://www.csar.org). OSHA Publication 3075, *Controlling Electrical Hazards*, Revised 2002. Michael McCann, PHD, CIH, The Center to Protect Workers Rights, *Why Construction Workers are Getting Electrocuted*, [www.cpwr.org](http://www.cpwr.org)

## 12. Extension Cords

Using damaged, frayed, or undersized extension cords increases the risks of electrical shock and/or fires. Extension cords should never be used as a substitute for the fixed wiring of a structure.

In addition, extension cords must not be:

- Run through holes in walls, ceilings, or floors
- Run through doorways, windows, or similar openings (unless physically protected)
- Attached to building surfaces (except with a tension take-up device within 6 feet of the supply end)
- Hidden in walls, ceilings, floors or conduit

### Choosing the Right Size Extension Cord

The size of wire in an extension cord must be able to handle the amount of current the cord will be expected to carry. The amount of current depends on the equipment plugged into the extension cord.

The amount of current a device needs to operate is often printed on the nameplate. If a power rating is given, it is necessary to divide the power rating in watts by the voltage to find the current rating. For

example, a 1,000-watt heater plugged into a 120-volt circuit will need almost 10 amps of current. Always make sure the wire size can handle the total current.

<b>American Wire Gauge (AWG)</b>	
<b>Wire Size</b>	<b>Handles Up To</b>
#10 AWG	30 amps
#12 AWG	25 amps
#14 AWG	18 amps
#16 AWG	13 amps

### Voltage Drop

The length of the extension cord also needs to be considered when selecting the wire size. Voltage drops over the length of a cord. If a cord is too long, the voltage drop can be enough to damage equipment. Many electric motors only operate safely in a narrow range of voltages and will not work properly at voltages different than the voltage listed on the nameplate. Even though light bulbs operate (though dimly) at

lowered voltages, do not assume electric motors will work correctly at less-than-required voltages. Also, when electric motors start or operate under load, they require more current. The larger the size of the wire, the longer a cord can be without causing a voltage drop that could damage tools and equipment.

### Proper Grounding of Extension Cords

The grounding path for extension cords must be kept intact to keep you safe. A typical extension cord grounding system has four components:

- A third wire in the cord, called a ground wire
- A three-prong plug with a grounding prong on one end of the cord
- A three-wire, grounding-type receptacle at the other end of the cord
- A properly grounded outlet

<b>Rules for Extension Cord Use</b>	
✓	Discard frayed cords
✓	Always use three-wire cords with ground plugs in place
✓	Discard cords when plugs separate from the wires
✓	Avoid pulling plugs out by the cord (pull on the plug)
✓	Discard cords with damaged insulative covers
✓	Don't run cords through walls, ceilings, floors, doorways, or windows
✓	Use only cords that have been properly inspected
✓	Use the proper strain relief devices that are designed to take stress off of plugs
✓	Don't hang cords on nails, or suspend them with staples, wires or string across walls
✓	Clean inspect, coil and store cords
✓	Use only cords that can handle the required load
✓	Never use plug assemblies designed for wall mounts on cord sets

Sources: Center for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) Publication No. 2002-123, *Electrical Safety, Safety and Health for Electrical Trades, Student Manual*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## Summary

1. An average of one worker is electrocuted on the job every day of every year! The vast majority of construction workers who die from electrocutions are not electricians.
2. You get shocked when electrical current passes through your body. Electricity passing through the body can also cause irregular or quivering of the heart (fibrillation) leading to respiratory failure and cardiac arrest (heart attack).
3. The most common shock-related injuries are severe burns at the points of entry and exit.
4. Amperage must be controlled in order to protect the electrical lines from overheating or short-circuiting.
5. The severity of injury from electrical shock depends on the amount of electrical current (amperage or amps) and the length of time the current passes through the body. Longer exposure times increase the danger to the shock victim.
6. Insulators such as rubber or plastic are used to coat metals and other conductors to stop or reduce the flow of electrical current. This helps prevent shock, fires, and short circuits.
7. Guarding involves locating or enclosing electric equipment to make sure people don't accidentally come into contact with its live parts.
8. Grounding reduces the risk of getting an electric shock. It is designed primarily to protect machines, tools, and insulation against damage. **It does not guarantee that you won't get a shock or be injured or killed** by an electrical current.
9. Fuses and circuit breakers are designed to protect conductors and equipment. They prevent wires and other components from overheating and open the circuit when there is a risk of a ground fault but **they are not designed to protect workers.**

10. Ground-fault circuit interrupters, or GFCIs, are used in wet locations, construction sites, and other high-risk areas. They are designed to provide shock protection for workers but are not a substitute for breakers.
11. Proper lockout/tagout procedures protect you from the dangers of the accidental or unexpected startup of electrical equipment. These procedures ensure that electrical equipment is deenergized before it is repaired or inspected and protects you against electrocution or shock.
12. Electricity seeks all paths to the ground. The path could include a tree, equipment (e.g., cranes, hoists, backhoes, etc.) or your body. If a part of equipment contacts a live power line, then anything in contact with the equipment will also be energized.
13. If you find yourself on energized ground and need to move away, you can avoid electrical shock or electrocution by shuffling your feet while moving out of the energized area. When you shuffle, keep your feet touching at all times to maintain the same voltage in both feet.
14. If power lines are in contact with a vehicle or mobile equipment you are operating stay in the vehicle if it is safe to do so. If you must abandon your vehicle, keep both feet together and hands by your side and make a short jump from your vehicle. You must be sure that your entire body clears the vehicle and that you land on your feet without stumbling.
15. Using damaged, frayed, or undersized extension cords increases the risks of electrical shock and/or fires. Extension cords should never be used as a substitute for the fixed wiring of a structure.



# Evaluation

## Activity 6: Electrical Safety

1. How important is this Activity for day laborers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an “X”** by the factsheets you feel are the most important.

	1. Electricity and Construction Fatalities		7. Guarding
	2. Why Is Electricity Dangerous?		8. Grounding
	3. How Do You Get Shocked?		9. Circuit Protection Devices
	4. Electricity Basics: Volts and Amps		10. Lockout/Tagout Procedures
	5. Effects of Electrical Shock		11. Protection From Overhead Power Lines
	6. Insulated Wires Prevent Shocks, Fires and Short Circuits		12. Extension Cords

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.

4. What would you suggest be done to improve this Activity?

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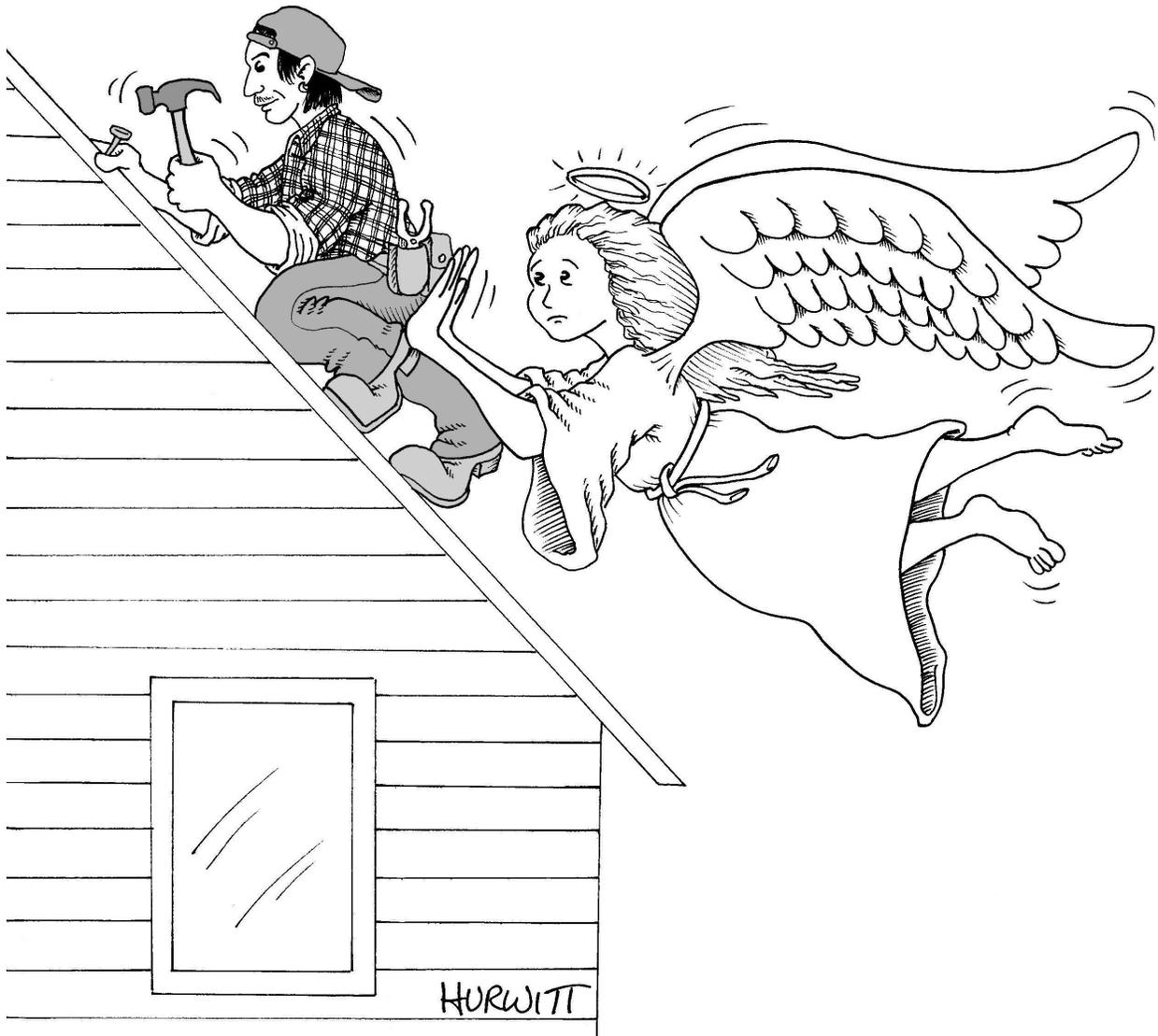
# Activity 7: Fall Protection

## Purpose

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To increase our knowledge of the fall protection systems that can be used to reduce the risk of falls on construction jobs.

This Activity has two tasks.



## Task 1

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**In your groups review the factsheets on pages 184-206. Then based on your own experience and the factsheets answer the questions below.**

1. How would you respond to a worker that said the following:

*“Falls are unavoidable in construction and the only way to protect yourself is by relying on your instincts and experience.”*

2. On construction jobs that you take, do contractors provide fall protection? If so, what kind of protection is provided?

**Place a check (✓) next to the fall protection systems that you have used on jobs. (Please make sure you review the factsheets that describe each system.)**

<b>Fall Protection Systems</b>		
<b>See Factsheets</b>	<b>Type of Fall Protection System</b>	<b>Protection Used On Jobs You Have Worked (✓)</b>
Factsheet 8	Personal Fall-Arrest System (PFAS)	
Factsheet 9	Personal Fall-Restraint System (PFRS)	
Factsheet 10	Positioning-Device System	
Factsheet 5	Guardrail System	
Factsheet 6	Safety-Net System	
Factsheet 11	Warning-Line System for Roofing Work	
Factsheet 13	Slide-Guard System for Roofing Work	

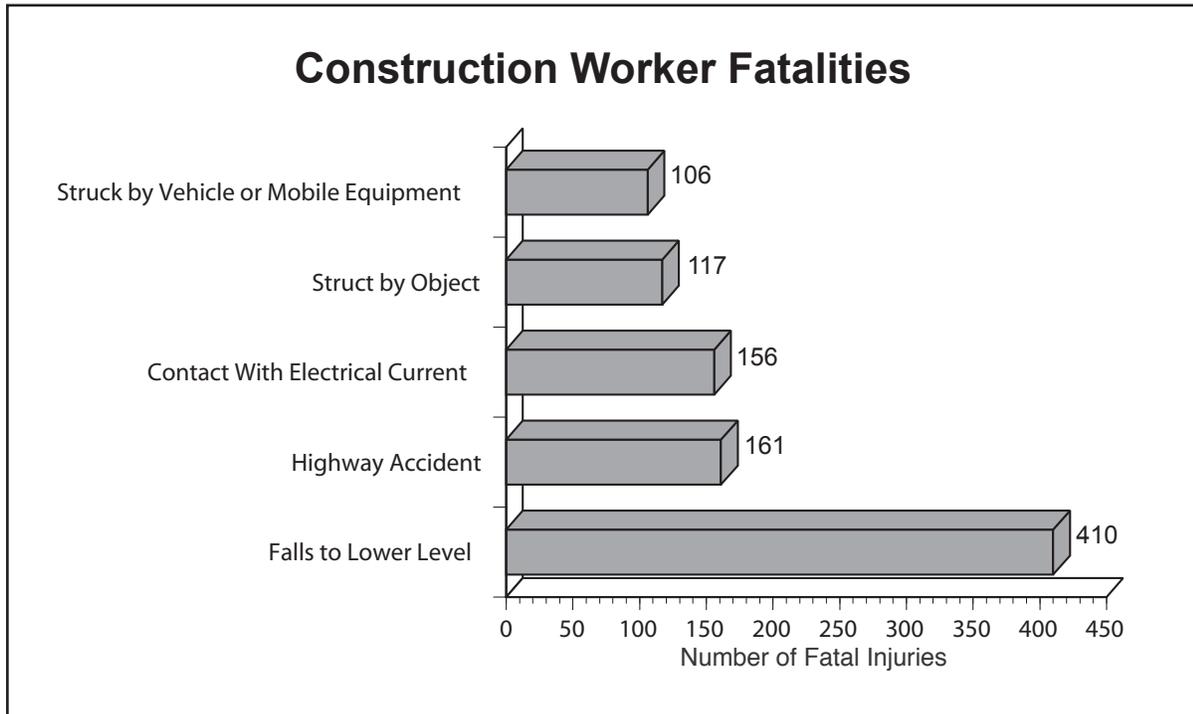




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4. How would you suggest that Juan approach the contractor? What should he say? How should he start the conversation? What would you recommend that Juan do if the contractor refuses to implement the required fall protection system(s)?

# 1. Fatal Falls in the Construction Industry

Falls to lower levels account for the greatest number of fatalities among construction workers.



Source: Centers for Disease Control (CDC), National Institute for Occupational Safety and Health, *Worker Health Chartbook, 2004*.

## 2. How Can The Risks of Falling Be Reduced?

For many in the construction industry, lowering the risks of falls means using fall-protection equipment such as personal fall-arrest systems, safety nets, or guardrails. But fall protection means more than equipment. Fall protection is what you do to eliminate fall hazards, to prevent falls, and to ensure that workers who may fall aren't injured.

<b>Factors That Determine Fall Protection</b>	
✓	The distance to lower levels
✓	The type of activities requiring fall protection and the specific requirements of each activity
✓	The specific types of equipment and components needed with each fall protection system
✓	How much vertical and horizontal movement employees will need to perform each activity
✓	Environmental conditions (i.e. wind, rain, extreme heat/cold) in which fall protection equipment will be used
✓	The potential difficulty of using fall protection systems to perform normal and/or non-routine job activities
✓	The need for anchorage points of suitable design and strength
✓	The presence of chemical, electrical, and welding hazards
✓	How employees will recover or be rescued from fallen positions
✓	The presence of sharp or rough surfaces and edges

### 3. The Limits of Fall Protection Under OSHA

According to OSHA, on any construction job where a worker could fall off an unprotected side or edge that is 6 feet or more above the lower level, the contractor must provide fall protection by using guardrails, safety nets, or personal fall arrest systems.

#### **Residential Construction Exception**

However, on residential construction jobs, if a contractor can demonstrate that it is not feasible or creates a greater hazard to use the fall protection systems listed above, then he must develop and implement a fall protection plan that, at a minimum, designates a *controlled access zone* and/or a *safety monitoring system*.

#### **Residential Fall Protection Plan Training Requirements**

If a residential construction contractor decides that using guardrails, safety nets or personal fall arrest systems are not feasible or they create a greater hazard, then he must implement a fall protection plan that includes training for all the workers hired to work on the job. The program must include training workers in the procedures to be followed in order to minimize the fall hazards.

**What is a Controlled Access Zone?**

A controlled access zone is a work area designated and clearly marked in which certain types of work may take place without the use of conventional fall protection systems.

Controlled access zones are used to keep workers out and allow only those authorized and properly trained to enter unprotected work areas.

**What is a Safety Monitoring System?**

If you are working on an unprotected roof edge, the contractor is required to assign someone to act as the safety monitor. The safety monitor's job is to warn workers when they are in danger of falling.  
*(For more information see Factsheet 11)*

## 4. Types of Fall Protection

If fall hazards can't be eliminated, then fall protection systems must be used to reduce the risks of falling or ensure that if workers do fall, they aren't injured. The table below lists the seven basic fall protection systems. They are designated as fall arrest and fall prevention systems.

### Fall Arrest Systems

Fall arrest systems reduce the risks of injury if you fall but they don't prevent you from falling. For example, a safety net is a fall arrest system. It won't prevent you from falling—which means you could still get hurt—but will reduce the chances of you being injured as a result of the fall.

### Fall Prevention Systems

Fall prevention systems are designed to keep you from falling. For example, a properly constructed guardrail system will prevent you from falling over an exposed edge.

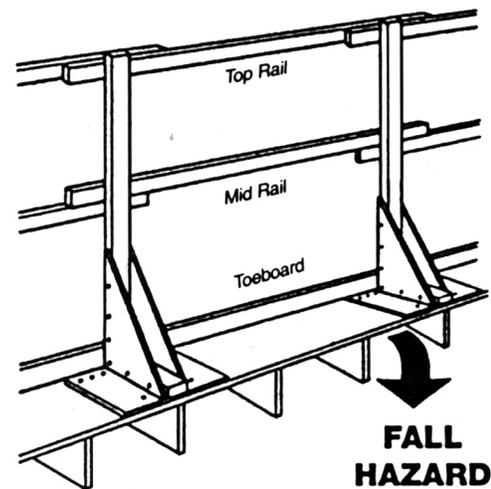
<b>Fall Protection Systems</b>		
<b>Type of Fall Protection System</b>	<b>Prevents Falls From Occurring</b>	<b>Protects From Injury If You Fall</b>
Personal Fall-Arrest System (PFAS)		X
Personal Fall-Restraint System (PFRS)	X	
Positioning-Device System		X
Guardrail System	X	
Safety-Net System		X
Warning-Line System for Roofing Work	X	
Slide-Guard System for Roofing Work	X	

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 5. Guardrails

A guardrail system consists of a toprail, midrail, and intermediate vertical member. Guardrail systems can also be combined with toe boards that prevent materials from rolling off the walking/working surface. **Guardrail systems are designed to prevent falls** and must be free of anything that might cut a worker or snag a worker's clothing. Toprails and midrails must be at least one-quarter-inch thick to reduce the risk of hand lacerations; steel or plastic banding cannot be used for toprails or midrails. Other requirements for guardrails include:

- Wire rope used for a toprail must be marked at least every six feet with high-visibility material.
- The toprail of a guardrail must be  $42 \pm 3$  inches above the walking/working surface. The top-edge height can exceed 45 inches if the system meets all other performance criteria.
- Midrails must be installed midway between the toprail and the walking/working surface unless there is an existing wall or fortification at least 21 inches high.
- Screens and mesh are required when material could fall between the toprail and midrail or between the midrail and the walking/working surface.
- Intermediate vertical members, when used instead of midrails between posts, must be no more than 19 inches apart.
- A guardrail system must be capable of withstanding a 200-pound force applied within two inches of its top edge in any outward or downward direction.
- Midrails, screens, and intermediate structural members must withstand at least 150 pounds applied in any downward or outward direction.

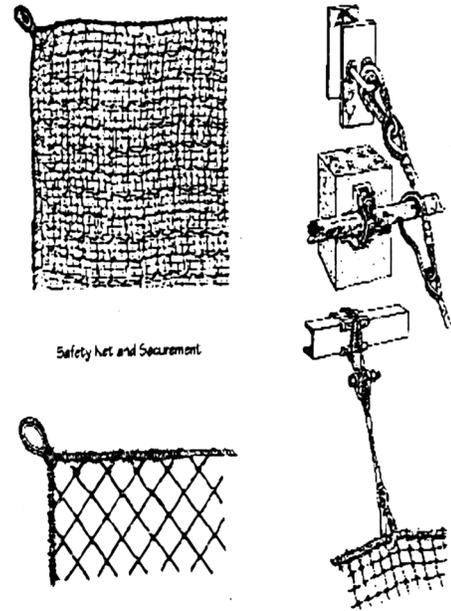


Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orsosha.org](http://www.orsosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 6. Safety Nets

Safety-net systems consist of mesh nets and connecting components. **They are designed to catch you if you fall.** Safety-net openings can't be more than six inches on a side, center to center. Safety nets must not be installed more than 30 feet below the working surface.

An installed net must be able to withstand a drop test consisting of a 400-pound sandbag, 30 inches in diameter, dropped from the working surface. Inspect safety nets regularly and remove debris from them no later than the start of the next work shift.



The minimum horizontal distance to the net's outer edge depends on how far below the working surface the net is placed, as shown in the table below.

Horizontal Distance to a Safety-Net's Outer Edge	
Net's distance below the working surface	Minimum horizontal distance from the edge of the working surface to the net's outer edge
Up to 5 feet	8 feet
5 to 10 feet	10 feet
Greater than 10 feet	13 feet

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orsosha.org](http://www.orsosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## **7. Requirements for Hole Covers**

When properly installed, **rigid covers prevent workers from falling** through skylights or temporary openings and holes in walking/work surfaces. Holes or openings should be covered as soon as they exist.

Hole cover safety requirements include:

- Covers must support at least twice the maximum expected weight of workers, equipment and materials. (Note: Skylights are not considered covers unless they meet the strength requirements)
- Covers must be secured to prevent accidental displacement
- Covers must have a full edged bearing on all sides.
- All covers must be painted with a distinctive color or marked with the word HOLE or COVER.

## 8. Personal Fall Arrest Systems

A personal fall-arrest system consists of an anchorage, connectors, and a full-body harness that work together to **catch and protect you from injury if you fall**. Personal fall-arrest systems are effective only if you know how all of the components work together. Other parts of the system may include a lanyard, a deceleration device, and a lifeline.

<b>Before you use a personal fall-arrest system, you should know the following:</b>	
✓	How to select and install a secure anchorage
✓	How to select and use connectors
✓	How to put on and use a full-body harness
✓	How to correctly attach and use a lanyard
✓	When a deceleration device is necessary
✓	How to erect and use a lifeline
✓	The correct procedures for using retractable devices
✓	How to estimate fall distances
✓	How to avoid swing falls
✓	How to inspect and maintain the system
✓	How you will be promptly rescued if you fall

### **Anchorage**

An anchorage is a secure point of attachment for lifelines, lanyards, or deceleration devices. How can you be sure that an anchorage is secure? An anchorage for a personal fall-arrest system must support at least 5,000 pounds. Anchorages that can't support 5,000 pounds must be able to maintain a safety factor of at least two — twice the impact force of a worker

free-falling six feet. If you don't know how much weight an anchorage will support, make sure a trained qualified person checks it before you trust your life to it.

<b>Possible Proper Anchorage</b>	<b>Improper Anchorage</b>
Roof Trusses	Roof Vents
Large Masonry Chimneys	Hatches
Roof Joists	Small Pipes
Other Structural Members	Guardrails

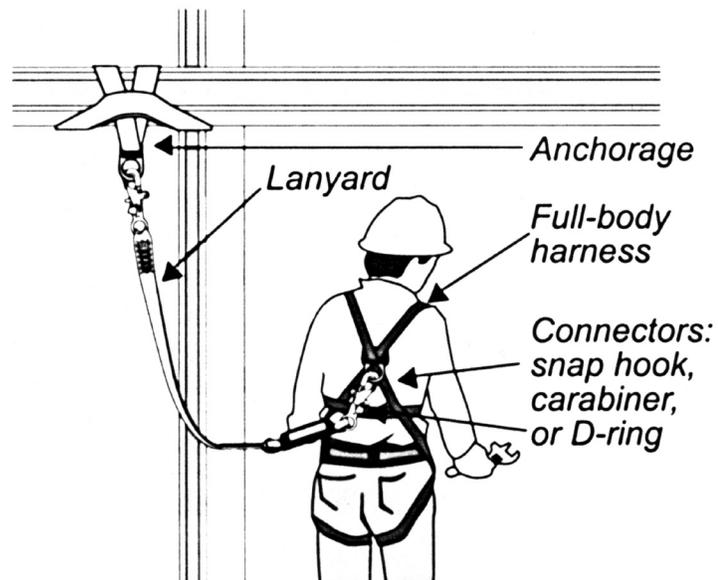
### *Anchorage Connector*

Anchorage strength is critical, but is not the only factor to consider. Unless an existing anchorage has been designed to accept a lanyard or lifeline, you'll need to attach an anchorage connector — a device that provides a secure attachment point. Examples include tie-off adapters,

hook anchors, beam connectors, and beam trolleys. Be sure that the connector is compatible with the lanyard or lifeline and appropriate for the work task.

#### *Attachment Point*

The anchorage can be used only as the attachment point for a personal fall-arrest system; it can't be used to support or suspend platforms.



#### *Location*

The anchorage should be located directly above the worker to reduce the chance of a swing fall.

#### *Fall Distance*

Because a personal fall-arrest system doesn't prevent a fall, the anchorage must be high enough above a worker to ensure that the arrest system, and not the next lower level, stops the fall. Consider free-fall distance, lanyard length, shock-absorber elongation, and body-harness stretch in determining the height of an anchorage. Free-fall distance is the distance a worker falls before a personal fall-arrest system begins to stop the fall.

#### **Connectors**

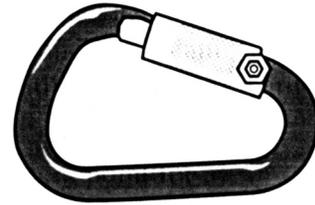
An anchorage, a lanyard, and a body harness are not useful until they're linked together. Connectors do the linking; they make the anchorage, the lanyard, and the harness a complete system. Connectors include carabiners, snap hooks, and D-rings.

*(continued)*

## 8. Personal Fall Arrest Systems *(continued)*

### *Carabiner*

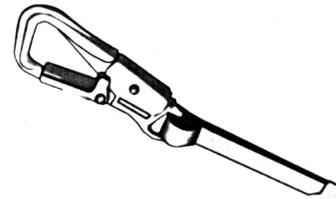
This steel connector has a locking gate and is used mostly in specialized work such as window cleaning and high-angle rescue. Carabiners must have a minimum tension strength of 5,000 pounds.



*Carabiner*

### *Snap Hooks*

Snap hooks open to receive a connecting component and automatically close when released. Snap hooks are typically spliced or sewn into lanyards and self-retracting lifelines. Snap hooks must be made of high tensile alloy steel and have a minimum tension strength of 5,000 pounds. Use only locking snap hooks with personal fall arrest systems; locking snap hooks have self-locking keepers that won't open until they're unlocked.



*Locking snap hook*

### *D-ring*

D-rings are the attachment points sewn into a full-body harness. D-rings must have a minimum tension strength of 5,000 pounds.

### **The Full-Body Harness**

The full-body harness has straps that distribute the impact of a fall over the thighs, waist, chest, shoulders, and pelvis. Full-body harnesses come in different styles, many of which are light and comfortable. Before you purchase a harness, make sure it fits, is comfortable, and that it's easy to adjust. A full-body harness should include a back D-ring for attaching lifelines or lanyards and a back pad for support. **Never use a body belt as part of a personal fall-arrest system.**

### **Lanyards**

A lanyard is a specially designed flexible line that has a snap hook at each end. One snap hook connects to the body harness and the other connects to an anchorage or a lifeline. Lanyards must have a minimum breaking strength of 5,000 pounds. They come in a variety

<b>Full Body Harness Checklist</b>	
✓	The harness must be made from synthetic fibers.
✓	The harness must fit the user. It should be comfortable and easy to adjust.
✓	The harness must have an attachment point, usually a D-ring, in the center of the back at about shoulder level. The D-ring should be large enough to easily accept a lanyard snap hook.
✓	Chest straps should be easy to adjust and strong enough to withstand a fall without breaking.
✓	Use only industrial full-body harnesses (not recreational climbing harnesses).
✓	The harness must be safe and reliable. It should meet ANSI and CSA standards and the manufacturer should have ISO 9001 certification, which shows the manufacturer meets international standards for product design, development, production, installation, and service.

of designs, including self-retracting types that make moving easier and shock absorbing types that reduce fall-arrest forces. **Never combine lanyards to increase length or knot them to make them shorter.**

### **Deceleration Devices**

Deceleration devices protect workers from the impact of a fall and include shock-absorbing lanyards, self-retracting lifelines or lanyards, and rope grabs.

#### *Shock-Absorbing Lanyard*

A shock absorber reduces the impact on a worker during fall arrest by extending up to 3.5 feet to absorb the arrest force. A shock-absorbing lanyard can reduce the force to about 900 pounds.

Because a shock-absorbing lanyard extends up to 3.5 feet, it's critical that the lanyard stops the worker before the next lower level. Allow about 20 vertical feet between the worker's anchorage point and the level below the working surface. Always estimate the total distance of a possible fall before using a shock-absorbing lanyard. **Never use a shock-absorbing lanyard if the shock absorber is even partially extended or if the lanyard has arrested a fall.**

*(continued)*

## 8. Personal Fall Arrest Systems *(continued)*

### *Self-Retracting Lanyard/Lifeline*

Self-retracting lanyards and lifelines offer more freedom to move than shock-absorbing lanyards. Each has a drum-wound line that unwinds and retracts as the worker moves. If the worker falls and the anchorage point is directly above the worker, the drum immediately locks and reduces the free-fall distance to about two feet. Some self-retracting lanyards will reduce free-fall distance to less than one foot. Self-retracting lanyards are available in lengths up to 20 feet. Self-retracting lifelines, which offer more freedom, are available in lengths up to 250 feet.

Self-retracting lanyards and lifelines that limit free-fall distance to two feet or less must be able to hold at least 3,000 pounds with the lanyard (or lifeline) fully extended. Self-retracting lanyards that don't limit free-fall distance to two feet must be able to hold at least 5,000 pounds with the lanyard (or lifeline) fully extended.

### *Beware of Swing Falls!*

If you use a self-retracting lanyard or lifeline, work below the anchorage to avoid a swing fall. The farther you move away from the anchorage, the farther you will fall and the greater your risk of swinging back into a hard object. Swing falls are hazardous because you can hit an object or a lower level during the pendulum motion that results when you swing back under the anchor point.

### *Rope Grab*

A rope grab allows a worker to move up a vertical lifeline but automatically engages and locks on the lifeline if the worker falls. When using a rope grab, keep the following in mind.

- The rope grab must be compatible with the lifeline
- The rope grab must be correctly attached to the lifeline (not upside down)
- Keep the lanyard (between the rope grab and the body harness) as short as possible
- Keep the rope grab as high as possible on the lifeline

## **Lifelines**

A lifeline is a cable or rope that connects to a body harness, lanyard, or deceleration device, and at least one anchorage. There are two types of lifelines, vertical and horizontal.

### *Vertical Lifeline*

A vertical lifeline is attached to an overhead anchorage and must be connected directly to a worker's full-body harness, lanyard, retractable device, or rope grab; it must have a minimum breaking strength of 5,000 pounds. When a worker needs to move horizontally, however, a vertical lifeline can be hazardous due to the potential for a swing fall — the pendulum motion that results when the worker swings back under the anchor point. A swing fall increases a worker's risk of striking an object or a lower level during the pendulum motion.

### *Horizontal Lifeline*

Unlike a vertical lifeline, the horizontal lifeline stretches between two anchorages. When you connect a lanyard or rope grab to the horizontal lifeline, you can move about freely, thus reducing the risk of a swing fall. However, horizontal lifelines are subject to much greater loads than vertical lifelines. If they're not installed correctly, horizontal lifelines can fail at the anchorage points. For this reason, horizontal lifelines must be designed, installed, and used under the supervision of a trained and qualified person.

### *Horizontal Lifelines and Sag Angles*

Any load on a horizontal lifeline will cause it to deflect, or sag. The sag angle is a horizontal lifeline's angle of deflection when it's subjected to a load, such as a falling worker. Reducing the sag angle (making a horizontal lifeline too tight) actually increases the force on the line during a fall. As you tighten a horizontal lifeline, you increase the impact load dramatically! To reduce loads on a horizontal lifeline, increase the sag angle or connect to the lifeline with a shock-absorbing lanyard.

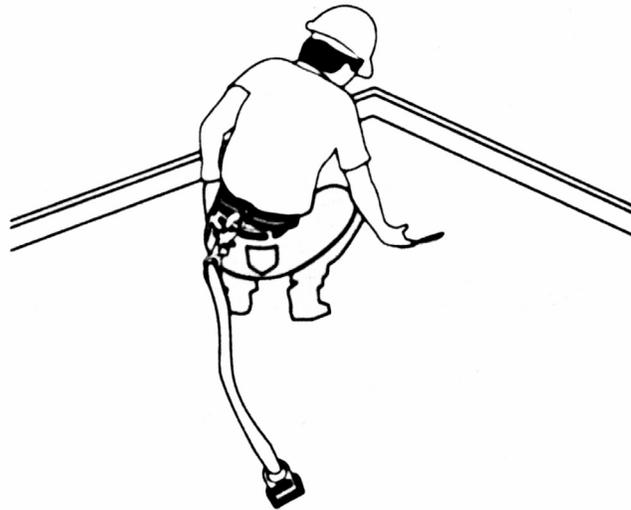
Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 9. Personal Fall-Restraint Systems

Unlike the personal fall-arrest system, which is designed to stop a fall, a personal fall-restraint system prevents a worker from reaching an unprotected edge and thus **prevents a fall from occurring**.

The system consists of an anchorage, connectors, and a body harness or a body belt. The attachment point to the body belt or full body harness can be at the back, front, or side D-rings.

The anchorage for a fall-restraint system must support at least 3,000 pounds.



Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orsosha.org](http://www.orsosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 10. Positioning-Device Systems

Positioning-device systems make it easier to work with both hands free on a vertical surface such as a wall or concrete form. Positioning-device systems are also called Class II work-positioning systems. The components of a positioning-device system — anchorage, connectors, and body support — are similar to those of a personal fall-arrest system.

However, the systems serve different purposes.

**A positioning-device system does not prevent falls but does provide support and must stop a free fall within two feet.** A personal fall-arrest system provides no support and must limit free-fall distance to six feet.



### Anchorage for Positioning-Device Systems

Positioning-device systems must be secured to an anchorage that can support at least twice the potential impact of a worker's fall or 3,000 pounds, whichever is greater.

### Connectors for Positioning-Device Systems

Connectors must have a minimum strength of 5,000 pounds. Snap hooks and D-rings must be proof-tested to a minimum load of 3,600 pounds without deforming or breaking.

### Body Support

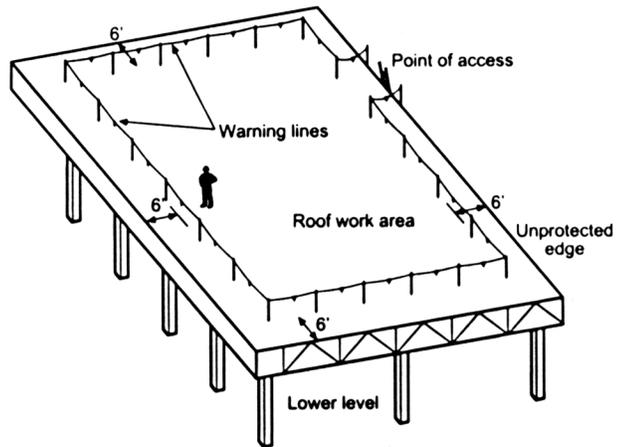
A body belt is acceptable as part of a positioning-device system. However, it must limit the arresting force on a worker to 900 pounds and it can only be used for body support. A full-body harness is also acceptable and must limit the arrest force to 1,800 pounds. Belts or harnesses must have side D-rings or a single front D-ring for positioning.

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 11. Warning Line Systems

A warning-line system for roofing work consists of ropes, wires or chains, and supporting stanchions that mark off an area where roofing work can be done without guardrails, personal fall-arrest systems, restraint systems, or safety nets. **Warning line systems are designed to prevent falls.**

Warning-line systems can only be used for roofing work on roofs that have slopes of 2:12 or less (see Factsheet 13 for more information on roof slopes). The purpose of the line is to warn roofers that they are near an unprotected edge. The warning line must be at least six feet from an unprotected edge and should:



- Be flagged at least every six feet with high-visibility material
- Be rigged so that the line is 34 to 39 inches from the walking/working surface
- Have a minimum tensile strength of 500 pounds. **Don't use plastic caution tape for a warning line**
- Be attached to each stanchion so that tension on one section of the line will not cause an adjacent stanchion to tip over (Stanchions must be able to support a force of at least 16 pounds applied horizontally in the direction of the roof edge without tipping over.)

Those who do roofing work between the warning line and an unprotected roof edge must be protected with personal fall-arrest systems, restraint systems, guardrail systems, safety monitoring systems, or safety nets.

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orsosha.org](http://www.orsosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 12. Monitoring Systems

If you are working between a warning line and an unprotected roof edge you can be protected through a safety monitoring system. This is a method in which a person, rather than a mechanical system, warns roofers when they are in danger of falling. **Monitoring systems are designed to prevent falls.**

<b>The Safety Monitor's Responsibilities:</b>	
✓	Recognize fall hazards.
✓	Warn employees when they are unaware of hazards or aren't working safely.
✓	Stay on the same walking/working surface as the workers to see them and to communicate with them while they are working.
✓	Avoid any other work or distracting activity while monitoring the workers.

### **Limits of Monitoring Systems**

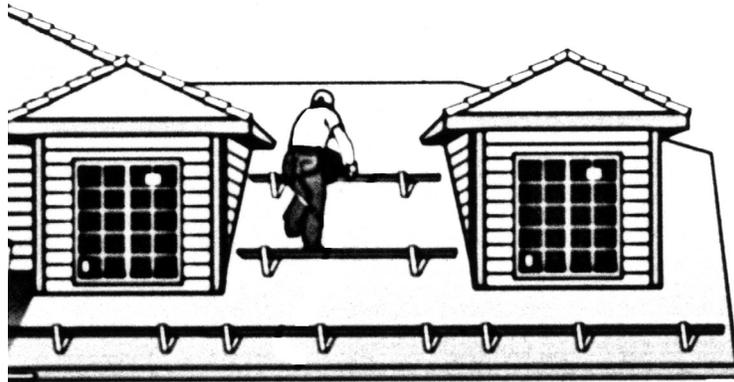
The monitor is responsible for recognizing fall hazards and warning workers about them. Safety monitoring can be used only to protect those who do roofing work on roofs that have slopes no greater than 2:12 and widths no greater than 50 feet. Safety monitoring on roofs wider than 50 feet is not permitted unless a warning-line system also protects the workers.

Only those who are doing roofing work are permitted in the area controlled by the safety monitor. Mechanical equipment can't be used or stored in the area.

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 13. Slide Guard Systems

A slide-guard system prevents workers from sliding down and falling from a sloped roof. The system consists of a slide guard (typically two-inch by six-inch lumber) and at least two roof brackets. Roof brackets are available from roofing-equipment suppliers. A slide-guard system can also be made at the work site without manufactured roof brackets. **Slide-guard systems cannot be the only means of fall protection on roofs with a ground-to-eave height greater than 25 feet.**



Requirements for slide-guard systems:

- Slide-guard systems can be used only on roofs with slopes between 3:12 and 8:12 and ground-to-eave height of 25 feet or less
- Roofs with slopes between 3:12 and 6:12 must have at least one slide guard below the work area, no closer than six inches from the eave
- Roofs with slopes between 6:12 and 8:12 must have multiple slide guards no more than eight feet apart vertically
- The lowest slide guard must be no closer than six inches from the eave
- The slide guard closest to the eave must be perpendicular to the roof surface (a 90° angle)

- All other slide guards must be set at an angle not less than 60 degrees to the roof surface
- Slide guards must provide continuous protection along the length of the roof

## Installing Slide Guards

### **Manufactured Roof Brackets**

Install manufactured roof brackets according to the manufacturer's directions. Each bracket must be six inches or larger and all brackets must bear on a solid surface. The horizontal space between brackets cannot exceed the manufacturer's specifications — or eight feet — whichever is less.

### **Attaching Slide Guards**

Use two-by-six lumber for slide guards. Secure the slide guards to the roof brackets or use another method to prevent them from failing due to material flex.

### **Job-Made Slide-Guard Systems**

Use two-by-six lumber for a job made slide-guard system. Vertical members must be backed to horizontal flat members. Anchor horizontal members to solid bearing surfaces with two 16- penny common nails or the equivalent every four feet. Anchor vertical members to horizontal members with one 16- penny common nail or the equivalent every two feet.

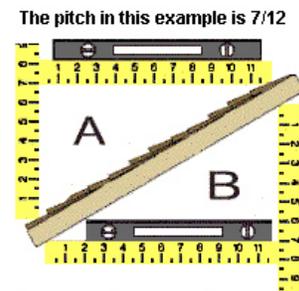
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## 13. Slide Guard Systems *(continued)*

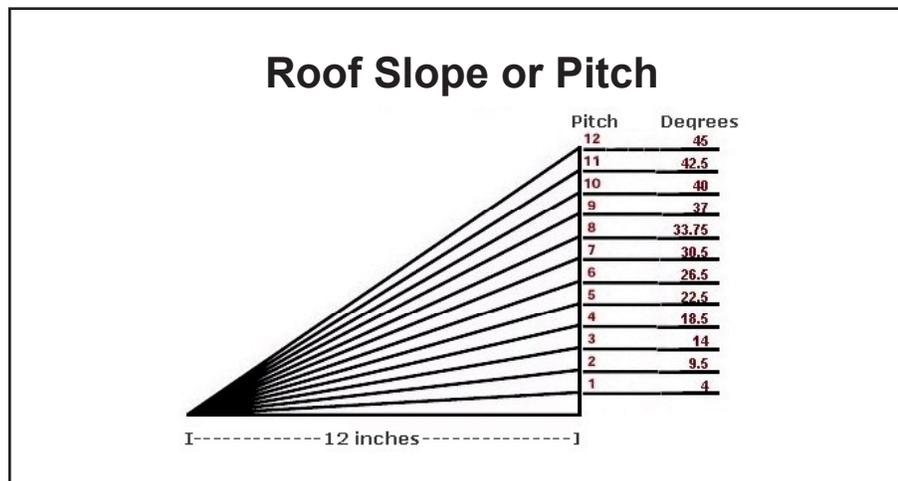
### How to Calculate Roof Slope or Pitch

So what does a slope or pitch of 7/12 mean? The 7 means that the roof rises 7 inches for every 12 inches it runs. There are two ways to calculate the roof pitch or what is also referred to as roof slope:

- Taking the measurement from the top of the roof**  
 Mark a level at 12 inches, hold it perfectly level and measure from the roof surface to your 12 inch mark, this will give you the rise. Be careful with this method as a roof with many layers of shingles, or any type of roofing that is irregular can give you less than precise results.
- Taking the measurement from the bottom of the rafters**  
 The procedure to calculate roof pitch is the same. This method tends to be more accurate because no layers of roofing are involved. To use this method there are 3 possible places to take your measurements: 1. The underside of a barge rafter on a gable end; 2. The underside of a rafter on an overhang at the bottom of the roof; and 3. The underside of a rafter in the attic.



The terminology used to describe roof pitch or slope, includes 7/12, 7-12, 7 to 12, 7 and 12, 7 on 12, and 7:12.



## 14. Other Fall Protection Safety Procedures For Residential Construction

For each of the construction installation processes listed in the table below you should follow the safety procedures.

<b>Installation Safety Procedures</b>	
<b>Tops of Foundation</b>	
✓	All form work must be properly supported before walking on top
✓	Conveniently locate materials and equipment
✓	Suspend work for adverse weather conditions
✓	Remove impalement hazards and materials from area below workers
<b>Floor Joists and Sheathings</b>	
✓	Stage materials for access
✓	Roll first joists or trusses into position and secure from ground, ladders, or sawhorse scaffolds
✓	Except for the first row of sheathing, work from established deck
✓	Roll each successive joist or truss into place and secure from a platform created from a sheet of plywood laid over previously secured joists or trusses
✓	All workers not assisting in the leading edge work are not permitted within 6 feet of the leading edge
<b>Erecting Exterior Walls</b>	
✓	Paint line 6 feet from perimeter prior to any erection to exclude access by other workers
✓	Stage material to minimize fall hazards
✓	Complete as much cutting and preparation as possible away from the deck edge
<b>Installing Trusses/Rafters</b>	
✓	Workers performing the installation must have no other duties
✓	Set first 2 trusses/rafters from ladders leaning on side wall
✓	Brace all trusses/rafters before using them as support
✓	Remain on top plate using previously stabilized truss/rafter as support while other trusses/rafters are erected
✓	Leave area of secured trusses only when necessary to secure another truss/rafter

## 14. Other Fall Protection Safety Procedures For Residential Construction *(continued)*

<b>Installing Roof Sheathing</b>	
✓	Stage Materials
✓	Install bottom row by standing in truss webs
✓	Install next rows from previously installed sheathing
✓	Install slide guards at no less than 13 foot intervals
✓	Suspend work if winds are greater than 40 mph
✓	Suspend work in adverse weather
<b>Roof Installation, Repair, Removal</b>	
✓	Must be protected by slide guards or safety monitor
✓	Install slide guards
✓	Install no more than 3 rows of material before slide guards
✓	Install slide guards along entire eave
✓	Stay 6 feet from edge except to perform work
✓	Guard or remove impalement hazards below work area
✓	Suspend work in adverse weather
✓	Use conventional fall protection when roof slope is greater than 8/12 or eave-to-next-lower-level distance is greater than 25 feet

Source: Oregon OSHA, Fall Protection for the Construction Industry, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept..., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.



## Summary

1. Falls account for the greatest number of fatalities among construction workers.
2. Fall protection is what you do to eliminate fall hazards, to prevent falls, and to ensure that workers who may fall aren't injured.
3. On any construction job where a worker could fall off an unprotected side or edge that is 6 feet or more above the lower level, the contractor must provide fall protection by using guardrails, safety nets, or personal fall arrest systems. However, on residential construction jobs, if a contractor can demonstrate that it is infeasible or creates a greater hazard to use the fall protection systems listed above, then he must develop and implement a fall protection plan that at a minimum designates a ***controlled access zone*** and/or a ***safety monitoring system***. The plan must include training workers in the procedures to be followed in order to minimize the fall hazards.
4. There are two types of fall protection and they including **fall arrest systems** which are designed to reduce the risks of injury if you fall and fall prevention systems which are designed to keep you from falling.
5. A Guardrail system consists of a toprail, midrail, and intermediate vertical member. Guardrail systems are designed to prevent falls and must be free of anything that might cut a worker or snag a worker's clothing.
6. Safety-net systems consist of mesh nets and connecting components. They are designed to catch you if you fall.
7. Rigid covers prevent workers from falling through skylights or temporary openings and holes in walking/work surfaces.
8. A personal fall-arrest system consists of an anchorage, connectors, and a full-body harness that work together to catch you if you fall and is effective only if you know how all of the components work

together. Other parts of the system may include a lanyard, a deceleration device, and a lifeline.

9. Unlike the personal fall-arrest system, which is designed to stop a fall, a personal fall-restraint system prevents a worker from reaching an unprotected edge and thus prevents a fall from occurring.
10. Positioning-device systems make it easier to work with both hands free on a vertical surface such as a wall or concrete form. Positioning-device systems are also called Class II work-positioning systems. The components of a positioning-device system — anchorage, connectors, and body support — are similar to those of a personal fall-arrest system. However, the systems serve different purposes. A positioning-device system provides support and must stop a free fall within two feet; a personal fall-arrest system provides no support and must limit free-fall distance to six feet.
11. A warning-line system for roofing work consists of ropes, wires or chains, and supporting stanchions that mark off an area where roofing work can be done without guardrails, personal fall-arrest systems, restraint systems, or safety nets.
12. If you are working between a warning line and an unprotected roof edge you can be protected through a safety monitoring system. This is a method in which a person, rather than a mechanical system, warns roofers when they are in danger of falling.
13. A slide-guard system prevents workers from sliding down a sloped roof. The system consists of a slide guard (typically made of two-inch by six-inch lumber) and at least two roof brackets. Roof brackets are available from roofing-equipment suppliers. A slide-guard system can also be made at the work site without manufactured roof brackets. Slide-guard systems cannot be the only means of fall protection on roofs with a ground-to-eave height greater than 25 feet.



# Evaluation

## Activity 7: Fall Protection

1. How important is this Activity for day laborers?

Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the factsheets you feel are the most important.

	1. Fatal Falls in the Construction Industry		8. Personal Fall-Arrest Systems
	2. How Can The Risks of Falling Be Reduced?		9. Personal Fall-Restraint Systems
	3. The Limits of Fall Protection Under OSHA		10. Positioning-Device Systems
	4. Types of Fall Protection		11. Warning Line Systems
	5. Guardrails		12. Monitoring Systems
	6. Safety Nets		13. Slide-Guard Systems
	7. Protection From Cave-ins: Slopping and Benching		14. Other Fall Protection Safety Procedures for Residential Construction

3. Which summary point do you feel is most important?

Please circle one number.

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.		

4. What would you suggest be done to improve this Activity?

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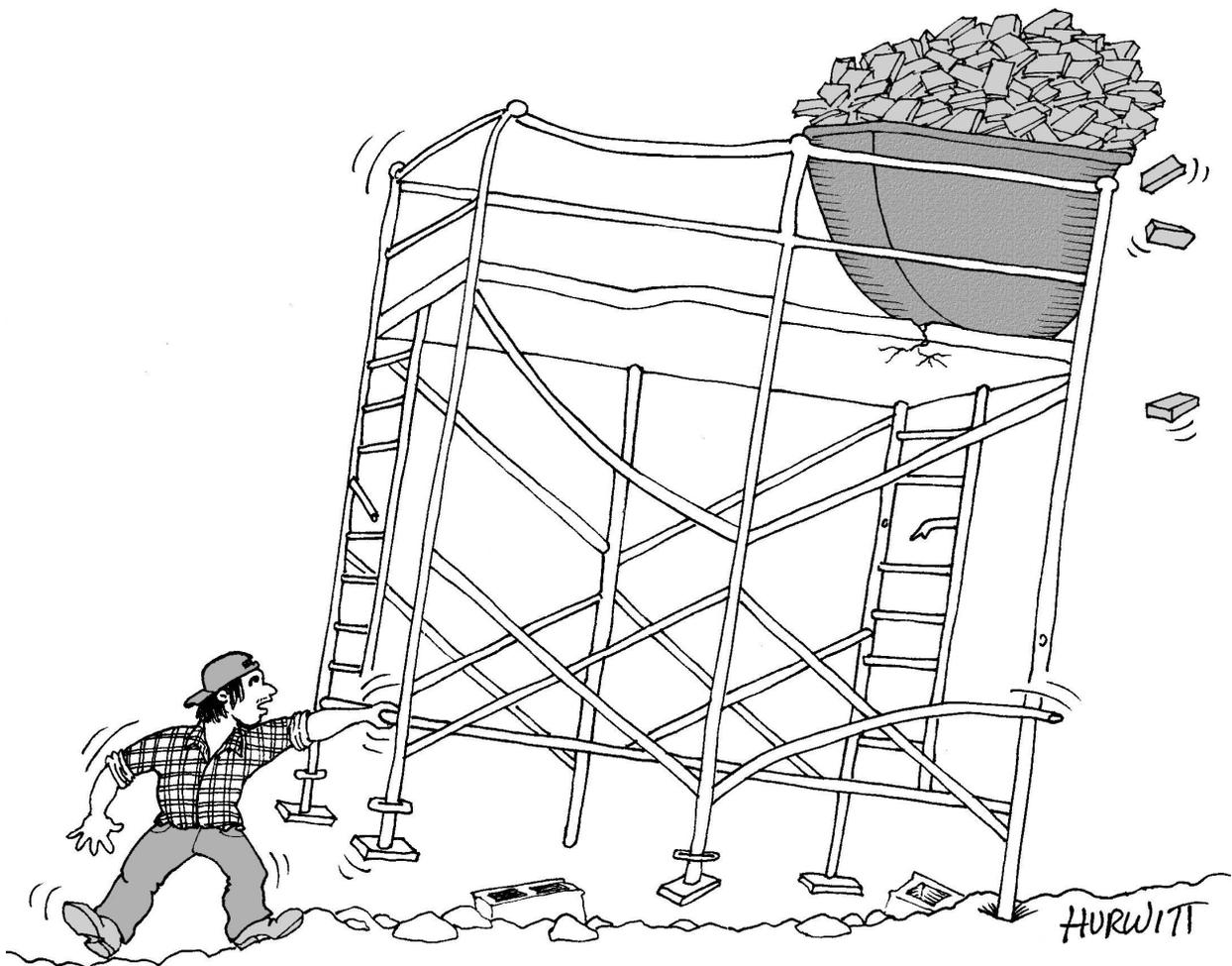


# Activity 8: Scaffold Safety

## Purpose

To learn more about how we can reduce the risks of being injured while working on scaffolds.

This Activity has two tasks.



## Task 1

---

Juan recently worked on a construction site where a scaffold collapsed and a worker was injured. Although he would prefer to stay away from them, Juan is sure that he will have to take jobs in the future that will require him to work off of scaffolds. In order to increase his awareness and reduce the risks of working on scaffolds, Juan needs answers to the questions below.

**In your groups, review the factsheets on pages 218-239 and then working together, using the factsheets and your own experience, answer the following questions.**

### Questions:

1. Can you use bricks or cinder blocks under the base plates to support a scaffold? Why or Why not?
2. When is the contractor required to provide guardrails for scaffolds?
3. Can you carry materials up and down a scaffold ladder?
4. Is there a proper way to climb up and down an ladder? (Please explain)

5. Can you use any type of lumber for a scaffold platform? (Please explain)
  
6. If you are using a ladder jack scaffold, do you need fall protection and are you required to fasten the ladders so they don't slip?
  
7. If it is straight, level, square, and rigid in all directions, is it safe to work on a scaffold in bad weather?
  
8. Do you need fall protection when working off of an aerial lift? If so what kind?

## **Task 2**

---

Juan is working a job off of a support frame scaffold. Instead of using 2 inch x 10 inch planks for mud sills, bricks and cinder blocks are supporting two of the scaffold's base plates. A diagonal brace is missing and a cross brace is partially unattached. The scaffold is twenty five feet high and there are no guardrails. The platform planks are not stamped for scaffold use. There are huge gaps between planks and they are worn and full of defects. Several of the planks are hanging over the edge where the built-in ladder is located. The contractor has instructed Juan to begin carrying materials up the scaffold's built-in ladder.

**What do you think Juan should do? What would you do?**

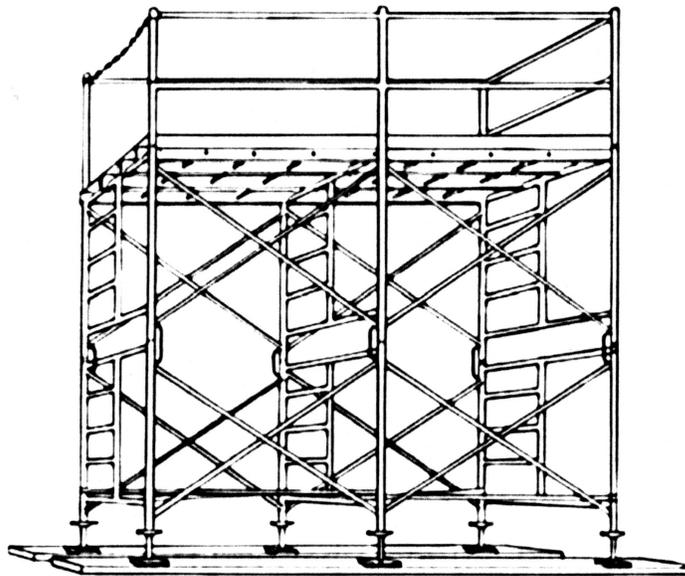


# 1. What Is a Scaffold?

A scaffold is an elevated platform that supports workers and materials. Lay a board across a couple of tall buckets and you have a supported scaffold — but not a safe one.

Scaffolds can be complex structures. Unsafe scaffolds can break, collapse, or give way. Planks, boards, decks, or handrails can fail. In some cases, entire structures have collapsed. Even on sound scaffolds, workers can slip or lose their balance, and without appropriate protection, they don't have to fall far to get hurt.

**Standard Frame Double-Pole Scaffold**



## 2. Scaffold Fatalities

In 2004, 89 workers were killed as a result of falls from scaffolds. Scaffold falls injure 29,000 workers every year. Nearly half (47%) of all scaffold accidents and deaths are caused by defective scaffolds.

In addition to problems with planks and guardrails, the main causes of injuries and deaths on scaffolds include:

- poor planning for assembling and dismantling
- missing tie-ins or bracing,
- loads that are too heavy
- being too close to power lines

<b>Fatal Falls in 2004</b>	
<b>Type of Falls</b>	<b>Number of Fatalities</b>
From Ladders	133
From Roofs	178
From Scaffolds	89

*(continued)*

## 2. Scaffold Fatalities *(continued)*

<b>Scaffold Hazards</b>	
<b>Erecting and dismantling scaffolds</b>	Fifteen to 20% of scaffold injuries involve erecting and dismantling. The most common problem is failing to provide an adequate working platform for a worker to use when installing the next lift or scaffold.
<b>Climbing up and down scaffolds</b>	Approximately 15% of scaffold-related injuries occur when workers are climbing up and down. Climbing up and down frames and/or braces are common but unacceptable practices. Ladders must be used to overcome the problem.
<b>Planks sliding off or breaking</b>	If scaffold planks are uncleaned or otherwise unsecured they easily slide off. Scaffold planks can also break if they are in poor condition or overloaded. It is important to use proper grades of lumber and inspect planks before erection to ensure that there are no weak areas, deterioration, or cracks. Another common problem is insufficient or excessive overhang of planks at their support. Excessive overhang can cause a plank to tip up when a worker stands on the overhanging portion. Insufficient overhang is a leading cause of planks slipping off.
<b>Improper loading or overloading</b>	Overloading causes excessive deflection in planks and can lead to deterioration and breaking. Overloading occurs most often in the masonry trade where skids of material can exceed 3000 lb. If the material is left overhanging the scaffold platform it can cause an imbalance leading to the scaffold overturning.
<b>Platforms not fully planked or “decked”</b>	This situation is related to injuries not only during erection and dismantling but in general scaffold use.
<b>Platforms without guardrails</b>	Platforms without guardrails are a serious safety problem in construction. Guardrails are an important fall prevention measure not only for high platforms but also for low ones. Guardrails must be installed along all open sides and ends of platforms. Guardrails for all working platforms should consist of a toprail, a midrail, and a toe board.

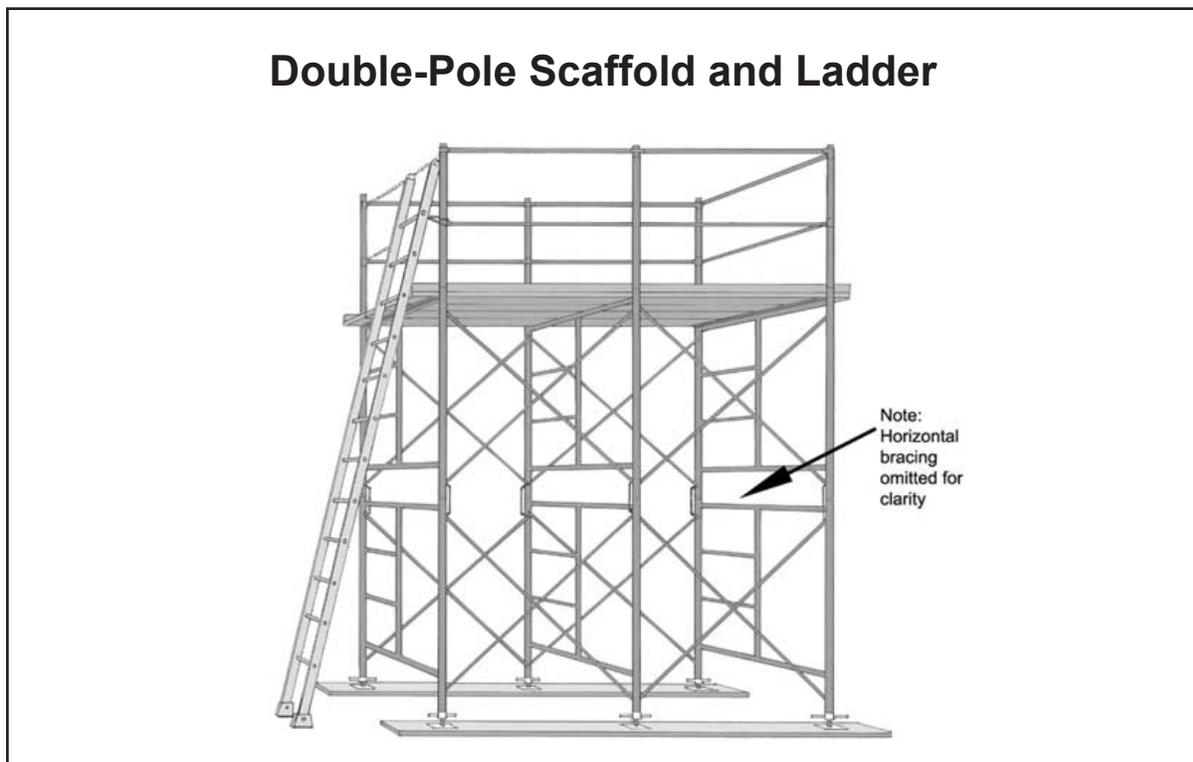
<p><b>Failure to install all required components such as base plates, connections, and braces</b></p>	<p>Failure to use all of the proper scaffold components is a serious safety problem. Corners are cut when scaffolds are only a few frames in height. All too frequently base plates, braces, and proper securing devices (such as “banana” clips or “pigtales” at the pins of frame scaffolds, and tie-ins) are not installed. Workers erecting the scaffold must have all the necessary components, and must use them to ensure that the scaffold is safe.</p>
<p><b>Moving rolling scaffolds in the vicinity of overhead electrical wires</b></p>	<p>Failure to maintain safe distances from overhead power lines while moving scaffolds is a major problem. Before attempting to move rolling scaffolds in outdoor open areas, check the route carefully to ensure that no overhead wires are in the immediate vicinity. Partial dismantling may be necessary in some situations to ensure that the scaffold will make the required safe clearances from overhead power lines. Hoisting scaffold material by forklift or other mechanical means requires careful planning and should be avoided in the vicinity of power lines. Transporting already-erected scaffolds by forklift, particularly in residential construction, has been the cause of many electrical contacts – this is a dangerous practice. Workers handling materials or equipment while working on the platform must also take care to avoid electrical contact.</p>
<p><b>Moving rolling scaffolds with workers on the platform.</b></p>	<p>Moving rolling scaffolds with workers on the platform can be dangerous. Where it is impractical for workers to climb down, and the scaffold is over 10 feet in height, each worker must be tied off with a full body harness and lanyard. Lifelines must be attached to a suitable anchor point other than the scaffold. Holes, depressions, curbs, etc. have all been responsible for scaffolds overturning while being moved. In some jurisdictions moving a scaffold with workers on the platform is prohibited if the platform exceeds a certain height.</p>

Sources: Center to Protect Workers' Rights (CPWR), *Scaffold Safety Hazard Alert*, 2004, [www.cpwr.com](http://www.cpwr.com). Construction Safety Association of Ontario Canada, *Construction Health and Safety Manual*, 2003, [www.csa.org](http://www.csa.org). Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000. Bureau of Labor Statistics (BLS), National Census of Fatal Occupational Injuries Summary 2004, <http://stats.bls.gov/news.release/foi.nr0.htm>

### 3. Supported Scaffolds

The supported double-pole scaffold pictured below is frequently used in construction. The ladder is properly sloped and secured to the scaffold structure and the rails extend 3 feet above the platform. On some systems, ladder rungs are built into the end frames. These ladders are not suitable for tall scaffold towers. Other models are equipped with ladders that attach to the end frames. Scaffolds in excess of 30 feet should have built-in stairs with rest platforms.

Most supported frame scaffolds are simple to assemble and familiar to workers employed in the construction industry. However, all parts must be used. Failure to install any of the components, such as bracing and base plates, increases the risk of accidents.



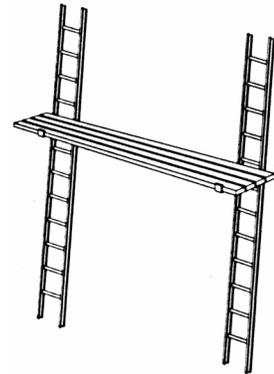
## Residential Construction

The most common types of supported scaffolds used for residential construction include:

### Ladder Jack Scaffolds

OSHA Requirements:

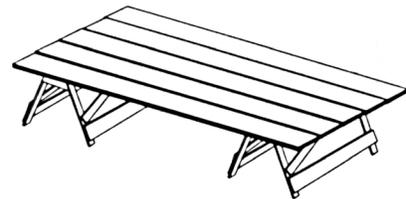
- Platforms must not exceed 20 feet in height
- All ladders used to support ladder jack scaffolds must meet the requirements of Subpart X, Stairways and Ladders
- Job-made ladders cannot be used to support ladder jack scaffolds
- The ladder jack must be designed and constructed to bear on the side rails and ladder rungs or on the ladder rungs alone
- Ladders that support ladder jacks must be placed, fastened, or equipped with devices to prevent slipping
- Scaffold platforms must not be bridged one to another



### Horse Scaffolds

OSHA Requirements:

- Scaffolds must not be constructed more than two tiers or 10 feet high, whichever is less
- When you arrange horses in tiers, place each horse directly over the horse in the tier below
- The legs of each horse must be nailed down or otherwise secured to prevent displacement
- Each tier must be cross-braced



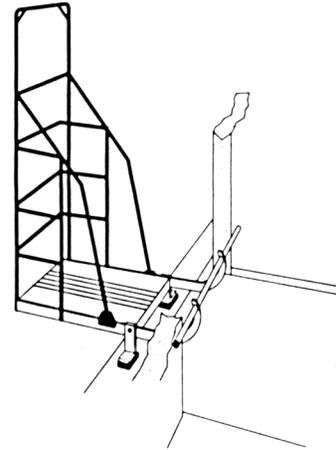
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### 3. Supported Scaffolds *(continued)*

#### Window Jack Scaffold

OSHA Requirements:

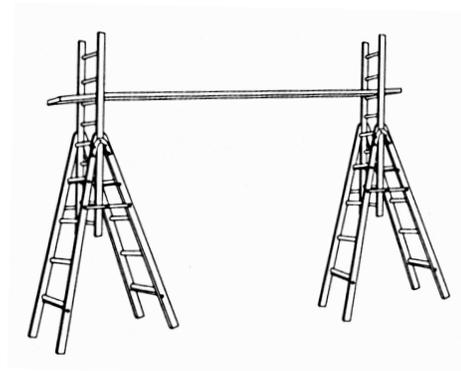
- Scaffolds must be securely attached to the window opening
- Use the scaffold to work only at the window opening through which the jack is placed
- Do not use window jacks to support planks placed between one window jack and another



#### Trestle Ladder Scaffolds

OSHA Requirements:

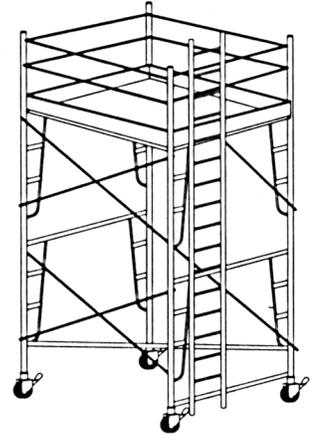
- Scaffold platforms must not be any higher than the second highest rung or step of the ladder supporting the platform
- All ladders used in conjunction with step, platform, and trestle ladder scaffolds must meet the pertinent requirements of Subpart X, Stairways and Ladders
- Do not use job-made ladders
- Ladders that support step, platform, and trestle ladder scaffolds must be placed, fastened, or equipped with devices to prevent slipping.
- Scaffolds must not be bridged one to another



## Mobile Scaffolds

### OSHA Requirements:

- Use cross, horizontal, or diagonal braces to prevent scaffolds from collapsing and to secure vertical members
- Scaffolds must be plumb, level, and squared
- All brace connections must be secured
- Lock casters and wheels to prevent scaffold movement
- When you use manual force to move a scaffold, apply the force as close to the base as practicable, but not more than 5 feet above the supporting surface
- Do not use forklifts, trucks, similar motor vehicles, or add-on motors to propel a scaffold unless the scaffold is specifically designed to be used with them
- Stabilize scaffolds so they do not tip when they are moved
- Platforms cannot extend outward beyond the scaffold base supports without outrigger frames or equivalent devices
- Use screw jacks or equivalent means to level the scaffold
- Caster stems and wheel stems must be secured in scaffold legs
- Before moving a scaffold, make sure each worker on the scaffold is aware of the move



## 4. Inspect Scaffolds Before You Start the Job

Before you use a scaffold make sure to inspect it and also make sure that weather conditions do not put you at risk. In short, you should not work on a scaffold in high winds or a storm. OSHA says you must not work on a scaffold that has ice or snow on it — except to get ice or snow off the scaffold.

<b>A Safe Scaffold:</b>	
☐	Must have safe access: internal stairs or ladders built into or attached to the frame. Do not climb the scaffold framing
☐	Must be stable and firm footed: at least 2x10x10 inch wooden bases when set on soil
☐	Must be straight, level, square, and rigid in all directions
☐	Must have diagonal bracing
☐	Must be secured to the building with strong tie-ins
☐	Must have sturdy guardrails on all open sides and ends
☐	Must have top rails 42 to 45 inches above the platform.
☐	Must be fully planked from side to side with 2x10 inch structural planks in good condition
☐	Must have planks that extend over supports by at least 6 inches but no more than 18 inches

Sources: Center to Protect Workers' Rights (CPWR), *Scaffold Safety Hazard Alert*, 2004, [www.cpwr.com](http://www.cpwr.com). Construction Safety Association of Ontario Canada, *Construction Health and Safety Manual*, 2003, [www.csao.org](http://www.csao.org). Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 5. Base Plates, Screw Jacks, Sills, Bracing, and a Solid Foundation

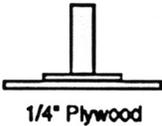
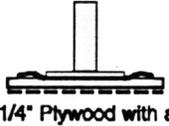
On supported scaffolds, base plates and adjustable screw jacks should be used whether the scaffold is outside on rough ground or indoors on a smooth level surface. Scaffolds erected on any type of soil should have mudsills.

### Mudsills

At minimum mudsills should be 2" x 10" planks (full size) and that are continuous under at least two consecutive supports. The scaffold feet should rest centrally on the mudsills and the sills should project at least 1 foot beyond the scaffold foot at the ends. Mudsills may be placed either along the length (longitudinally) or across the width of the frames. Generally, bearing capacity will be increased by running sills longitudinally because the sill has more contact with the ground. Base plates should be centred on the width of the sill and nailed securely after the first tier has been erected.

### Solid Foundation

To support scaffolds, backfilled soils must be well compacted and levelled. Mud and soft soil should be replaced with compacted gravel or crushed stone. Embankments that appear unstable or vulnerable to erosion by rain must be contained. Otherwise, the scaffold must be set far enough back to avoid settlement or failure of the embankment.

Type of Sill	Ground Conditions
 <p>2" X 10" Timber</p>	<ul style="list-style-type: none"> <li>• Asphalt Surface</li> <li>• Paths</li> <li>• Grass</li> <li>• Clay</li> <li>• Gravel</li> <li>• Generally Good Firm Ground</li> </ul>
 <p>3" X 12" Timber</p>	<ul style="list-style-type: none"> <li>• Soft or Loose Ground</li> <li>• Made-Up Ground</li> <li>• Wet Sites</li> <li>• All Heavy Loaded Scaffolds</li> <li>• On Earth Type Surface</li> </ul>
 <p>1/4" Plywood</p>	<ul style="list-style-type: none"> <li>• Flat Concrete</li> <li>• Level Stone</li> <li>• Steel</li> <li>• Load Bearing</li> <li>• Brick Work or Similar Work Surface</li> </ul>
 <p>1/4" Plywood with a suitable material to protect the surface</p>	<ul style="list-style-type: none"> <li>• Marble</li> <li>• Mosaic</li> <li>• Polished Wood</li> <li>• Linoleum</li> <li>• Carpets, Etc.</li> </ul>

*(continued)*

## 5. Base Plates, Screw Jacks, Sills, Bracing, and a Solid Foundation *(continued)*

### **Bracing**

Properly installed supported scaffolds include diagonal and cross braces. If the braces are missing, bent, or not properly installed, the scaffold will be unstable and more likely to collapse.

### **Beware of Frozen Soil**

Take particular care when erecting scaffolds on frozen ground. Thawing soil is often water-soaked, resulting in considerable loss of bearing capacity. You must take thawing into account when tarps or other covers will be placed around a scaffold and the enclosure will be heated.

### **No Bricks, Blocks or Pieces of Lumber Under Scaffolds!**

Do not use blocking or packing such as bricks, short pieces of lumber, or other scrap materials either under scaffold feet or under mudsills. If the scaffold is subjected to heavy loading, bricks or blocks can break. Vibration can cause blocking to move or shift, leaving a scaffold leg unsupported. Unbalanced or unsupported legs can topple a scaffold when heavy loads are applied.

## 6. Guardrails

Guardrails prevent workers from falling but OSHA does not require guardrails until scaffolds are 10 feet high. Unfortunately a considerable number of severe injuries and even fatalities are due to falls from scaffolds that are less than 10 feet high.

Some manufacturers have recently introduced temporary guardrails workers can use when erecting scaffolds. A guardrail can be set in position from the previous level and can provide a protected work platform for the worker to install the next level of components. Each type of guardrail has a unique design and system of attachment to the scaffold.

<b>Guardrail Requirements</b>	
☐	Toprail should be 38 to 45 inches high
☐	Toprails may be wood, metal or cable
☐	Toprail must withstand a force of 200 pounds (or 100 pounds on suspension scaffolds)
☐	Midrails must be 1 x 6 inch lumber or an equivalent material
☐	Toe Boards must be at least 3.5 inches high

Sources: Construction Safety Association of Ontario Canada, Construction Health and Safety Manual, 2003, [www.csao.org](http://www.csao.org). Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 7. Ladders and Safe Access

Whether built into frames, attached as a separate component, or portable, ladders are an important means of access to scaffold platforms. Unfortunately, suitable ladders are not often provided or used.

A major problem with ladders built into the frame is that planks sometimes stick out so far that it's difficult to get from the ladder to the platform. This situation results in many injuries but can be overcome in one of three ways:

- Use manufactured platform components which do not project beyond the support
- Use a portable ladder where platform elevations are less than 30 feet in height
- Use a stand-off vertical ladder with a cage

You should always place portable straight ladders with an adequate slope and secure them to the scaffold structure. Ladder rails should extend at least 3 feet above the platform level to make it easier to get on and off the ladder. Rest stations should be decked in on scaffold towers at intervals no greater than every 30 feet.

### **Proper Use of the Ladder (Three Point Climbing)**

Falls often happen when workers are getting on or off the ladder at the platform level. Both hands must be free to hold guardrails or ladder rails. Do not carry tools or materials by hand when climbing ladders. Wear a tool belt and pouch and move material up or down by rope.

Always use three-point contact when climbing ladders. This means using two hands and one foot, or two feet and one hand, to maintain contact with the ladder at all times. Always face the ladder when climbing and always keep your center of gravity between the two ladder rails.

Sources: Construction Safety Association of Ontario Canada, Construction Health and Safety Manual, 2003, [www.csao.org](http://www.csao.org). Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 8. Safe Platforms

Platforms for frame scaffolds are normally aluminum/plywood platforms or wood planks. Planks normally come in 8-foot or 16-foot lengths to cover one or two 7-foot bays with adequate overhang. Scaffold platforms must be fully decked or planked between the front uprights and the guardrail supports.

<b>What To Look For</b>	
<b>Platform gaps</b>	Platform units must be placed so that the spaces between the units do not exceed one inch.
<b>Platform and walkway widths</b>	Platforms and walkways must be at least 18 inches wide. If work areas are too narrow for 18-inch platforms or walkways, workers can use narrower platforms, but they must be protected from fall hazards by guardrails and/or personal fall-arrest systems.
<b>Front edge of platforms</b>	The front edge of a scaffold platform cannot be more than 14 inches from the face of a structure unless guardrails or personal fall-arrest systems are used to protect workers from falling between the structure and the platform. There are two exceptions to this requirement: (1) the front edge distance for outrigger scaffolds must be no more than three inches; and (2) scaffolds used for plastering and lathing work can be no more than 18 inches from the face of a structure.
<b>Platform lengths</b>	A platform 10 feet or less in length must extend at least 6 inches, but no more than 12 inches, beyond its support unless the excess length is guarded or can support workers and material without tipping. A platform longer than 10 feet can extend no more than 18 inches beyond a support unless the excess length is guarded or can support workers and material without tipping.
<b>Abutted planks</b>	When platform planks are abutted to create a long platform, each abutted end must rest on a separate support. Abutted planks touch end to end on separate support surfaces; they do not rest on one another.
<b>Overlapped planks</b>	Platform planks overlapped to create a long platform must overlap at least 12 inches over supports unless the planks are nailed together or otherwise restrained so they do not move.
<b>Paint (opaque) finishes</b>	Wood platforms cannot be covered with opaque finishes, because opaque finishes cover defects in wood. Wood platform edges, however, may be marked for identification. Preservatives or slip-resistant and fire-retardant finishes are acceptable as long as the finish does not cover structural defects or make them hard to spot.
<b>Mixed or modified components</b>	Scaffold components made by different manufacturers cannot be mixed unless they fit together easily and do not change the scaffold's integrity. Components made by different manufacturers cannot be modified to intermix unless a competent person approves. Scaffold components made from different metals cannot be used together.

Source: OR-OSHA, Scaffolds, Temporary Elevated Work Platforms, Guidelines for Oregon Workers, 2003, [www.orosha.org](http://www.orosha.org) Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 9. Scaffold Capacity

Scaffolds and scaffold components must not be loaded over their maximum intended loads or rated capacities. Remember that the maximum intended load for a component depends on the scaffold type and configuration. Scaffolds and components must be able to support four times their maximum intended load —not the rated load. The intended load includes workers, equipment, and supplies. The intended load should never exceed the rated load unless the design is approved by an engineer and the manufacturer.

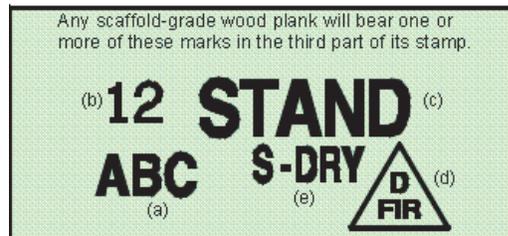
### Load Distribution

When materials are placed on scaffolds they should be distributed evenly across the platform. Heavier loads should be distributed across the platform and centered on the scaffold's uprights.

### Use Only Scaffold Grade Lumber

Scaffold grade wood planks are identified by grading stamps that may include:

- 12
- STAND
- ABC
- S-DRY
- 



Scaffold planks must be in good condition. Look for damage that reduces width, length, thickness, or strength. Replace damaged planks immediately.

## 10. Suspension Scaffolds

OSHA defines a suspension scaffold as one or more platforms suspended by ropes or other non-rigid means from an overhead structure. Suspension scaffold outrigger beams must be able to support at least 4 times the intended load.

<b>Suspension Scaffold Safety Procedures</b>	
☐	Suspension scaffolds must be attached to the roof, tied to a secure anchorage, or secured with counterweights
☐	Suspension ropes and rigging must support at least 6 times the intended load
☐	Counterweights must be attached to secure and strong places on a building so they won't move
☐	Do not use counterweights that consist of bags of sand or gravel, masonry blocks, or roofing materials that can flow or move
☐	Do not use gas-powered equipment or hoists
☐	Hoists must have automatic brakes for emergencies
☐	A 1-point or 2-point suspended scaffold must be tied or secured to prevent swaying

Various types of suspension scaffolds include:

### **Interior Hung Scaffolds**

OSHA Requirements:

- Scaffolds must be suspended only from a roof or other structural members such as ceiling beams
- Inspect overhead supporting members such as roofs or ceiling beams before erecting the scaffold
- Connect suspension ropes and cables to overhead supporting members by shackles, clips, or thimbles

### **Multi-level Suspended Scaffolds**

OSHA Requirements:

- Scaffolds must be equipped with additional independent support lines equal to the number of supported points, as strong as the suspension ropes, and rigged to support the scaffold if the suspension rope(s) fails

*(continued)*

## 10. Suspension Scaffolds *(continued)*

- Independent support lines and suspension ropes must not be attached to the same anchorage points
- Supports for platforms must be attached directly to the support stirrup and not to any other platform

### Multi-point Adjustable Suspension Scaffolds

OSHA Requirements:

- When you use two or more scaffolds, they must not be bridged to one another unless they are designed to be bridged, the bridge connections are articulated, and the hoists are properly sized
- If bridges are not used, you can go from one platform to another only when the platforms are the same height and are abutting
- Scaffolds must be suspended from metal outriggers, brackets, wire rope slings, or hooks

### Two-Point Adjustable Suspension Scaffolds

OSHA Requirements:

- Platforms must not be more than 36 inches wide
- Platforms must be securely fastened to hangers
- The blocks for fiber or synthetic ropes must consist of at least one double and one single block. The sheaves of all blocks must fit the size of the rope used
- Platforms must be ladder-type, plank-type, beam-type or light-metal-type
- Do not bridge or connect two-point scaffolds to one another when raising or lowering them unless the bridge connections are attached and the hoists are properly sized
- You can go from one platform to another only when the platforms are the same height, are abutting, and you use walk-through stirrups specifically designed for this purpose

## 11. Fall Protection

When you work from a scaffold more than 10 feet above a lower level, you must be protected from falling. The contractor has the option, in many cases, of protecting workers with guardrails or personal fall-arrest systems. However, on single-point or two-point adjustable suspension scaffolds, guardrails and personal fall-arrest systems are required. On other types of scaffolds only personal fall-arrest systems are allowed. The table below shows the fall protection required for various types of scaffolds.

<b>Fall Protection Required</b>	<b>Type of Scaffold</b>
<b>Personal fall-arrest system</b>	<ul style="list-style-type: none"> <li>• boatswain's chair</li> <li>• catenary scaffold</li> <li>• float scaffold</li> <li>• needle beam scaffold</li> <li>• ladder jack scaffold</li> </ul>
<b>Guardrails</b>	<ul style="list-style-type: none"> <li>• self-contained adjustable scaffold when platform is supported by the frame structure</li> <li>• walkways located within a scaffold</li> </ul>
<b>Personal fall-arrest system and guardrails</b>	<ul style="list-style-type: none"> <li>• single-point adjustable suspension scaffold</li> <li>• two-point adjustable scaffold</li> <li>• self-contained adjustable scaffold when platform is supported by ropes</li> </ul>
<b>Personal fall-arrest system, guardrails, or grabline</b>	<ul style="list-style-type: none"> <li>• crawling board (chicken ladder)</li> </ul>
<b>Personal fall-arrest system or guardrails</b>	<ul style="list-style-type: none"> <li>• overhand bricklaying on a supported scaffold</li> <li>• all other types of scaffolds not identified in this table</li> </ul>

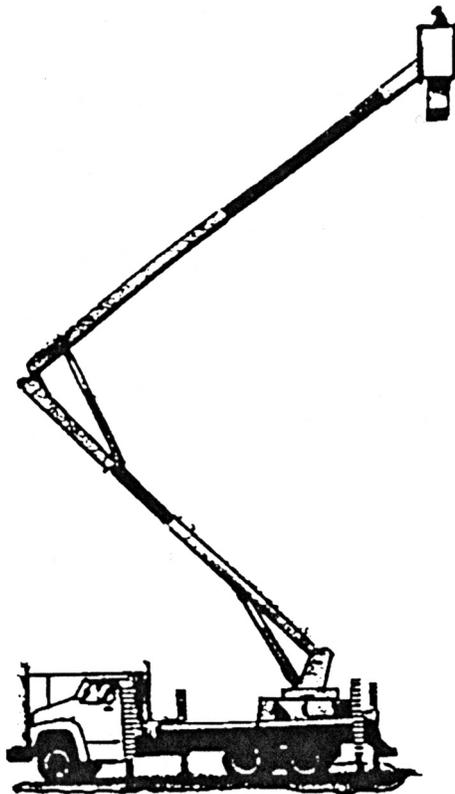
Source: OR-OSHA, Scaffolds, Temporary Elevated Work Platforms, Guidelines for Oregon Workers, 2003, [www.orosha.org](http://www.orosha.org)

## 12. Aerial Lifts

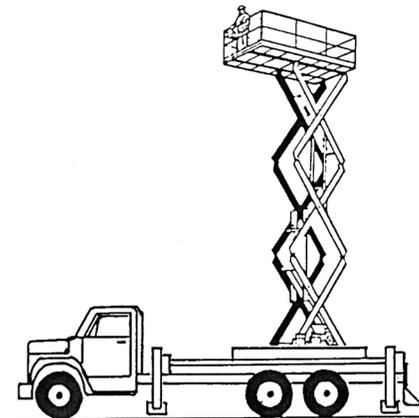
Aerial lifts are vehicle-mounted or self propelled elevating work platforms. The various types of aerial lifts include:

- Vehicle-mounted elevating and rotating work platforms
- Manually propelled elevating aerial platforms
- Boom-supported elevating work platforms
- Self-propelled elevating work platforms

### Vehicle-Mounted Elevating and Rotating Aerial Devices



Vehicle-Mounted Aerial Platform with Telescoping and Rotating Boom



Vehicle-Mounted Aerial Platform (Scissor Type)

## Fall Protection for Aerial Lifts

The fall protection required for aerial lifts depends on the type of aerial lift used. The table below shows the acceptable fall protection for each type of lift.

<b>Type of Lift</b>	<b>Fall Protection Required</b>
<b>Vehicle-mounted elevating and rotating work platforms</b>	Platforms other than buckets or baskets must include guardrail systems—guardrails, a midrail, and toe boards. Each person who works on a boom-support platform must wear a body harness and lanyard attached to the boom or basket
<b>Manually propelled elevating aerial platforms</b>	The platform must have a guardrail 39-45 inches above the floor, a midrail, and toe boards at least 4 inches high.
<b>Boom-supported elevating work platforms</b>	The platform must have a guardrail 39-45 inches above the floor, a midrail, and toe boards at least 4 inches high. Each worker on the platform must wear a body harness and lanyard attached to the boom or platform.
<b>Self-propelled elevating work platforms</b>	The platform must have a guardrail 39-45 inches above the floor, a midrail, and toe boards at least 4 inches high.

Source: OR-OSHA, Scaffolds, Temporary Elevated Work Platforms, Guidelines for Oregon Workers, 2003, [www.orosha.org](http://www.orosha.org)  
Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## **13. Falling Objects**

Workers on scaffolds must wear hard hats and be protected by toe boards, screens, guardrail systems, debris nets, catch platforms, or canopies when falling objects are a hazard.

If tools, materials, or equipment could fall from a scaffold and hit others, the area below the scaffold must be barricaded or a toe board must be placed along the edge of the scaffold platform. Paneling or screening must protect persons below when tools, materials, or equipment are piled higher than the top edge of the toe board. In addition, guardrail systems, canopies, or catch platforms may be installed to retain materials.

## 14. Follow Safe Procedures On Scaffolds

<b>Do's and Don'ts For Scaffold</b>	
<b>Do's</b>	<b>Don'ts</b>
Make sure all connectors are in place and completely tight	Do not allow tools, materials or debris to collect on scaffolds
Replace guardrails after loading or unloading	Never throw or drop tools, materials or equipment from scaffolds
Use 3-point climbing	Do not stand on ties
Get off mobile scaffolds before they move	Do not stand on guardrails or plank extensions
Wear the right clothing and safety gear	Do not overreach outside of the guardrails
	Stay off scaffolds during loading and unloading
	Don't hang traps without evaluation
	Never leave partially dismantled scaffolds unguarded or unlabeled

Source: Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## Summary

1. A scaffold is an elevated platform that supports workers and materials.
2. Each year, more than 60 workers are killed by falls from scaffolds. Nearly half (47%) of all scaffold accidents and deaths are caused by defective scaffolds.
3. Supported frame scaffolds are simple to assemble, widely used by the construction trades and the components can be lifted manually by workers. However, all parts must be used! Failure to install any of the components, such as bracing and base plates, increases the risk of accidents.
4. Before you use a scaffold make sure to inspect it and also make sure that weather conditions do not put you at risk.
5. On supported scaffolds, base plates and adjustable screw jacks should be used whether the scaffold is outside on rough ground or indoors on a smooth level surface. Scaffolds erected on any type of soil should have a mudsill. Never use bricks, short pieces of lumber, or other scrap materials under scaffold feet or under mudsills.
6. Guardrails prevent workers from falling but OSHA does not require guardrails until scaffolds are 10 feet high. Unfortunately a considerable number of severe injuries and even fatalities are due to falls from scaffolds that are less than 10 feet high.
7. Falls often happen when workers are getting on or off the ladder at the platform level. Both hands must be free to hold guardrails or ladder rails. Do not carry tools or materials by hand when climbing ladders. Wear a tool belt and pouch and move material up or down by rope. Always use three-point contact when climbing ladders.

8. All scaffold platforms, except walkways and platforms used by erectors and dismantlers, must be fully decked or planked between the front uprights and the guardrail supports.
9. Scaffolds and scaffold components must not be loaded over their maximum intended loads or rated capacities. Scaffolds and components must be able to support four times their maximum intended load—not the rated load. The intended load includes workers, equipment, and supplies. The intended load should never exceed the rated load unless the design is approved by an engineer and the manufacturer.
10. OSHA defines a suspension scaffold as one or more platforms suspended by ropes or other non-rigid means from an overhead structure. Suspension scaffold outrigger beams must be able to support at least 4 times the intended load.
11. When you work from a scaffold more than 10 feet above a lower level, you must be protected from falling. The contractor has the option, in many cases, of protecting workers with guardrails or personal fall-arrest systems. However, on single-point or two-point adjustable suspension scaffolds, guardrails and personal fall-arrest systems are required. On other types of scaffolds only personal fall-arrest systems are allowed.
12. Aerial lifts are vehicle-mounted or self propelled elevating work platforms. The fall protection required for aerial lifts depends on the type of aerial lift used.
13. Workers on scaffolds must wear hard hats and be protected by toe boards, screens, guardrail systems, debris nets, catch platforms, or canopies when falling objects are a hazard.



# Evaluation

## Activity 8: Scaffold Safety

1. How important is this Activity for day laborers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an "X"** by the factsheets you feel are the most important.

1.	What Is a Scaffold	8.	Safe Platforms
2.	Scaffold Fatalities	9.	Scaffold Capacity
3.	Supported Scaffolds	10.	Suspension Scaffolds
4.	Inspect Scaffolds Before You Start the Job	11.	Fall Protection
5.	Base Plates, Screw Jacks, Sills and a Solid Foundation	12.	Aerial Lifts
6.	Guardrails	13.	Falling Objects
7.	Ladders and Safe Access	14.	Follow Safe Procedures On Scaffolds

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.		

4. What would you suggest be done to improve this Activity?

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# **Activity 9: Hand and Power Tools Safety**

## **Purpose**

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To learn more about how we can reduce the risks of hand and power tool injuries on the job.

This Activity has two tasks.

## Task 1

In your groups, review Factsheets 1-7 on pages 248-257. Then using the factsheets and your own experience complete the Hand and Power Tool Worksheet below.

<b>Hand and Power Tool Worksheet</b>			
<b>How to complete the worksheet:</b>			
Column I: Place a check next to the type of tools you use on jobs.			
Column II: Place a check next to the type of tools that have caused your or your co-workers to be injured.			
Column III: Use the factsheets and your own experience to explain what happened and how the injury could have been prevented.			
	<b>Column I</b>	<b>Column II</b>	<b>Column III</b>
Type of Tool	Tools You Use on Jobs (✓)	Tools That Have Caused Injuries (✓)	For each type of tool that has caused an injury explain what happened and how the injury could have been prevented.
<b>Hand</b> (see Factsheet 1)			
<b>Electric</b> (see Factsheet 3)			
<b>Powder-Actuated</b> (see Factsheet 4)			
<b>Pneumatic</b> (see Factsheet 5)			
<b>Hydraulic</b> (see Factsheet 6)			
<b>Liquid Fuel (Gas)</b> (see Factsheet 7)			



# 1. Hand Tool Hazards

Manually powered hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance. For example:

- If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other workers
- If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other workers
- If the jaws of a wrench are sprung, the wrench might slip
- If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other workers

Personal protective equipment (PPE) such as safety goggles and gloves should be worn to protect against hazards that may be encountered while using hand tools.

## 2. Power Tool Hazards

The types of power tools are determined by their power source:

- electric
- powder-actuated
- pneumatic
- hydraulic
- liquid fuel

Power tools are extremely hazardous when used improperly. They must be fitted with guards and safety switches.

<b>Power Tool General Precautions</b>	
✓	Never carry a tool by the cord or hose.
✓	Never yank the cord or the hose to disconnect it from the receptacle.
✓	Keep cords and hoses away from heat, oil, and sharp edges.
✓	Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
✓	Keep all people not involved with the work at a safe distance from the work area.
✓	Secure work with clamps or a vise, freeing both hands to operate the tool.
✓	Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
✓	Maintain tools with care; keep them sharp and clean for best performance. Follow instructions in the user's manual for lubricating and changing accessories.
✓	Be sure to keep a good footing and maintain good balance when operating power tools.
✓	Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.
✓	Remove all damaged portable electric tools from use and tag them: "Do Not Use."

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## **3. Electric Tools**

Electrical burns and shocks are among the most serious electrical tools hazards. Electrical shocks, can lead to heart failure. Under certain conditions, even a small amount of electric current can result in fibrillation—irregular beats or quivering—of the heart and death. An electric shock can also cause the operator to fall off a ladder or other elevated work surface and be injured due to the fall.

### **Use Three-Wire Cords With a Ground**

In order to reduce the risks of shock and burns, electric tools must have a three-wire cord that is double insulated, grounded and plugged into a grounded receptacle, or powered by a low voltage isolation transformer. Three-wire cords contain two current carrying conductors and a grounding conductor. Any time an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong must never be removed from the plug.

### Double-Insulated Tools

Double-insulated tools provide protection against electrical shock without third-wire grounding. On double insulated tools, an internal layer of protective insulation completely isolates the external housing of the tool.

### Ground-Fault Circuit Interrupters (GFCIs)

In the construction industry, electric tools must be protected by ground-fault circuit interrupters or an assured equipment-grounding conductor program.

<b>Electric Power Tools Do's and Don'ts</b>	
✓	Operate electric tools within their design limitations.
✓	Use gloves and appropriate safety footwear when using electric tools.
✓	Store electric tools in a dry place when not in use.
✓	Do not use electric tools in damp or wet locations unless they are approved for that purpose.
✓	Keep work areas well lighted when operating electric tools.
✓	Ensure that cords from electric tools do not present a tripping hazard.

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 4. Powder-Actuated Tools

Powder-actuated tools operate like a loaded gun. They are used to fire a fastener into hard materials such as concrete, mild steel and masonry. Powder-actuated tools are so dangerous that they must be operated only by specially trained employees. The trained operator must select a powder level—high or low velocity—that is appropriate for the powder-actuated tool and necessary to do the work without excessive force.

<b>Hazards of Powder-Actuated Tools</b>	
<b>Hazard</b>	<b>Description</b>
Flying Particles	On impact, materials may break up, blow apart, or spall off. This often happens when fasteners are fired too close to a corner of masonry or concrete or when they strike materials such as glazed tile, hollow tile, or thin marble tile.
Ricochets	These usually result when the tool is not held at right angles to the base material, or the fastener hits a particularly hard material such as stone or hardened steel. Always check the base material to ensure that it can safely accept the fastening device.
Noise	Powder-actuated tools create an extreme pulse of sound when fired. Operators and others in the area should wear hearing protection – especially when the tool is operated in a confined space.
Sprains and Strains	These injuries usually result from using the tool repeatedly in awkward, cramped, or unbalanced positions. Operators should try to work from a balanced position on a solid surface.
Explosions	There is always the risk of explosion or fire when the tools are used in atmospheres contaminated by flammable vapor, mist, or dust. The work area must be ventilated – mechanically if necessary.
Blow-Through	When the base material does not offer enough resistance, the fastener may pass completely through and fly out the other side. This is particularly dangerous when fasteners penetrate walls, floors, or ceilings where others may be working. If necessary, areas behind, around, and under material should be kept clear of people.

<b>Do's and Don'ts for Powder-Actuated Tools</b>	
✓	Do not use a tool in an explosive or flammable atmosphere.
	Inspect the tool before using it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions and has the proper shield, guard, and attachments recommended by the manufacturer.
✓	Do not load the tool unless it is to be used immediately.
	Do not leave a loaded tool unattended, especially where it would be available to unauthorized persons.
✓	Never point the tool at anyone.
✓	Keep hands clear of the barrel end.
✓	Do not fire fasteners into material that would allow the fasteners to pass through to the other side.
✓	Do not drive fasteners into very hard or brittle material that might chip or splatter or make the fasteners ricochet.
✓	Always use an alignment guide when shooting fasteners into existing holes.
✓	When using a high-velocity tool, do not drive fasteners more than 3 inches (7.62 centimeters) from an unsupported edge or corner of material such as brick or concrete.
✓	When using a high velocity tool, do not place fasteners in steel any closer than 1/2-inch (1.27 centimeters) from an unsupported corner edge unless a special guard, fixture, or jig is used.

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 5. Pneumatic Tools

Many different types of tools are powered by compressed air. They are fast, powerful, and ideal for repetitive tasks such as the nailing of large areas of roof decking or chipping and breaking concrete. A compressor, powered by a combustion or electric motor, supplies the air for the tools.

Air-powered tools include:

- jack hammers
- chipping hammers
- drills
- grinders
- sanders
- staplers
- framing nailers
- wrenches
- brad nailers
- winches
- air nozzles
- saws
- buffers
- impact tools
- sprayers

<b>Hazards of Pneumatic Tools</b>	
<b>Hazard</b>	<b>Description</b>
Air Embolism	This is the most serious hazard, since it can lead to death. If compressed air from a hose or nozzle enters even a tiny cut on the skin, it can form a bubble in the bloodstream – with possibly fatal results.
Physical Damage	Compressed air directed at the body can easily cause injuries –including damage to eyes and eardrums.
Flying Particles	Compressed air at only 40 pounds per square inch can accelerate debris to well over 70 miles per hour when it is used to blow off dust, metal shavings, or wood chips. These particles then carry enough force to penetrate the skin.

<b>Do's and Don'ts for Pneumatic Tools</b>	
✓	Run combustion engines outside or in a well ventilated area to prevent the build-up of carbon monoxide gas.
✓	When moving compressors to another location, ask for help or use mechanical devices to prevent back injuries.
✓	Occasionally workers suffer eye injuries when compressed air is used to blow out form work. Wear safety goggles and respiratory protection.
✓	Always secure hose connections with wire or safety clips to prevent the hose from whipping except when automatic cut-off couplers are used.
✓	Make sure hoses are clear of traffic and pose no tripping hazards.
✓	Replace worn-out absorption pads and springs. Too much vibration of the tool can damage nerves in fingers, hands, and other body parts. This is called "white finger disease" or Raynaud's Syndrome.
✓	Some tools have a high decibel rating – for instance, jack hammers and impact drills. To prevent hearing loss, always wear hearing protection.
✓	Never tamper with safety devices.
✓	Keep hands away from discharge area – on nailers in particular.
✓	Match the speed rating of saw blades, grinding wheels, cut-off wheels, etc. to tool speed. Too fast or too slow a rotation can damage the wheels, release fragments, and injure workers.
✓	Never use air to blow dust or dirt out of work clothes. Compressed air can enter the skin and bloodstream with deadly results.
✓	Turn off the pressure to hoses when the system is not in use.
✓	Turn off the air pressure when changing pneumatic tools or attachments. Never "kink" a hose to stop air flow.

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 6. Hydraulic Power Tools

Many different types of tools are powered by hydraulic fluids. Hydraulic tools are powered by high pressure liquid, (water or oil that is pumped through a hose). One of the prime hazards of hydraulic tools is that leaks can develop in the hose or around the tool's fittings. Cases have been recorded in which workers have tried to "plug" such holes with a finger or hand. The high pressure has actually been known to force oil into the skin.

Hydraulic tools must be checked for leaks, cracks or kinks and inspected to ensure that all connections are secure. When operating hydraulic power tools the manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

### When to Use Insulating Hydraulic Fluid

The insulating type of hydraulic fluids are used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines.

### Fire

When using hydraulic power tools fire is also a major concern. In order to reduce the risk of fire the fluid used in hydraulic power tools must be an approved fire resistant fluid that retains its operating characteristics at extreme temperatures.

## 7. Liquid Fuel Tools

Fuel-powered tools are usually operated with gasoline. Fuel vapors are among the most serious hazards associated with the use of fuel-powered tools. Fuel vapors can burn or explode and also give off dangerous exhaust fumes. Gas or fuel must be handled, transported, and stored in approved flammable liquid containers, according to proper procedures for flammable liquids.

Fuel powered tools include:

- Masonry Saws
- Concrete Saws
- Chain Saws
- Pressure Washers
- String Trimmers
- Edgers
- Hedge Trimmers

### **Proper Procedures for Fuel Powered Tools**

Before refilling a fuel-powered tool tank, the operator must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors. When a fuel-powered tool is used inside a closed area, effective ventilation and/or proper respirators such as atmosphere-supplying respirators must be utilized to avoid breathing carbon monoxide. Fire extinguishers must also be available in the area.

### **Personal Protective Equipment (PPE)**

You should wear eye and hearing protection when operating fuel-powered tools.

## Task 2

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In your groups, review Factsheets 8-11 on pages 260-265. Then using the factsheets and your own experience answer the questions below.

### Questions:

1. You have been hired to operate a “Porter Cable Grinder” for an entire day (8-hours). Do you need ear protection? Why or Why not?
2. When operating a grinder do you need eye protection? Why or why not?
3. Before using the grinder you notice the following:

The **control switch** on the grinder is stuck in the “on” position and the only way to shut it off is by removing the power cord plug from the receptacle.

The **protective guards** are missing and **grinder wheel** appears to be cracked.

What should you do?



## **8. Guards**

The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.

Machine guards must be provided to protect the operator and others from the following:

- Point of operation
- In-running nip points
- Rotating parts
- Flying chips and sparks

Safety guards must never be removed when a tool is being used. Portable circular saws having a blade greater than 2 inches (5.08 centimeters) in diameter must be equipped at all times with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work material.

## 9. Operating Controls and Switches

Hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released. These tools also may be equipped with a “lock-on” control, if it allows the operator to also shut off the control in a single motion using the same finger(s).

### Power Tools that Require a Constant-Pressure Switch or Control Shut Off

- belt sanders
- reciprocating saws
- saber saws
- scroll saws
- jigsaws with blade shanks greater than 1/4-inch wide
- other similar tools
- drills
- tappers
- fastener drivers
- horizontal, vertical, and angle grinders with wheels more than 2 inches in diameter
- disc sanders with discs greater than 2 inches (5.08 centimeters)

The following hand-held power tools must be equipped with either a positive “on-off” control switch, a constant pressure switch, or a “lock-on” control:

- disc sanders with discs 2 inches or less in diameter
- grinders with wheels 2 inches or less in diameter
- platen sanders, routers, planers, laminate trimmers, nibblers, shears, and scroll saws
- jigsaws, saber and scroll saws with blade shanks a 1/4-inch or less in diameter

It is recommended that the constant-pressure control switch be regarded as the preferred device. Hand-held power tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools with no means of holding accessories securely, must be equipped with a constant-pressure switch.

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000.

## 10. Portable Abrasive Wheel Tools

In order to prevent portable abrasive grinding, cutting, polishing, and wire buffing wheels from throwing off flying fragments they must be equipped with guards that:

1. Cover the spindle end, nut, and flange projections
2. Maintain proper alignment with the wheel
3. Do not exceed the strength of the fastenings

Before an abrasive wheel is mounted, it must be inspected closely for damage and should be *sound* or *ring* tested to ensure that it is free from cracks or defects.

### Ring Testing An Abrasive Wheel

To test an abrasive wheel, tap the wheel gently with a light, non-metallic instrument. If it sounds cracked or dead, do not use it.. A stable and undamaged wheel, when tapped, will give a clear metallic tone or “ring.”

### **Reduce the Risk of Cracking**

To prevent an abrasive wheel from cracking, it must fit freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place without distorting the flange. Always follow the manufacturer's recommendations and make sure that the spindle speed of the machine will not exceed the maximum operating speed marked on the wheel.

### **Reduce the Risk of Disintegration During Start-Ups**

An abrasive wheel may disintegrate or explode during start-up. Allow the tool to come up to operating speed prior to grinding or cutting. The operator should never stand in the plane of rotation of the wheel as it accelerates to full operating speed.

### **Portable Grinders**

Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of wheel breakage.

When using a powered grinder:

- Always use eye or face protection
- Turn off the power when not in use
- Never clamp a hand-held grinder in a vise

## 11. Power Tools and Noise

Overexposure to noise can lead to permanent hearing loss. The National Institute of Occupational Safety and Health (NIOSH) recommends that hearing protection be worn, when operating power tools with a decibel (dB) level above 85. Tools with lower dB levels pose less of a hazard than tools with higher dB levels.

### Decibels and Exposure Limits

Decibels (dB) measure the loudness of noise. This measure is based on a mathematical shorthand, using multiplication rather than addition. When decibels go up by 3, loudness doubles. For example, 93 dB is twice as loud as 90 dB.

In general, the louder the noise, the shorter the amount of time you can be exposed before hearing protection is required. For example, you can be exposed to a noise level of 90 dB for 8 hours per day before hearing protection is required. But if the noise level reaches 115 dB and the exposure exceeds 15 minutes then hearing protection is required.

Permissible Noise Exposures	
Duration Per Day in Hours	Sound Level in dB
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5 (30 minutes)	110
.25 (15 minutes)	115

<b>Electric Power Tool Decibel Levels</b>	
<b>Type of Tool</b>	<b>Decibel Level (dB)</b>
<b>Circular Saws</b> (Unloaded)	
• Makita (Model #5277NB)	95
• Milwaukee (Model #6390-20)	97
• DeWalt (Model #DW364)	103
• Porter Cable (Model #324MAG)	109
<b>Drills</b> (Unloaded)	
• Makita (Model #6303H)	89
• Milwaukee (Model #0300-20)	90
• DeWalt (Model #DW235G)	93
• Skil (Model #6265)	98
<b>Grinders</b> (Unloaded)	
• Makita (Model #9527NB)	97
• Milwaukee (Model #6156-20)	98
• DeWalt (Model #DW818)	101
• Porter Cable (Model #7430)	103
<b>Jig Saw</b> (Unloaded)	
• Skil (Model #4380)	92
• Black and Decker (Model #1590EVSK)	95
• Milwaukee (Model #6266-22)	98
• DeWalt (Model #DW318)	98

Sources: OSHA Publication 3080, *Hand and Power Tools*, 2002. Building and Construction Trades Dept., Construction Industry Partnership, *The Smart Mark Residential Construction Health and Safety Training Program*, 2000. National Institute of Occupational Safety and Health (NIOSH), Power Tools Database, [www.cdc.gov/niosh/topics/noise/workplace\\_solutions/toolsDatabase\\_alt.html](http://www.cdc.gov/niosh/topics/noise/workplace_solutions/toolsDatabase_alt.html).

## Summary

1. The greatest hazards posed by hand tools result from misuse and improper maintenance.
2. Power tools are extremely hazardous when used improperly. They must be fitted with guards and safety switches.
3. Electrical burns and shocks are among the most serious electrical tools hazards. Under certain conditions, a small amount of electric current can result in fibrillation of the heart and death. An electric shock also can cause the operator to fall off a ladder or other elevated work surface and be injured due to the fall.
4. Powder-actuated tools operate like a loaded gun and are used to fire a fastener into hard materials such as concrete, mild steel and masonry. They must be treated with extreme caution and are so dangerous that they must be operated only by specially trained employees.
5. Tools powered by compressed air are fast, powerful, and ideal for repetitive tasks such as the nailing of large areas of roof decking or chipping and breaking concrete. Compressed air directed at the body can easily cause injuries –including damage to eyes and eardrums.
6. Hydraulic tools are powered by high pressure liquid, (water or oil that is pumped through a hose). Hydraulic tools can develop leaks in the hose or around the tool's fittings. Cases have been recorded in which workers have tried to “plug” such holes with a finger or hand. The high pressure has actually been known to force oil into the skin.
7. Fuel-powered tools are usually operated with gasoline. Fuel vapors are among the most serious hazards associated with the use of fuel-powered tools. Fuel vapors can burn or explode and also give off dangerous exhaust fumes. Gas or fuel must be handled, transported, and stored in approved flammable liquid containers, according to proper procedures for flammable liquids.

8. The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.
9. Hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released. These tools also may be equipped with a “lock-on” control, if it allows the operator to also shut off the control in a single motion using the same finger(s).
10. Before an abrasive wheel is mounted, it must be inspected closely for damage and should be *sound* or *ring* tested to ensure that it is free from cracks or defects.
11. Overexposure to noise can lead to permanent hearing loss. The National Institute of Occupational Safety and Health (NIOSH) recommends that hearing protection be worn, when operating power tools with a decibel (dB) level above 85.



# Evaluation

## Activity 9: Hand and Power Tools Safety

1. How important is this Activity for day laborers?

**Please circle one number.**

<b>Activity Is Not Important</b>			<b>Activity Is Very Important</b>	
1	2	3	4	5

2. Please **put an “X”** by the factsheets you feel are the most important.

	1. Hand Tool Hazards		6. Hydraulic Power Tools
	2. Power Tool Hazards		7. Liquid Fuel Tools
	3. Electric Tools		8. Guards
	4. Powder-Actuated Tools		9. Operating Controls and Switches
	5. Pneumatic Tools		10. Portable Abrasive Wheel Tools
			11. Power Tools and Noise

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.				

4. What would you suggest be done to improve this Activity?

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# **Activity 10: Personal Protective Equipment and Chemical Protective Clothing**

## **Purpose**

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To evaluate the importance, use and limits of personal protective equipment (PPE) and chemical protective clothing in preventing injuries and exposures.

This Activity has two tasks.

## Task 1

---

Juan has found work moving equipment and chemicals from one building to another. He has been on the job for several days. The contractor has informed Juan that he will have more work at the same location for at least another week. On the jobsite Juan has noticed that some workers are wearing personal protective equipment (PPE) while others are not. At this point Juan is wearing a hard hat (his own) but he's starting to worry that he may not be properly protected.

Review the jobsite conditions described by Juan below and the factsheets on pages 274-288 and then working in your groups make a list of the PPE Juan should be wearing on this job. Also, if you need more information than Juan has provided please list the follow-up questions you would ask Juan.

### **Juan's List of Jobsite Conditions:**

1. It's so loud that I have to scream for others to hear me talk and each day I come home with a ringing in my ears.
2. There are workers working above me using power tools and other equipment.
3. The 55 gallon chemical drums have residue on them and some are leaking.
4. Because of the work being performed above me there are small objects flying all over the place.
5. Sharp objects (nails, pieces of metal, etc.) are all over the floor.

**Based on your own experience and the factsheets on pages 274-288, complete the worksheet below to determine what PPE Juan should be wearing on this job.**

<b>PPE</b>	<b>YES</b>	<b>NO</b>	<b>NOT SURE</b>	<b>Why, Why Not, or Need More Information (List Factsheet(s) Used)</b>
Eye Protection				
Head Protection				
Hand Protection				
Body Protection				
Foot/Leg Protection				
Hearing Protection				

# 1. PPE and the Hierarchy of Controls

The Occupational Safety and Health Administration (OSHA) requires employers to eliminate, substitute or use engineering controls to reduce hazardous conditions on the job. Employers must apply these *higher level controls* before resorting to the use of *lower level controls* such as warnings, training and procedures and the use of personal protective equipment (PPE). It is important to recognize that **PPE is the least effective way to control a hazard.**

Hierarchy of Controls
1. Elimination/Substitution
2. Engineering
3. Warnings (administrative)
4. Training Procedures
5. Personal Protective Equipment

Applying the *Hierarchy of Controls* is the most effective way to deal with workplace hazards. The lower levels of control—warnings, training/procedures, and PPE—are acceptable only when the higher levels of control—elimination, substitution or engineering—are not feasible or do not adequately reduce risk.

## Selecting the Right PPE

OSHA strongly recommends that employers conduct a comprehensive *hazard assessment* prior to determining the PPE needed. For each work site, a certificate must be completed that lists the findings of the inspections and the specific protective equipment needed.

In order to select the appropriate PPE employers should:

- Conduct an exposure assessment to determine the type and amount of hazardous exposure
- Take into account the factors affecting PPE selection
- Understand the assigned protection factors
- Know the kinds of PPE and their characteristics

Factors Affecting PPE Selection
<b>Physical configuration of the job site</b> <i>(Will PPE be used in tightly constrained areas with machinery that could snag hoses?)</i>
<b>Medical condition of the person wearing the PPE</b>
<b>Correct fit and comfort of PPE</b>
<b>Resistance to physical stress</b> <i>(Will PPE be used in an area where abrasions, cuts, punctures or tears may occur?)</i>

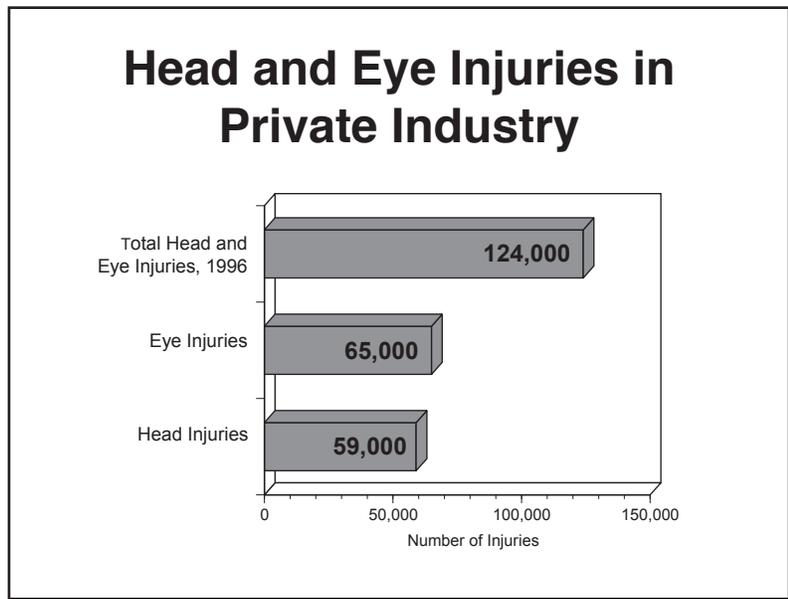
Sources: OSHA Regulations (Standards 29 CFR), *PPE*, 1910.132 and *Non-Mandatory Compliance Guidelines for Hazard Assessment and PPE Selection*, 1910 Subpart I App B. Center for Disease Control, 1998.

## 2. Eye Protection

Eye protection must be provided where there is a potential for injury to the eyes or face from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or a combination of these. Protective eye equipment should:

- Provide adequate protection against the particular hazards
- Be comfortable to wear under the existing work conditions
- Fit snugly without interfering with a person's movement or vision
- Be durable
- Be capable of being disinfected
- Be kept clean and in good repair

For eye protection, it is important that the protective equipment properly fit the person without interfering with their ability to move or see.



Source: Occupational Safety and Health Administration, *Personal Protective Equipment*, Washington DC, 1998.

### 3. Head Protection

Serious head injuries can kill or impair you for life. Wearing a properly fitted safety helmet or hard hat is one of the easiest ways to protect your head from injury. Hard hats can protect you from impact and penetration hazards as well as from electrical shock and burns.

If you are working on a job where objects might fall from above or there is a possibility of accidental head contact with electrical hazards, or you could bump your head against fixed objects (e.g., exposed pipes or beams) then you should be wearing a hard hat. Whenever you are working below others who are using tools or working under a conveyor belt, you should be wearing a hard hat.

#### Types of Hard Hats

##### **Class A:**

- General service (building construction, shipbuilding, lumbering)
- Good impact protection but limited voltage protection

##### **Class B:**

- Electrical/Utility work
- Protects against falling objects and high-voltage shock and burns

##### **Class C:**

- Designed for comfort, offers limited protection
- Protects against bumps from fixed objects, but does not protect against falling objects or electrical shock

Hard hats must have a hard outer shell and a shock-absorbing lining that includes a headband and straps that suspend the shell from 1 to 1 1/4 inches away from the head. This provides shock absorption during an impact and ventilation during normal wear. Protective headgear must meet ANSI Standard Z89.1-1986 (Protective Headgear for Industrial Workers) or provide an equivalent level of protection (see Factsheet 5 for more information on ANSI Standards).

Source: OSHA Publication 3151-12R, Personal Protective Equipment, 2003.

## 4. Hand Protection

There are many types of gloves available to protect against a wide variety of hazards. It is extremely important that you use gloves that are designed for the hazards and tasks of the job you are doing. Gloves made for protection against one hazard may not protect against another hazard even though they may appear to be protecting your hands.

In general, gloves fall into four groups:

- **Leather, canvas or metal mesh** provide protection from cuts, burns, or heat;
- **Fabric and coated fabric** gloves provide protection from dirt and abrasions
- **Chemical and liquid-resistant gloves** provide protection from burns, irritation and dermatitis;
- **Insulating rubber gloves** provide protection from cuts, lacerations and abrasions

<b>Factors That Determine Glove Selection</b>	
✓	Type of chemicals handled
✓	Nature of contact (total immersion, splash, etc.)
✓	Duration of contact
✓	Area requiring protection (hand only, forearm, arm)
✓	Grip requirements (dry, wet, oily)
✓	Thermal protection
✓	Size and comfort
✓	Abrasion/resistance requirements

Source: OSHA Publication 3151-12R, Personal Protective Equipment, 2003.

## 5. Use the Proper Gloves for Chemicals

If you work with chemicals you must use protective gloves. Unfortunately, MSDSs fall short of making specific recommendations for glove protection.

There is no glove currently available that is resistant to all chemicals, and no glove offers protection for an infinite period of time. That leaves important questions that must be answered including:

- How long should we use the gloves?
- After exposure can we decontaminate the gloves?
- After glove reuse will decontamination cause degradation?

### **ASTM Standards**

In order to help you answer these questions the American Society for Testing and Materials (ASTM) has developed several standards regarding the performance of glove protection (F1407,F739,F903). The ASTM standards address glove degradation, permeation, penetration and breakthrough (*see Factsheet 7 for more information on degradation, permeation, penetration and breakthrough*).

If the gloves you are using have been tested by the manufacturer using the ASTM standards, it will say so on the packaging and you will be able to determine if the gloves are appropriate for the work you are doing. If they have not been tested you should not use them.

*(continued)*

## 5. Use the Proper Gloves for Chemicals *(continued)*

The chart below lists some common materials used in making gloves and their protection values (*see the Appendix on pages 435 for a list of various gloves and their protection ratings for specific chemicals. Use it to help you select the most appropriate gloves for your protection*).

MATERIAL	PROTECTION VALUE
<b>Butyl Rubber</b>	Resistant to bases and many organics.
<b>Neoprene</b>	Resistant to mineral acids, organic acids, caustics, alcohol, and petroleum solvents.
<b>Nitrile</b>	Resistant to mineral acids, caustics, and petroleum solvents.
<b>Natural Rubber</b>	Resistant to ketones, alcohols, caustics, and organic acids.
<b>Polyurethane</b>	Resistant to alcohols, bases, aliphatic hydrocarbons
<b>Polyvinyl Chloride (PVC)</b>	Resistant to mineral acids, caustics, organic acids, and alcohols.
<b>Polyvinyl Alcohol (PVA)</b>	Resistant to chlorinated solvents, petroleum solvents and aromatics (not resistant to water).

Sources: *Centers for Disease Control, 1998*. OSHA, May 1995; *Fit the Glove* by Gerard Arotti. Michael Roder, *A Guide For Evaluating the Performance of Chemical Protective Clothing (CPC)*, US Dept. of Health and Human Services; June 1990.

## 6. Body Protection

There are many varieties of body protection available for specific hazards. The following are examples of workplace hazards that could cause bodily injury:

- Cuts
- Radiation
- Temperature extremes
- Hot splashes from molten metals and other hot liquids
- Impacts from tools, machinery and materials
- Hazardous chemicals

Protective clothing comes in a variety of materials (each effective against particular hazards) including:

- Paper-like fiber used for disposable suits provide protection against dust and splashes.
- Treated wool and cotton adapts well to changing temperatures, is comfortable, and fire-resistant and protects against dust, abrasions and rough and irritating surfaces.
- Duck is a closely woven cotton fabric that protects against cuts and bruises when handling heavy, sharp or rough materials.
- Leather is often used to protect against dry heat and flames. Rubber, rubberized fabrics, neoprene and plastics protect against certain chemicals and physical hazards.
- When chemical or physical hazards are present, check with the clothing manufacturer to ensure that the material selected will provide protection against the specific hazard.

*(continued)*

## 6. Body Protection *(continued)*

### Types of Chemical Protective Clothing (CPC)

If a hazard indicates a need for full body protection against toxic substances or harmful physical agents, the clothing should be carefully inspected before each use; it must fit and function properly. The following are the basic types of CPC available. In emergency situations where the chemical is unknown and airborne, OSHA requires all employers to provide Hazmat team responders with fully encapsulated suits to protect both skin and lungs.

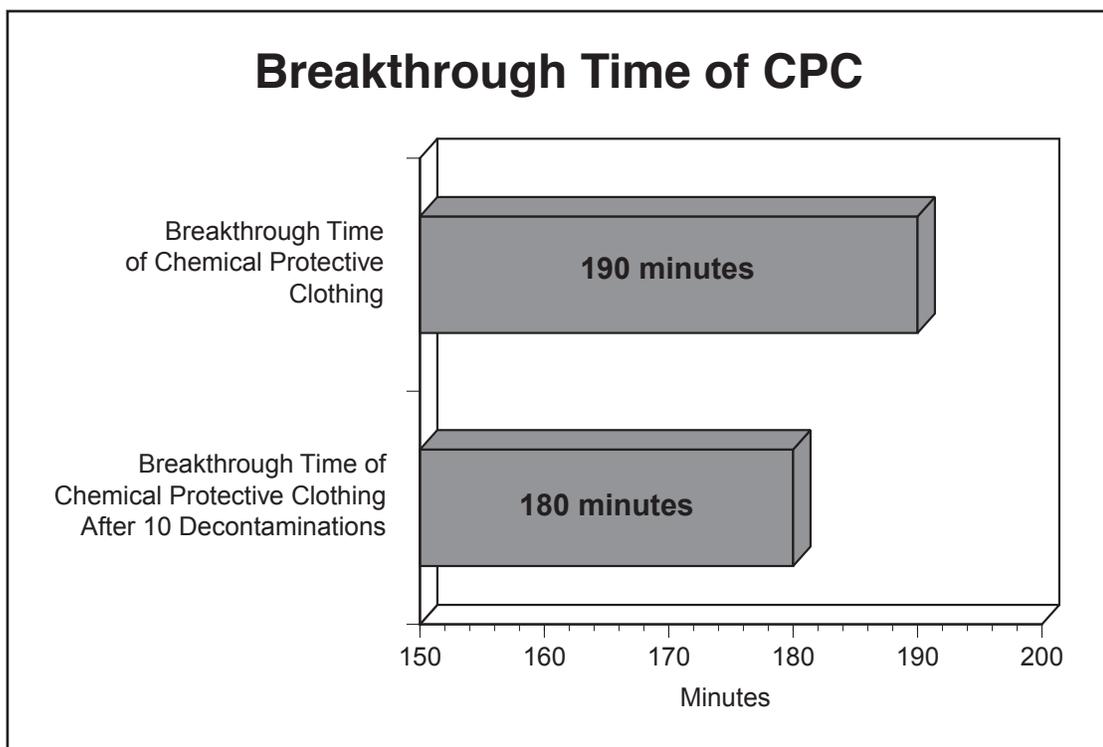
<b>CPC for Emergencies</b>
<p><b>Fully Encapsulated Suits</b> These suits protect from splashes and vapors. The encapsulated suit is used with a supplied air mask and self-contained breathing apparatus (SCBA) so that a sealed environment is created to keep out all forms of contaminants.</p>
<p><b>Splash Suits (Non-Encapsulating Suits)</b> The suit consists of a jacket and hood in combination with a pair of pants or bib overalls. The suit provides protection from chemical splashes. It is worn with protective boots and gloves. Duct tape is used to seal any overlap between boot and cuff, glove and sleeve, and hood and respirator.</p>
<b>Other CPC</b>
<p><b>Aprons, Leggings and Sleeve Protectors</b> These garments do not provide full and complete body protection. However, they do provide additional splash protection when used with non-encapsulating suits.</p>
<p><b>Face-Shields and Goggles</b> When full-face respirators are used, the face and eyes are protected. In situations where these respirators are not used, face-shields or goggles need to be used to protect the face from chemicals.</p>
<p><b>Helmets, Hoods and Hair Coverings</b> This type of equipment is used in some situations to provide head protection against chemicals. Safety helmets are also used to protect against head hazards.</p>

Source: OSHA Standard 29 CFR 1910.138, "Hand Protection. OSHA Personal Protective Equipment Program, *General Guidelines for Choosing Personal Protective Equipment*, App. A and B. OSHA Publication 3151-12R, Personal Protective Equipment, 2003.

## 7. The Limits of CPC

CPC can leak. The leakage has a lot to do with *breakthrough time*—the point when a chemical *permeates* the protective clothing.

A Department of Health and Human Services study found that the breakthrough time of CPC can decrease from 190 minutes to 180 minutes after 10 decontaminations (disinfecting or sterilizing the clothing).



*(continued)*

## 7. The Limits of CPC *(continued)*

### Evaluating CPC

There are three things to keep in mind when evaluating the limits of protective clothing:

#### 1. Permeation

When the chemical passes through the protective material, this is called permeation. For example, even though a plastic glove looks solid, it still has many pores and open spaces. The proper glove will provide a barrier, but over time and with extended use, chemicals eventually pass through.

#### 2. Degradation

When the chemical corrodes, dissolves or damages the protective clothing, this is called degradation. If the chemical changes the protective properties of the clothing, then it will no longer be protective. Sometimes degradation is visible—the material may be puckered, brittle and/or eroded. Sunlight and high temperatures can cause degradation.

#### 3. Penetration

When a chemical passes through a garment/glove by way of holes or imperfections, this is called penetration. Penetration can occur at zippers or stitched seams and through pin holes or tears in a garment or glove.

## 8. Foot/Leg Protection

If you face possible foot or leg injuries from falling or rolling objects, crushing or penetrating materials, exposure to hot substances, corrosive or poisonous materials, or exposure to electrical hazards then you will need foot and leg protection.

When to Wear Foot or Leg Protection	
✓	When heavy objects such as barrels or tools might roll onto or fall on the feet
✓	Working with sharp objects such as nails or spikes that could pierce the soles or uppers of ordinary shoes
✓	Exposure to molten metal that might splash on feet or legs
✓	Working on or around hot, wet or slippery surfaces
✓	Working when electrical hazards are present

Foot and leg protection choices include the following:

- **Leggings** protect the lower legs and feet from heat hazards such as molten metal or welding sparks.
- **Metatarsal guards** protect the instep area from impact and compression.
- **Toe guards** fit over the toes of regular shoes to protect the toes from impact and compression hazards.
- **Combination foot and shin guards** protect the lower legs and feet, and may be used in combination with toe guards when greater protection is needed.
- **Safety shoes** have impact-resistant toes and heat-resistant soles that protect the feet against hot work surfaces common in roofing, paving and hot metal industries. The metal insoles of some safety shoes protect against puncture wounds. Safety shoes may also be designed to be electrically conductive to prevent the buildup of static electricity in areas with the potential for explosive atmospheres or nonconductive to protect workers from workplace electrical hazards.

Source: OSHA Publication 3151-12R, Personal Protective Equipment, 2003.

## 9. Hearing Protection

Overexposure to noise can lead to permanent hearing loss. If you are experiencing any of the symptoms listed below then you may be overexposed to noise.

- Difficulty hearing normal speech in the work area
- Shouting to make oneself heard more than an arm’s length away
- Ringing in the ears after leaving the work area
- After work, dulled or muffled hearing that disappears after 14 hours (It’s hard to hear normal conversation, TV, radio, etc.)
- Headaches, dizziness or other health conditions related to stress (for example: high blood pressure, fatigue, etc.)
- Co-workers who are hard of hearing

### Decibels and Exposure Limits

Decibels (dB) measure the loudness of noise. **When decibels go up by 3, loudness doubles.** For example, 93 dB is twice as loud as 90 dB.

In general, the louder the noise, the shorter the amount of time you can be exposed before hearing protection is required. For example, you can be exposed to a noise level of 90 dB for 8 hours per day before hearing protection is required. But if the noise level reaches 115 dB hearing protection is required if the exposure exceeds 15 minutes.

<b>Permissible Noise Exposures</b>	
<b>Duration Per Day in Hours</b>	<b>Sound Level in dB</b>
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5 (30 minutes)	110
.25 (15 minutes)	115

## **Types of Hearing Protection**

The basic types of hearing protection include:

- **Single-use earplugs** made of waxed cotton, foam, silicone rubber or fiberglass wool. They are self-forming and, when properly inserted, they work as well as most molded earplugs.
- **Pre-formed or molded earplugs** must be individually fitted by a professional and can be disposable or reusable. Reusable plugs should be cleaned after each use.
- **Earmuffs** require a perfect seal around the ear. Glasses, facial hair, long hair or facial movements such as chewing may reduce the protective value of earmuffs.

### **Ear Plugs Not Always Effective**

A National Institute for Occupational Safety and Health (NIOSH) study shows that as actually worn in the facility, earplugs **are less than half as effective** in protecting workers' hearing as their manufacturers claim. In 15 different facilities, 420 workers had their hearing tested while wearing one of four types of earplugs. The results were compared with the earplug manufacturers' claims. None of the plugs provided the claimed percentage of effectiveness.

### **Ear Muffs May Provide Even Less Protection**

Ear muff manufacturers also dangerously overstate the effectiveness of their product. In fact, earmuffs may provide even less protection than earplugs. A study of shipyard workers showed there was greater hearing impairment among the workers who had used earmuffs than those who had used plugs. A study concluded that plastic plugs were more comfortable to wear than earmuffs, and therefore provided the best protection for long-term use.

Sources: NIOSH, *A Practical Guide to Preventing Hearing Loss*, 96-110, Appendix B, "Hearing Protection Devices," July, 1999 OSHA Publication 3151-12R, Personal Protective Equipment, 2003.

## 10. Cleaning and Maintenance of PPE

Here are some guidelines for the cleaning and maintenance of PPE:

- All protective equipment should be maintained in good condition and replaced when no longer suitable for its purpose.
- PPE should not be used longer than the time indicated by the manufacturer.
- PPE should be cleaned, disinfected and thoroughly examined before it is used again.
- A record should be kept of the condition, cleaning, disinfection, and examination of personal protective equipment.
- When PPE is sent off site to be cleaned, care should be taken to make sure that the contractor fully understands the precautions necessary for handling contaminated clothing.



## Task 2

---

You have been offered a job that will require you to wear a respirator. The contractor has assured you that he has the proper equipment for the job.

**In your groups review the factsheets on pages 292-298, then working together make a list of questions you should ask about the job and respirator before doing the work.**

---

**Questions you would ask the contractor before starting the job:**

1.

2.

3.

4.

5.

## 11. Respirators: A Last-Ditch Control

Respirators are extremely limited as a control device. Their use must be carefully monitored. Here are some of the major problems:

Respirators...

- Are hot and uncomfortable
- Often fit poorly (allowing the toxic substance to get in)
- Put extra stress on the heart and lungs
- Limit conversation (and therefore safety)
- Do not offer any protection whatsoever against many chemicals
- Do not stop the toxic chemical from getting into the environment
- Do not prevent skin exposure
- Do not prevent eye exposure

## 12. What OSHA Says About Respirators

Here's what OSHA says in its respiratory protection standard (29 CFR 1910.134):

**“...In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used.”**

According to OSHA, any workplace where respirators are necessary to protect the health of workers or whenever respirators are required, the employer must establish and implement a written respiratory protection program.

<b>Written Respiratory Protection Programs Must Include:</b>
Procedures for selecting respirators.
Medical evaluation for workers who are using respirators.
Fit testing.
Procedures for proper use of respirators in routine and emergency situations.
Procedures and schedules for proper cleaning and maintaining of respirators.
Procedures to ensure air quality and flow of breathing for atmosphere-supplying respirators.
Training in the proper use of respirators, their limitations and their maintenance.
Procedures for regularly evaluating the effectiveness of the program.

## 13. Types of Respirators

### **Air-Purifying Respirators (APRs)**

These are the most commonly used and misused respiratory protection devices. They involve the use of cartridges or canisters that contain either filters (to screen out dusts, fumes, or mists) or activated charcoal or other absorbent material (to screen out organic vapors, acids, gases, etc.) to reduce exposures of the wearer. APRs come in two types:

- **Negative-pressure** types (either half-face or full-face), where filtered air is not forced into the mask
- **Powered-air** types, where filtered air is forced into the mask

The powered-air respirator is more protective and more comfortable than the negative-pressure type because it forces air to flow out, thereby helping to prevent inward leakage of contaminants. APRs generally leak at the seal between the face and the mask. That's why you need to be fit-tested.

### **Supplied Air Respirators**

This respirator involves wearing a mask, which is hooked up to a “fresh,” uncontaminated, outside source of air by a hose. This fresh, unfiltered air (no cartridges or canisters are used) is forced into the face-piece. This type of equipment offers more protection than the air-purifying respirators but can be cumbersome to wear.

### **Self-contained breathing apparatus (SCBA)**

This is similar to a supplied-air respirator but the fresh uncontaminated source of air comes from a “bottle” or “tank” worn on the back. **This is the only type of respirator protection permitted for use in atmospheres that are Immediately Dangerous to Life or Health (IDLH).**

### **Particulate Respirators**

Particulate respirators are the simplest, least expensive, and least protective of the respirator types available. **Particulate respirators only protect against particles. They do not protect against chemicals, gases, or vapors, and are intended only for low hazard levels.** Particulate respirators are “air-purifying respirators” because they clean particles out of the air as you breathe. Even if you can’t see the particles, there may be too many in the air for this respirator to provide adequate protection.

### **Dust Masks Are Not Respirators!**

Dust masks should not be regarded as PPE, and if they are “required,” it is due to a lack of understanding of the nature of their function. They can sometimes provide comfort against hot/cold air and nuisance (non-toxic) dusts, fumes, or mists, so you can say they “protect” against discomfort. But they are not respirators and they **ARE NOT** to be used for protection against airborne toxic particulate matter or for gases or vapors. They are never to be used as protection from illness or injury.

*(continued)*

## 13. Types of Respirators *(continued)*

### NIOSH Approved Particulate Respirators

The National Institute for Occupational Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention (CDC), tests and certifies respirators for use by workers to protect against workplace hazards. Respirators certified by NIOSH will say “NIOSH Approved” and may have a certification number.

However, NIOSH only certifies respirators against specific hazards. Just because a respirator is certified does not mean it will protect against ALL hazards. NIOSH-certified respirators are supplied with Approval Labels that identify the hazards that the respirator is approved to protect against. If you are buying a respirator, you should check the Approval Label to be sure that it has been certified against the hazards you want protection against. NIOSH-approved disposable respirators are marked with the manufacturer’s name, the part number (P/N), the protection provided by the filter (e.g. N-95), and “NIOSH.”

<b>Disposable Particulate Respirators (Filtering Facepiece)</b>	
<b>Type</b>	<b>Description</b>
N95	Filters at least 95% of airborne particles. Not resistant to oil.
N99	Filters at least 99% of airborne particles. Not resistant to oil.
N100	Filters at least 99.7% of airborne particles. Not resistant to oil.
R95	Filters at least 95% of airborne particles. Somewhat resistant to oil.
R99*	Filters at least 99% of airborne particles. Somewhat resistant to oil.
R100*	Filters at least 99.7% of airborne particles. Somewhat resistant to oil.
P95	Filters at least 95% of airborne particles. Strongly resistant to oil.
P99*	Filters at least 99% of airborne particles. Strongly resistant to oil.
P100	Filters at least 99.7% of airborne particles. Strongly resistant to oil.

Source: NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42 CFR 84, Publication No. 96-101, January 1996, <http://www.cdc.gov/niosh/npptl/topics/respirators/>

## 14. What Is Fit Testing?

Respirators are not made to fit every kind of face. As a result, OSHA mandates that employers make certain the respirators properly fit each of us.

Most respirators are made to fit the average male face. Scars, dentures, high cheekbones, etc. can make it next to impossible to get a proper fit with a respirator. In order for a respirator to be effective it has to create a seal with the wearer's face. Fit testing must be repeated annually and cannot be performed on workers with facial hair or other objects that can interfere with a proper face to respirator seal.

Fit testing involves giving a respirator to a worker and instructing him or her on how to wear the mask. The respirator must then be put on and adjusted so it is snug but comfortable. To achieve this, the contractor may have to provide you with a number of respirators made by a variety of manufacturers.

A qualitative fit test involves having an irritant like smoke, which will cause coughing, or a chemical with a strong smell, like banana oil, sprayed all around the respirator while you are wearing it. If the respirator doesn't fit, you'll cough or smell bananas.

### **OSHA Updates Fit Testing Procedures**

OSHA recently increased the rigors of qualitative fit testing, requiring that specific exercises be conducted and specific information be read during fit testing to ensure a proper fit. For more information, see OSHA Regulations (Standards - 29 CFR) 1910.134 App. A, Fit Testing Procedures (Mandatory).

## 15. Respirator Maintenance and Care

Under the OSHA respiratory standard, the following respirator maintenance and care must be performed by the employer:

- Respirators issued for the exclusive use of an employee must be cleaned and disinfected to maintain sanitary conditions.
- Respirators that are shared, emergency-use respirators, or respirators used in fit testing must be cleaned and sanitized after each use.
- Respirators must be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.
- All respirators must be inspected before each use and during cleaning.
- All respirators maintained for emergency use must be inspected monthly and checked for proper function after each use.
- All SCBAs must be inspected monthly.
- Written records of maintenance must be maintained for emergency-use respirators.



## Summary

1. Using the *hierarchy of controls* employers must eliminate, substitute or use engineering controls to reduce hazardous conditions on the job. PPE is the least effective control in the hierarchy of controls.
2. OSHA strongly recommends that employers conduct a comprehensive *hazard assessment* prior to determining the PPE needed.
3. Eye protection must be provided where there is a potential for injury to the eyes or face from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or a combination of these.
4. If you are working on a job where objects might fall from above, or there is a possibility of accidental head contact with electrical hazards, or you could bump your head against fixed objects (e.g., exposed pipes or beams) then you should be wearing a hard hat.
5. When hand protection is required it is extremely important that you use gloves that are designed for the hazards and tasks of the job you are doing.
6. If a hazard indicates a need for full body protection against toxic substances or harmful physical agents, the clothing should be carefully inspected before each use; it must fit and function properly.
7. Workers required to wear personal protective equipment (PPE) should be trained in its proper use, care and limits.
8. If you face possible foot or leg injuries from falling or rolling objects, crushing or penetrating materials, exposure to hot substances, corrosive or poisonous materials, or exposure to electrical hazards then you will need foot and leg protection.
9. Overexposure to noise can lead to permanent hearing loss. There are three basic types of hearing protection. **Single-use earplugs** are made of waxed cotton, foam, silicone rubber or fiberglass wool. They

are self-forming and, when properly inserted, they work as well as most molded earplugs. **Pre-formed or molded earplugs** that are individually fitted by a professional can be disposable or reusable. Reusable plugs should be cleaned after each use. The third type is  **earmuffs** require a perfect seal around the ear.

10. Respirators are extremely limited as a control device. Their use must be carefully monitored. There are four types of respirators including **air-purifying respirators (APRs), supplied air respirators, self-contained breathing apparatus (SCBA), and particulate respirators.**
11. According to OSHA, any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required, the employer must establish and implement a written respiratory protection program.
12. Respirators are not made to fit every kind of face. As a result, OSHA mandates that employers make certain the respirators properly fit each of us. Fit testing involves giving a respirator to a worker and instructing him or her on how to wear the mask. The respirator must then be put on and adjusted so it is snug but comfortable. To achieve this, the company may have to provide you with a number of respirators made by a variety of manufacturers.
13. Dust masks should not to be regarded as PPE. They are not respirators and they **ARE NOT** to be used for protection against airborne toxic particulate matter or for gases or vapors. They are never to be used as protection from illness or injury.
14. If you are buying a respirator, you should check the Approval Label to be sure that it has been certified against the hazards you want protection against. NIOSH-approved disposable respirators are marked with the manufacturer's name, the part number (P/N), the protection provided by the filter (e.g. N-95), and "NIOSH."



# Evaluation

## Activity 10: Personal Protective Equipment

1. How important is this activity for day laborers?

**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please **put an “X”** by the **one factsheet** you feel is the most important.

1.	PPE and the Hierarchy of Controls	9.	Hearing Protection
2.	Eye Protection	10.	Cleaning and Maintenance of PPE
3.	Head Protection	11.	Respirators: A Last-Ditch Control
4.	Hand Protection	12.	What OSHA Says About Respirators
5.	Use the Proper Gloves for Chemicals	13.	Types of Respirators
6.	Body Protection	14.	What Is Fit Testing?
7.	The Limits of CPC	15.	Respirator Maintenance and Care
8.	Foot/Leg Protection		

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	

4. What would you suggest be done to improve this Activity?

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# Activity 11: Chemical Hazards and MSDSs

## Purpose

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To increase our knowledge of the how we may be exposed to hazardous chemicals on the job and what we can do to reduce the risks.

This activity has two tasks.



## Task 1

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In your groups, read the factsheets on pages 308-315. Then based on the factsheets and your own experience write a response to the statement below. For each paragraph, list the factsheets that helped you write your response.

### Statement:

“Working at this facility is nothing like working on a construction site or at a place where they produce lots of toxic chemicals. So I doubt that OSHA would be worried about the chemicals that we work with.

For many years I worked at a place that produced hazardous chemicals and I always knew when we were making the highly toxic stuff because you could smell it.

But even when I worked with highly toxic chemicals I wasn't that concerned. The truth is as long as you don't drink the stuff or pour it directly into your eyes, it can't get into your system.

I should know, I was exposed a few times but nothing ever happened to me. As long as you can avoid getting a heavy dose in your system, small amounts of the stuff won't hurt you.

I think the whole chemical hazards thing is overblown and I'm not going to worry about the cleaning chemicals I use on my job.”

---

**How would you respond? (Please make a list.)**

**1.**

**2.**

**3.**

**4.**

**5.**

# 1. The Hazard Communication Standard

The Occupational Safety and Health Administration (OSHA) requires all employers to comply with the Hazard Communication Standard (HAZCOM). It requires employers to inform employees about the chemical hazards they are potentially exposed to on the job.

Under HAZCOM employers must develop a hazard communication program that includes training employees on how to safely use the chemicals they work with.

A basic HAZCOM program must include the following:

- A list of the hazardous chemicals used at the workplace
- Chemical labeling procedures
- Material Safety Data Sheets
- Employee training
- A written plan explaining how the employer will comply with the hazard communication standard

## **What Is OSHA?**

The Occupational Safety and Health Administration (OSHA), is an agency of the U.S. Department of Labor. Congress created OSHA under the Occupational Safety and Health Act of 1970. Prior to 1970, no uniform, comprehensive provisions existed to protect workers against unsafe or hazardous work situations.

OSHA's sole responsibility is to develop mandatory job safety and health standards and enforce them through workplace inspections, employer assistance, and by imposing citations and financial penalties.

OSHA covers all private sector employers and employees in manufacturing, construction, long shoring, shipping, agriculture, law, medicine, charity, disaster relief, organized labor, private education, and religious groups who employ workers.

## 2. Chemical Hazard Awareness

There are four basic ways that chemicals can enter your body:

- **Direct contact**—on the skin or eyes
- **Absorption**—through the skin
- **Accidental Ingestion**—through the mouth
- **Inhalation**—through the lungs



### **Direct Contact = Surface**

The cleaners and disinfectants we work with can burn or irritate the skin and eyes on contact, causing damage on the surface. Dermatitis (inflammation of the skin) and conjunctivitis (inflammation of the eye membrane) are two examples.

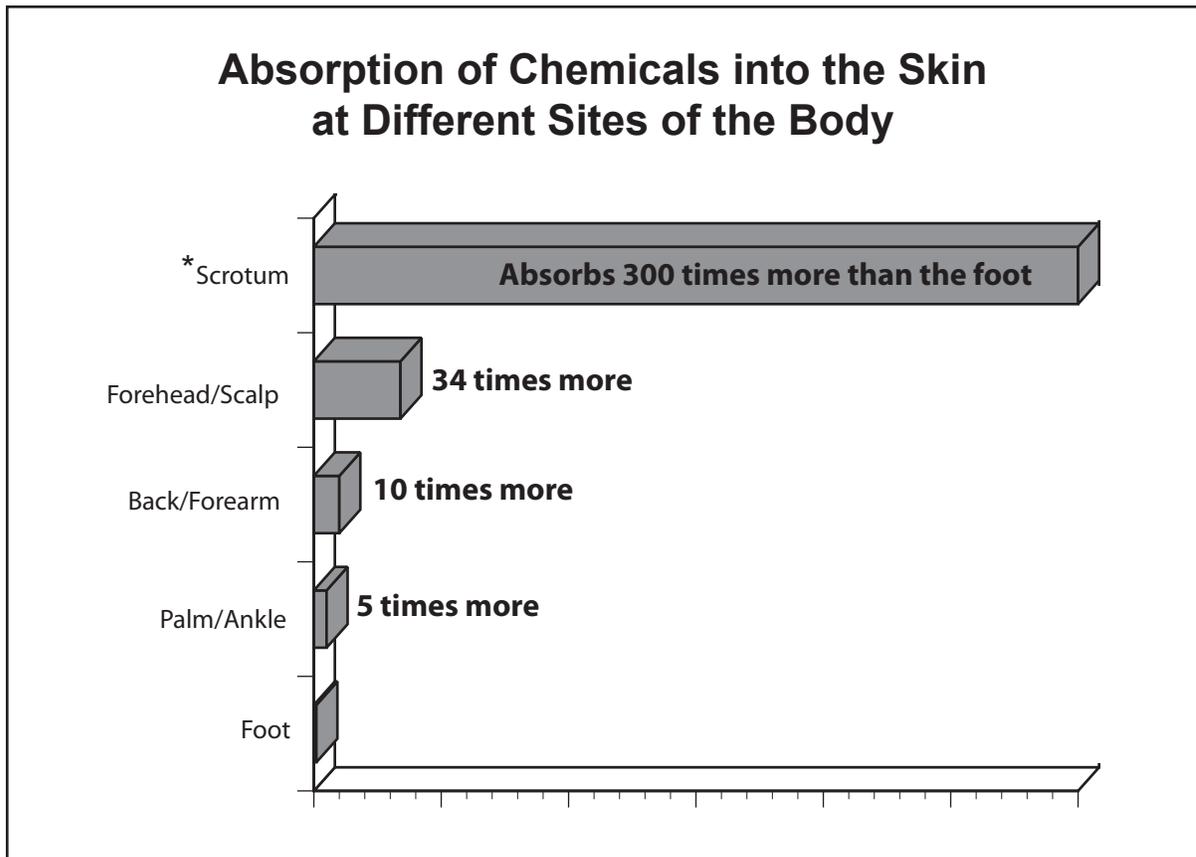
### **Absorption = Penetration**

Some chemicals can pass right through the skin undetected and enter the bloodstream. They are carried throughout the body, causing harm. Broken skin or puncture wounds greatly increase the rate at which chemicals are absorbed.

Source: Occupational Safety and Health Administration, *Personal Protective Equipment*, Washington DC, 1998.

## Absorption of Chemicals by Your Body

Chemicals can enter your system by being absorbed through the skin. In fact, as the chart below shows, when it comes to absorption through the skin, different parts of your body absorb chemicals at very different rates. (If you are working with chemicals you should wash your hands **BEFORE** and after using the bathroom!)



\*For men (studies of female workers yet to be done).

Source: E. Hodgson and P.E. Levi, *A Textbook of Modern Toxicology*, Second Edition. Stamford: Appleton & Lange, 1997, pg. 36-40.

### 3. Don't Trust Your Nose

You can't rely on your sense of smell to protect you from exposure to toxic chemicals. Let's face it, your nose has some important limitations. Here are the basic ones:

- Some dangerous chemicals, such as carbon monoxide, are odorless. No nose can smell them.
- For some chemicals, you can only detect the smell when the toxin is around you in such large quantities that your health is being harmed by it. For example, by the time you can smell ethylene oxide (used in gas sterilizers), you're already in trouble.
- Our noses can become accustomed to chemicals. That means that after a while we can't smell even very powerful odors. For instance, our noses can learn to turn off strong odors like ammonia and bleach.



## 4. Dose and the Body's Response

After ingestion, inhalation or skin contact, toxic chemicals as well as their by-products react in the body. For most toxic substances to cause harm there needs to be a sufficient "dose" given.

"Dose" refers to how much a substance reacts with the body. Dose is measured by the concentration of the substance and the time period of the exposure.

The higher the concentration, the larger the dose.

The longer the exposure, the larger the dose.

There are basically two ways the body reacts to a dose of a toxic substance:

- **Linear/Non-Threshold** For any dose, no matter how small, the body may have a reaction. This type of response may be found with cancer-causing chemicals and cancer-causing physical agents, such as radiation. **Any** dose carries a risk.
- **Threshold** There needs to be a certain level of dose before there is a bodily response. This type of response is found with most toxic chemicals (not for cancer-causing agents and chemicals). For example, low-level exposure to acetone (found in nail polish remover) throughout the plant is not very harmful, but at higher concentrations it will cause irritation to the eyes, mucous membranes, and upper respiratory tract. Nausea, dizziness and headaches may result.

Sources: *Centers for Disease Control, 1998*. OSHA, May 1995; *Fit the Glove* by Gerard Arotti. Michael Roder, *A Guide For Evaluating the Performance of Chemical Protective Clothing (CPC)*, US Dept. of Health and Human Services; June 1990.

## 5. The Long and Short of It

There are two different types of effects that result from toxic exposure. They are acute and chronic.

### Acute Effects

“Acute” means that health effects are felt at the time of exposure or shortly after, or result from a short-term, highly concentrated exposure. Examples of acute effects:

- Hydrogen chloride (HCl), when inhaled, causes fluid to collect in the lungs (pulmonary edema) and bleeding in the respiratory tract. When it comes into contact with the skin, it causes severe burns unless promptly washed off.
- Caustic soda, also known as sodium hydroxide (NaOH), corrodes the skin. It burns, and actually dissolves the skin while in contact with it.
- Carbon monoxide (CO) bonds to the protein in blood that is responsible for carrying oxygen to the cells. If enough of the blood bonds with CO instead of oxygen, the cells “starve” and you may die.

Although acute toxicity is often seen within minutes or hours after a sudden, high exposure there are some instances where a one-time high-level exposure causes delayed effects. For example, symptoms of high exposures to certain pesticides may not appear for several days.

### **Chronic Effects**

“Chronic” is a word that means the ill effects will not be seen for some time after exposure. It is associated with low concentration exposures over a longer period of time.

- Cancer is a chronic effect, as is asbestosis.
- Lung diseases, like bronchitis and emphysema, are examples of noncancerous, chronic diseases.
- Solvents can cause chronic damage to the liver, kidneys and brain.

**Many chemicals can cause either chronic or acute effects.** The difference is in the amount of the dose. High doses generally cause acute effects. Low doses over time cause chronic effects.

- Exposure to PCBs in large doses can cause a skin disease called chloracne.
- Exposure to benzene over a long period of time can cause leukemia, a chronic effect.
- Exposure to arsenic over a long period of time can cause lung cancer, a chronic effect.

## Task 2

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**In your groups review the factsheets (including the MSDS for sodium hypochlorite solution) on pages 318-333. Then based on your own experience and the factsheets answer the questions below.**

1. If you worked with sodium hypochlorite solution would you be concerned about a fire or explosion hazard?  
  
 Yes  
 No
  
2. What personal protective equipment (PPE) does the MSDS call for in handling sodium hypochlorite solution?
  
  
  
  
  
  
  
  
  
  
3. What first aid is recommended for sodium hypochlorite solution?
  
  
  
  
  
  
  
  
  
  
4. What is recommended for the proper storage of sodium hypochlorite solution?

5. Is sodium hypochlorite solution incompatible with other chemicals?

6. What are the health hazards that could result from exposure to sodium hypochlorite solution?

Acute (Short-Term) Hazards

Chronic (Long-Term) Hazards

7. Did you find working with the MSDS difficult or confusing?  
Why or why not?

8. Are MSDSs a useful health and safety resource tool at work?  
Why or why not?

## 6. What's in an MSDS?

Material Safety Data Sheets (MSDSs) give detailed information on chemical and physical dangers, safety procedures and emergency response techniques. Employers are required to have MSDSs for every hazardous chemical in the workplace. The MSDSs must be readily accessible to all employees on every shift and in the employee's work area.

MSDSs include the following information:

1. Product identity
2. Hazardous ingredients
3. Physical and chemical characteristics
4. Fire and Explosion Data
5. Reactivity
6. Health hazards
7. Precautions for safe handling and use
8. Control measures

A description of each section is included below and on the next few pages.

### **Section I: Product Identity**

This information gives you the product's name as it appears on the label and on the company's chemical inventory list. Product identity is usually the chemical's brand name, e.g. "Solvent 460" or "Trichlor." The manufacturer is listed along with a contact person you can call to get more information on the product.

### **Section II: Hazardous Ingredients**

This section is the key part of the MSDS. It gives you the basic ingredients in the product and tells you the legal and recommended limits for workplace exposures. Remember to get the exact spelling of the chemicals because many chemicals have similar names but different health effects.

The following explains some technical language you might find on data sheets related to exposure limits:

**PEL (Permissible Exposure Limit):** This is the **maximum** exposure established by OSHA. It can be a time-weighted average (TWA) exposure limit, a “ceiling” exposure limit, or a “peak” exposure limit. These are all legal standards.

**TLV (Threshold Limit Value):** This is a **recommended** average concentration over an 8-hour day. This term is used to express the airborne concentration of a material to which nearly all persons supposedly can be exposed without adverse effects, day after day. TLVs can be expressed in three different ways. (TLVs are suggested, **not legal**, standards established by the American Conference of Governmental Hygienists [ACGH], which is not a government agency.)

- **TLV-TWA (Time-Weighted Average):** This is the concentration for a normal 8-hour workday or 40-hour workweek. If the MSDS only lists TLV, it usually means a time-weighted average.

### To Determine Whether a Product Contains a Highly Toxic Chemical

Check the “Hazardous Ingredients” section of the material safety data sheet (MSDS). If an ingredient is identified as a carcinogen, do not use the product. Products without carcinogens are available for all uses.

All MSDSs must list any ingredient subject to the reporting requirements under Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), also called the Toxics Release Inventory, or TRI. Screen out products containing these ingredients, which have been identified as chemicals of concern to US EPA.

If you have questions about the health or environmental impacts of specific product ingredients, do a search on the Internet or contact the supplier.

*(continued)*

## 6. What's in an MSDS? *(continued)*

- **TLV-STEL (Short-Term Exposure Limit):** This is the maximum concentration for a 15-minute period (maximum of four such periods per day, with at least 60 minutes between exposure periods, provided that the daily TLV-TWA is not exceeded). This is like the OSHA “ceiling” limit.
- **TLV-C (Ceiling Exposure Limit):** This is the concentration that should not be exceeded even for a split second. This is like the OSHA “peak” limit.

### Section II: Hazardous Ingredients *(continued)*

**LD50 or LC50 (Lethal Dose and Lethal Concentration):** These terms refer to the dose or concentration of a chemical, which, in experiments, kills 50 percent of the test animals.

**Skin or “S”:** This means the substance may be absorbed through the skin by liquid contact or through the mucous membranes and eyes by direct contact or airborne contact.

Below are some explanations for the numbers used in this section. (Note that for most substances,  $\text{mg}/\text{m}^3$  can be converted into ppm, which means parts per million. It is used for measuring the concentration of a gas or vapor in a million parts of air.)

- **$\text{mg}/\text{m}^3$ :** This is milligrams of substance per cubic meter of air. The term is most commonly used for measuring concentrations of dusts, metal fumes, or other particles in the air.
- **$\text{mg}/\text{kg}$ :** This is milligrams of substance per kilogram of body weight. It is used generally to measure toxic chemicals given to experimental animals to ingest.

### Section III: Physical/Chemical Characteristics

This section provides critical information about the properties of chemicals such as vapor pressure, vapor density, boiling point and evaporation rate. These measurements can help you learn a lot about hazards of a particular chemical.

<b>Chemical Properties</b>	
<b>Boiling Point</b>	The boiling point of a substance is the temperature at which the liquid boils or becomes a gas. The lower the boiling point, the quicker it evaporates and the easier it is to inhale. Chemicals with boiling points below 100°C (or 212°F) require special caution.
<b>Vapor Pressure</b>	A high vapor pressure indicates that a liquid will evaporate easily. Chemicals which evaporate quickly are called volatile. This means that air concentrations can build up quickly, even though the substance is in liquid form. Liquids with high vapor pressures may be especially hazardous if you are working with them in a confined space or an enclosed area.
<b>Vapor Density</b>	If the vapor density is less than one, it will tend to rise in air. If the vapor density is greater than one, it will fall in air and concentrate in the bottom of tanks or confined spaces.
<b>Appearance and Odor</b>	This information may help identify a substance that spills or leaks in your work area. However, many chemicals are hazardous at levels lower than they can be smelled. Also, many chemicals, such as hydrogen sulfide and ammonia, cause “olfactory fatigue”, which means that workers rapidly lose their ability to smell the substance.
<b>Specific Gravity</b>	If the specific gravity is greater than one, the substance will sink in water; if less than one, it will float on top of water.
<b>Evaporation Rate</b>	This is the rate at which a substance evaporates compared to either ether, which evaporates quickly, or butyl acetate, which evaporates slowly. If the substance has an evaporation rate greater than one, it evaporates faster than the comparison substance. For comparison to butyl acetate, fast evaporation is 3.0 and above, slow is 0.8 and below, medium is anything in between.

(continued)

## 6. What's in an MSDS? (continued)

### Section IV: Fire and Explosion Data

This section provides basic information on the fire hazards of a chemical (flashpoint) and the special precautions necessary to extinguish a fire (extinguishing media).

<b>Flash Point</b>	This is the lowest temperature at which a liquid gives off enough vapor to form a mixture with air that can be ignited by a spark. Liquids with flash points below 100°F are considered flammable, and liquids with flash points between 100 and 200°F are considered to be combustible. Flammable and combustible liquids require special handling and storage precautions.
<b>Extinguishing Media</b>	It should specify what kind of fire extinguisher to use. There are four classifications of fires: Class A for paper and wood, Class B for more flammable materials such as liquids or greases, Class C for electrical fires, and Class D for fires involving metals or metal alloys.

### Section V: Reactivity Data

This section tells us whether or not the chemical is likely to break down or react with other substances to cause fires, explosions, or the release of different, even more hazardous, substances.

### Section VI: Health Hazard Data

This section describes the health effects of the chemical, including signs and symptoms of exposure and medical conditions made worse by exposure. Acute (short-term) and chronic (long-term) effects of exposure must always be included. Routes of entry (inhalation, skin contact, swallowing) and emergency and first aid procedures must also be included. This section must also contain information on target organs (liver, kidneys or central nervous system), signs or symptoms of exposure, medical conditions generally aggravated by exposure, and emergency First Aid procedures.

Unfortunately, a lot of MSDSs in circulation do not contain complete and accurate health hazard information. They often leave out chronic health information, such as whether a chemical causes cancer or birth defects and most have not been studied for these effects. In fact, Environmental Defense Fund research indicates that currently even the most basic toxicity testing results cannot be found in the public record for nearly 75% of the top-volume chemicals in commercial use.

### **Section VII: Precautions for Safe Handling and Use**

This section should give you information to plan for emergencies (e.g., type of emergency respirators to have on hand, exit routes, and ways to deal with small spills). It also provides procedures for proper waste disposal and precautions for storage and handling. This section is often incomplete for emergency planning purposes.

### **Section VIII: Control Measures**

This section provides information on appropriate respirators, protective clothing, ventilation, and safe work practices. The information usually represents the bare minimum in protection and tends to emphasize protective gear and respirators over engineering controls that could eliminate the problem at the source of exposure.

## **CHECKING THE ACCURACY OF MSDSs**

What can be done if you suspect that the MSDS that you received is not accurate or complete?

- Ask your employer: If an MSDS is not accurate, your employer is responsible for obtaining an accurate, complete MSDS. Ask your employer to request a more accurate MSDS from the supplier or manufacturer.
- Contact the manufacturer: You or your union can contact the manufacturer and ask for a more accurate MSDS. Some MSDSs are also available on-line.
- Contact the NJ Dept. of Health: The Right to Know Program can provide Hazardous Substance Fact Sheets that have more complete information on specific ingredients listed on MSDSs. ([www.state.nj.us/health/eoh/rtkweb/](http://www.state.nj.us/health/eoh/rtkweb/) or phone: 609-984-2202).

Sources: American Federation of State, County and Municipal Employees (AFSCME), *How to Read a Material Safety Data Sheet*, [www.afscme.org/health/faq-msds.htm](http://www.afscme.org/health/faq-msds.htm) *Cleaning for Health, Products and Practices for a Safer Environment*, INFORM, August 2002, [www.informinc.org/cleanforhealth.php](http://www.informinc.org/cleanforhealth.php)

## 7. The Problems with MSDSs

MSDSs give guidance on using, storing, and handling substances safely on the job and in emergencies such as fires and spills. But MSDSs have some problems. Here's how Anne Jackson, the corporate safety director for Pepperidge Farm Inc., put it:

*“The MSDSs I have to work with at Pepperidge Farm usually fall into one of two categories: those written by attorneys for attorneys and those written by chemical engineers for chemical engineers... The origin of the problem is a lack of focus by OSHA and chemical suppliers on the true purpose of the requirement – protecting employees!”*

### **Hospital Study Focuses on MSDS Problems**

The Seattle Area Hospital Council conducted a study of 476 MSDSs to see how accurate they were. Here's what they found:

- 53.4% of the MSDSs did not have all the blanks filled in
- 30% were inconsistent (meaning, they included information which contradicted itself)
- 97.1% did not have all of the required elements
- OSHA Permissible Exposure Limits did not appear on 90%
- 89% did not say whether the chemical was a carcinogen

## 8. pH: A Basic Chemical Term

The pH of a chemical tells you if the chemical is an acid, a base (also called alkali or caustic), or neutral. The pH scale goes from 0 to 14, with 7 being neutral (water is neutral with a pH of 7).

<b>pH less than 7 = acid</b>														
<b>pH more than 7 = base</b>														
<b>Strong Acid</b>				<b>Neutral</b>						<b>Strong Base</b>				
<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>

The lower the pH (below 7), the stronger the acid. The higher the pH (above 7), the stronger the base. Many organic hydrocarbons (e.g., gasoline, benzene, kerosene, etc.) have almost neutral pHs (close to 7).

Here are some things to remember about pH:

- Chemicals with a pH much lower or much higher than 7 will cause irritation and burns to the part of the body coming into contact with the material.
- Basic chemicals (those with a pH above 7) are much more dangerous to the eyes than are acids. Acids “sit” on the surface of the eyes, if splashed, and can therefore be washed off (if done quickly), often without resulting in permanent damage.
- Base substances rapidly penetrate the eye tissue, often causing quick and lasting damage.
- Store like with like. Chemicals with lower or higher pH should only be stored with chemicals of like pH and never with their opposite or a neutral chemical.

*(continued)*

## 8. pH: A Basic Chemical Term *(continued)*

### The Fearsome Incompatibles

<b>Keep these...</b>	<b>away from these...</b>	<b>or you may get these</b>
Acids	Bases	<b>Heat Violent Reaction</b>
Acids or Bases	Reactive Metals (Aluminum, Beryllium, Calcium, Lithium, Potassium, Magnesium, Sodium, Zinc Powder), Metal Hydrides	<b>Fire Explosion Hydrogen Gas</b>
Water or Alcohols	Concentrated Acids or Bases Calcium, Lithium, Potassium, Metal Hydrides, Other Water Reactive Wastes	<b>Heat Fire Explosions Flammable and Toxic Gases</b>
Reactive Organic Compounds or Solvents (Alcohols, Aldehydes, Nitrated Hydrocarbons)	Concentrated Acids or Bases, Reactive Metals and Metal Hydrides	<b>Fire Explosion</b>
Cyanide or Sulfide Solutions	Acids	<b>(Toxic) Hydrogen Cyanide Sulfide Gas</b>
Strong Oxidizers (Chlorates, Chlorine, Chrome Acid, Hypochlorites, Nitrates, Perchlorates, Permanganates, Peroxides)	Organic Acids, Concentrated Mineral Acids, Reactive Metals, Metal Hydrides, Reactive Organic Compounds or Solvents, Flammable or Combustible Waste	<b>Fire Explosion</b>

## **9. An Alternative Source of Information**

Through New Jersey's Right to Know program you can obtain factsheets (at no charge) for 1,717 commonly used hazardous substances and chemicals (630 are available in Spanish). The factsheets are easier to read than most MSDSs. ([www.state.nj.us/health/eoh/rtkweb/](http://www.state.nj.us/health/eoh/rtkweb/)).

The phone number for the Right to Know program is 609-984-2202. The e-mail address is [rtk@doh.state.nj.us](mailto:rtk@doh.state.nj.us).

### **Additional Sources**

Safety Information Resources on the Internet  
<http://siri.uvm.edu/>

The Center for Construction Research and Training, Resources and Publications, Spanish Resources  
<http://www.cpwr.com/rp-spanishspeakers.html>

## 10. Your Rights Under the Law

OSHA requires your company to:

- Have an MSDS for every hazardous chemical used in the workplace (including all maintenance and cleaning chemicals)
- Provide you with a copy of the MSDS no later than 15 days after the request, at no charge
- Ensure that MSDSs are readily accessible to all employees during each shift
- Provide training to you and your co-workers prior to handling hazardous chemicals so that you understand the health effects of these chemicals and how to work with them safely

### **You Can File an OSHA Complaint**

If you are concerned about a health and safety problem on your job and your employer refuses to solve the problem you can file an OSHA complaint. If you file an OSHA complaint you will have to complete an OSHA-7 Complaint Form and it must be faxed, mailed or emailed to the local OSHA Regional Office. You can obtain a complaint form by contacting the OSHA area office or going online ([www.osha.gov/as/opa/worker/complain.html#happens](http://www.osha.gov/as/opa/worker/complain.html#happens)).

Your complaint may result in an OSHA investigation. If an OSHA investigation doesn't solve the problem you can still request an OSHA on-site inspection. If OSHA decides not to inspect, they must notify you in writing and give reasons. You may question this decision with the OSHA area director and regional administrator.

## The OSHA General Duty Clause

Section 5(a)(1) of the Occupational Safety and Health Act requires that an employer:

*“shall furnish to each of his employees employment and a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”*

This is known as the OSHA “general duty clause.”

<b>MSDS</b> Material Safety Data Sheet		24 Hour Emergency Telephone: 800-859-2151 CHEMTREC: 1-800-424-9300
	From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865	National Response in Canada CANUTEC: 613-958-4666
All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.		

**NOTE:** CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

## SODIUM HYPOCHLORITE SOLUTION

MSDS Number: S4106 --- Effective Date: 05/05/00

### 1. Product Identification

Synonyms: Bleach; hypochlorous acid, sodium salt; soda bleach; sodium oxychloride  
 CAS No.: 7681-52-9  
 Molecular Weight: 74.44  
 Chemical Formula: NaOCl  
 Product Codes: 9416, P005

### 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hypochlorite (as NaOCl)	7681-52-9	5%	Yes
Water	7732-18-5	95%	No

### 3. Hazards Identification

#### Emergency Overview

**WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY.**

J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate  
 Flammability Rating: 0 - None  
 Reactivity Rating: 1 - Slight  
 Contact Rating: 2 - Moderate  
 Lab Protective Equip: GOGGLES; LAB COAT  
 Storage Color Code: Orange (General Storage)

#### Potential Health Effects

##### Inhalation:

May cause irritation to the respiratory tract, (nose and throat); symptoms may include coughing and sore throat.

##### Ingestion:

May cause nausea, vomiting.

##### Skin Contact:

May irritate skin.

##### Eye Contact:

Contact may cause severe irritation and damage, especially at higher concentration.

##### Chronic Exposure:

A constant irritant to the eyes and throat. Low potential for sensitization after exaggerated exposure to damaged skin.

##### Aggravation of Pre-existing Conditions:

Persons with impaired respiratory function, or heart disorders (or disease) may be more susceptible to the effects of the substance.

### 4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Ingestion:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

**Note to Physician:**

Consider oral administration of sodium thiosulfate solutions if sodium hypochlorite is ingested. Do not administer neutralizing substances since the resultant exothermic reaction could further damage tissue. Endotracheal intubation could be needed if glottic edema compromises the airway. For individuals with significant inhalation exposure, monitor arterial blood gases and chest x-ray.

## 5. Fire Fighting Measures

**Fire:**

Not considered to be a fire hazard. Substance releases oxygen when heated, which may increase the severity of an existing fire. Containers may rupture from pressure build-up.

**Explosion:**

This solution is not considered to be an explosion hazard. Anhydrous sodium hypochlorite is very explosive.

**Fire Extinguishing Media:**

Use any means suitable for extinguishing surrounding fire. Use water spray to cool fire-exposed containers, to dilute liquid, and control vapor.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

## 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

Sodium Hypochlorite:

AIHA (WEEL) - STEL - 2 mg/m<sup>3</sup>

-OSHA Permissible Exposure Limit (PEL):

0.5 ppm (TWA), 1 ppm (STEL) as Chlorine

-ACGIH Threshold Limit Value (TLV):

1 ppm (TWA), 3 ppm (STEL) as Chlorine

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

## 9. Physical and Chemical Properties

**Appearance:**  
Colorless to yellowish liquid.  
**Odor:**  
Chlorine-like odor.  
**Solubility:**  
100% in water.  
**Density:**  
1.07 - 1.14  
**pH:**  
9 - 10 (neutral solution-no excess sodium hydroxide)  
**% Volatiles by volume @ 21C (70F):**  
ca. 95  
**Boiling Point:**  
40C (104F) Decomposes slightly  
**Melting Point:**  
-6C (21F)  
**Vapor Density (Air=1):**  
No information found.  
**Vapor Pressure (mm Hg):**  
17.5 @ 20C (68F)  
**Evaporation Rate (BuAc=1):**  
No information found.

## 10. Stability and Reactivity

**Stability:**  
Slowly decomposes on contact with air. Rate increases with the concentration and temperature. Exposure to sunlight accelerates decomposition. Sodium hypochlorite becomes less toxic with age.  
**Hazardous Decomposition Products:**  
Emits toxic fumes of chlorine when heated to decomposition. Sodium oxide at high temperatures.  
**Hazardous Polymerization:**  
Will not occur.  
**Incompatibilities:**  
Ammonia (chloramine gas may evolve), amines, ammonium salts, aziridine, methanol, phenyl acetonitrile, cellulose, ethyleneimine, oxidizable metals, acids, soaps, and bisulfates.  
**Conditions to Avoid:**  
Light, heat, incompatibles.

## 11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a tumorigen and mutagen. Irritation data: eye, rabbit, 10 mg - Moderate

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sodium Hypochlorite (as NaOCl) (7681-52-9)	No	No	3
Water (7732-18-5)	No	No	None

## 12. Ecological Information

**Environmental Fate:**  
No information found.  
**Environmental Toxicity:**  
No information found.

## 13. Disposal Considerations

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

Not regulated.

## 15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                TSCA  EC   Japan  Australia
-----
Sodium Hypochlorite (as NaOCl) (7681-52-9)  Yes  Yes  Yes    Yes
Water (7732-18-5)                          Yes  Yes  Yes    Yes
-----\Chemical Inventory Status - Part 2\-----
Ingredient                Korea  DSL   NDSL   Phil.
-----
Sodium Hypochlorite (as NaOCl) (7681-52-9)  Yes   Yes  No     Yes
Water (7732-18-5)                          Yes   Yes  No     Yes
-----\Federal, State & International Regulations - Part 1\-----
Ingredient                -SARA 302-  -SARA 313-
RQ   TPQ   List  Chemical Catg.
-----
Sodium Hypochlorite (as NaOCl) (7681-52-9)  No   No   No     No
Water (7732-18-5)                          No   No   No     No
-----\Federal, State & International Regulations - Part 2\-----
Ingredient                CERCLA  -RCRA-
                261.33  8 (d)
-----
Sodium Hypochlorite (as NaOCl)
(7681-52-9)                100    No    No
Water (7732-18-5)          No     No    No
Chemical Weapons Convention: No   TSCA 12(b): No   CDTA: No
SARA 311/312: Acute: Yes   Chronic: No   Fire: No   Pressure: No
Reactivity: No                (Mixture / Liquid)

```

**Australian Hazchem Code:** No information found.

**Poison Schedule:** S5

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 0 Reactivity: 1

**Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY.

**Label Precautions:**

Avoid contact with eyes, skin and clothing.  
 Avoid breathing mist.  
 Keep container closed.  
 Use with adequate ventilation.  
 Wash thoroughly after handling.

**Label First Aid:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 1, 2, 3, 8, 11, 14, 15, 16.

**Disclaimer:**

\*\*\*\*\*  
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 \*\*\*\*\*

Prepared by: Environmental Health & Safety  
 Phone Number: (314) 654-1600 (U.S.A.)

## Summary

1. The Occupational Safety and Health Administration (OSHA) requires all employers to comply with the Hazard Communication Standard (HAZCOM). It requires employers to inform employees about the chemical hazards they are potentially exposed to on the job
2. There are four basic ways that chemicals can enter your body:
  - Direct contact—on the skin or eyes
  - Absorption—through the skin
  - Ingestion—through the mouth with food
  - Inhalation—through the lungs
3. You can't rely on your sense of smell to protect you from exposure to toxic chemicals.
4. After ingestion, inhalation or skin contact, toxic chemicals as well as their by-products affect the body. For most toxic substances to cause harm there needs to be a sufficient "dose" given. The higher the concentration, the larger the dose. The longer the exposure, the larger the dose.
5. There are two different types of effects that result from toxic exposure. They are acute and chronic. "Acute" means that health effects are felt at the time of exposure or shortly after, or result from a short-term, highly concentrated exposure. "Chronic" is a word that means the ill effects will not be seen for some time after exposure.
6. Material Safety Data Sheets (MSDSs) give detailed information on chemical and physical dangers, safety procedures and emergency response techniques. Employers are required to have MSDSs for every hazardous chemical in the workplace. The MSDSs must be readily accessible to all employees on every shift and in the employee's work area.

7. MSDSs have some problems. They are sometimes hard to read and are not written for their intended purpose—to protect workers.
8. The pH of a chemical tells you if the chemical is an acid, a base (also called alkali or caustic), or neutral. Chemicals with lower or higher pH should only be stored with chemicals of like pH and never with their opposite or a neutral chemical.
9. Through New Jersey's Right to Know program you can obtain factsheets (for no charge) on over 1,700 commonly used hazardous substances and chemicals. The factsheets are easier to read than most MSDSs.
10. OSHA requires employers to provide training to you and your co-workers prior to handling hazardous chemicals. OSHA also requires employers to have MSDSs readily accessible to all employees during each shift. If you are concerned about a health and safety problem on your job and your employer refuses to solve the problem you can file an OSHA complaint.



# Evaluation

## Activity 11: Chemical Hazards and MSDSs

1. How important is this activity for you and your co-workers?

Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an “X” by the one factsheet you feel is the most important.

1.	The Hazard Communication Standard	6.	What’s in an MSDS?
2.	Chemical Hazard Awareness	7.	The Problems with MSDSs
3.	Don’t Trust Your Nose	8.	pH: A Basic Chemical Term
4.	Dose and the Body’s Response	9.	An Alternative Source of Information
5.	The Long and Short of It	10.	Your Rights Under the Law

3. Which summary point do you feel is most important?

Please circle one number.

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

4. What would you suggest be done to improve this Activity?

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# **Activity 12: Concrete and Masonry Safety**

## **Purpose**

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To learn more about how to reduce the risks of chemical and dust exposures on concrete and masonry jobs.

This Activity has one task.

## Task

---

Juan has found steady employment working for a concrete and masonry contractor. As a helper working with different crews he is learning new skills but he has noticed that his co-workers seem to have different work habits. On jobs where blocks and stone are being dry-cut, some wear “dust masks,” others tie handkerchiefs across their faces to avoid breathing in the dust and some wear nothing at all. A co-worker has told Juan that the dust is a problem and that the contractor should really be wet-cutting the block and stone.

On concrete jobs Juan is concerned about wet concrete and what it seems to be doing to his hands and arms. His skin is drying and cracking. He’s shown it to other workers but they have told him that it’s just part of the work and that everyone who does this kind of job has dry skin.

Also, on both the concrete and cutting jobs, Juan has noticed that some workers change their cloths before they get into cars at the end of the day while others like Juan wear their work cloths home.

**Note:** Juan’s youngest daughter greets him every day when he comes home from work by running up, jumping into his arms and giving him a big hug. She has recently developed a rash on her face and arms that the doctor hasn’t been able to clear up.

**In your groups review the factsheets on pages 342-363. Then working together complete the worksheet on the next page to inform Juan about the dust and skin hazards of working concrete and mason jobs and what he needs to do to protect himself and his family.**

---

## **Juan's Info Sheet for Concrete and Masonry Safety**

1. Should Juan be concerned about the dust? (Please Explain)
2. Should Juan be concerned about silica dust when the crew he is working with is dry cutting?
3. What is silicosis?
4. Will a "dust mask" or handkerchief provide enough protection from silica dust?
5. What is the safest method for reducing exposures to silica dust?
6. Should Juan be concerned about his skin drying and cracking? (Please explain)
7. What is Dermatitis?
8. What makes wet cement a hazard?
9. Is there a possible connection between Juan's daughter's rash and his job? (Please explain)
10. What steps should Juan take to reduce the risks of cement exposures?

# 1. Lung Diseases in Construction

The dust generated from cutting and grinding construction materials and the fumes from paints, solvents, and welding operations pose significant hazards to the lungs of construction workers.

Debilitating and fatal lung diseases among construction workers include:

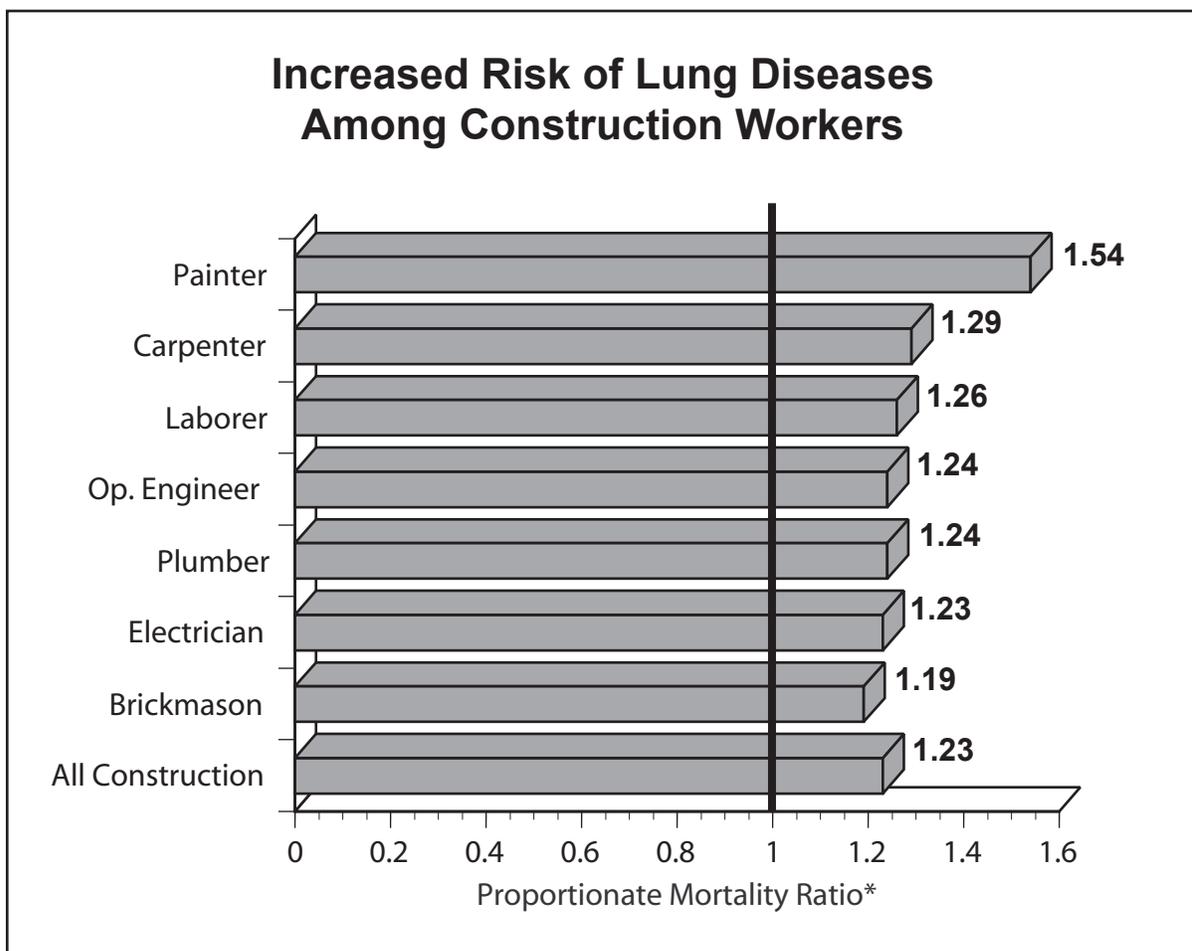
- silicosis, tuberculosis and lung cancer from exposure to silica
- asbestosis from asbestos
- asthma and fluid in the lungs from gases and fumes produced during welding
- lung irritation and carbon monoxide poisoning from diesel exhausts

## **Under Reporting of Silicosis Deaths in U.S.**

Deaths from silicosis and exposures to asbestos are believed to be declining, but the National Institute for Occupational Safety and Health (NIOSH) has said silicosis deaths are underreported. And while the work around asbestos has been tightly regulated in the U.S. since 1976, new exposures continue during unprotected (and illegal) demolition and abatement work.

### Exposures Increase Risk of Death for Construction Workers

In the chart below risk is based on the *proportionate mortality ratio* (PMR). A PMR equal to 1.0 means that the proportion of deaths from a given cause among workers in a trade is equal to the proportion of deaths for the total U.S. population. In other words, for a laborer, the risk of dying from diseases like silicosis, asbestosis, or respiratory conditions due to silica dust, chemical fumes or vapors is 26% higher than for the rest of the population.



Source: The Center to Protect Workers' Rights (CPWR), *The Construction Chart Book*, 2002, <http://www.cpwr.com/rp-chartbook.html>

## 2. Silica Dust

Day laborers face a serious workplace hazard when they are exposed to *crystalline silica dust*. Exposures to silica dust can lead to a disease called silicosis—a serious and incurable respiratory disease that occurs when particles of crystalline silica are inhaled and become embedded in the lung. The disease can be fatal. It is estimated that 300 workers die each year from silica exposure.

Jobs that can produce exposure to silica dust include demolition, breaking concrete, drywall installation/removal, insulation installation/removal, and works dealing with cement.

Construction materials that contain silica include:

- many abrasives used for blasting
- brick, refractory brick
- concrete, concrete block, cement, mortar
- granite, sandstone, quartzite, slate
- gunite
- mineral deposits
- rock and stone
- sand, fill dirt, top soil
- asphalt containing rock or stone
- dry wall

### Exposure Levels

Sand and materials such as concrete contain concentrated amounts of crystalline silica. When concrete products including masonry blocks, bricks, concrete slabs and/or rocks are chipped, hammered, drilled, crushed, hauled, sand blasted, sawed or swept, workers are exposed to crystalline silica dust, and they may develop silicosis. Even materials containing small amounts of crystalline silica may be hazardous if they are used in ways that produce high dust concentrations.

<b>Concrete/Masonry Tasks and Silica Exposures</b>	
<b>Task</b>	<b>Exposure</b>
Wet Cutting and/or Laying Blocks in Mortar	Wet tasks, such as wet cutting of blocks, or laying blocks in mortar, have less potential for overexposure
Block Running and Mixing	Supporting tasks, such as block running and mortar mixing, usually will not lead to silica overexposures as long as you avoid areas where concrete or cement dust is visibly present in the air.
Dry Cutting	<b>Dry cutting blocks or concrete frequently may result in dangerous exposures up to 10 times the OSHA Permissible Exposure Limit (OSHA PEL).</b> Exposure at this level may produce lung disease over a period of 10 years or more.
Grinding	<b>Grinding out existing mortar joints prior to tuckpointing brick walls may cause exposures that exceed 50 times the OSHA PEL.</b> Exposures at this level may cause lung disease over a period of several months to 10 years.

Sources: NIOSH, Hazard Review: *Health Effects of Occupational Exposure to Respirable Crystalline Silica*, Publication No. 2002-129, April 2002. Art Wickman, CIH, Georgia Tech's Safety and Health Consultation Program, *Preventing Silicosis Among Masons*, [www.oshainfo.gatech.edu/silicosis.html](http://www.oshainfo.gatech.edu/silicosis.html). The Center to Protect Workers' Rights (CPWR) *On Center*, April 2005, Vol. 5, No. 1.

## 3. Reducing the Risk of Silica Dust Exposures

### Use Water

Water is the most efficient means of controlling dust from cutting concrete products. Bench saws for blocks and bricks typically have ports on the upper blade guard where water supply lines can be attached. Portable saws may or may not be equipped with water supply ports. If the saw is equipped with wet cutting capability, the mason needs to pre-plan the work to ensure that water will be available at the location while cutting, and that the connections to the water supply are made.

If the saw is not equipped with wet cutting capability, an alternative is to use water supplied by a portable water tank or cart. Two workers may be needed for the task, one to operate the cutting tool, and the other to provide the water supply. Again, the mason must pre-plan the job to ensure that the materials and manpower are available to allow for wet cutting. Some abrasive cutting tools, such as grinders, can be equipped with a self contained pump which collects, filters, and reuses a small amount of water.

### Don't Rely on Respirators

Respirators are often ineffective or not properly used and as a result, they do not provide the same level of protection as wet cutting. However, if exposures to crystalline silica cannot be sufficiently reduced by wet cutting or ventilation, you must wear appropriate respiratory protection.

The choice of respirators depends on the *permissible exposure limit* (PEL) for the job you are doing.

- **For Exposures up to 5 times the PEL:**  
Disposable NIOSH approved particulate respirators  
**Typical jobs**—block running, erecting scaffolds, mortar mixing
- **Exposures up to 10 times the PEL:**  
Half-mask respirators with dust cartridges  
**Typical jobs**—dry cut block saws, dry cut portable saws

- **Exposures up to 50 times the PEL:**  
Full-face piece respirators with dust cartridges, quantitatively fit tested, or supplied airline respirators  
**Typical jobs**—when using grinders prior to tuckpointing

### **Dust Masks Are Not Respirators!**

Dust masks should not to be regarded as PPE, and if they are “required,” it is due to a lack of understanding of the nature of their function. They can sometimes provide comfort against hot/cold air and nuisance (non-toxic) dusts, fumes, or mists, so you can say they “protect” against discomfort. But they are not respirators and they **ARE NOT** to be used for protection against airborne toxic particulate matter (such as silica dust) or for gases or vapors. They are never to be used as protection from illness or injury.

#### **Particulate Respirators**

Particulate respirators are the simplest, least expensive, and least protective of the respirator types available. They look similar to dust masks but the difference is they protect against particles. They do not protect against chemicals, gases, or vapors, and are intended only for low hazard levels. Particulate respirators are “air-purifying respirators” because they clean particles out of the air as you breath. Even if you can’t see the particles, there may be too many in the air for this respirator to provide adequate protection.

All particulate respirators must be approved by NIOSH (National Institute of Occupational Safety and Health). Additionally, a respiratory protection program must be implemented, to ensure that respirators are used safely. (For more information about respiratory protection programs, see the Task 2 of the PPE Activity.)

## 4. Do Not Dry Cut!

### Working Around Block Specifications

Specifications for block work often contain the requirement that they be laid in a dry condition. This requirement should not prevent the use of a wet cutting saw. The work can be planned so that blocks can be wet cut in advance and dried before they are laid. During dry weather, blocks may be laid soon after they are cut. During wet weather, they may need to be cut several hours in advance, or may need to be placed in a drying chamber.

### NJ Law Prohibits Dry Cutting

In 2004, the Bricklayers Union and other labor organizations in New Jersey worked with legislators to reduce worker exposures to silica. The bill prohibited dry cutting of masonry and required the use of water or engineering and work-practice controls for the dust, unless a contractor could show that such controls were not feasible. Acting Governor Richard J. Codey signed the bill and it became law on December 9, 2004. If no other protections are possible, the employer is to provide full-face respirators as part of a complete, OSHA-approved program.

OSHA has a permissible exposure limit (PEL) for silica and began a special silica hazards emphasis program in 1996. OSHA held stakeholder meetings in 1999 but they are still working to develop a comprehensive standard.

**For more information on silica see Appendix B on page 441.**

## CHAPTER 172

**AN ACT** prohibiting the dry cutting and dry grinding of masonry in certain instances and supplementing P.L.1962, c.45 (C.34:5-166 et seq.).

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

C.34:5-182 Dry cutting, grinding of masonry, certain circumstances; prohibited.

1. In order to protect the health and safety of employees against the effects of silicosis and other respiratory diseases, the dry cutting of masonry units by means of hand-held, gas-powered or electrical, portable chop saws or skill saws and the dry grinding of masonry materials shall be prohibited, except in instances in which it is determined, in a manner consistent with all applicable standards promulgated pursuant to the federal Occupational Safety and Health Act of 1970 (29 U.S.C.s.651 et seq.), that the use of water in the cutting or grinding is not feasible.

In any instance in which it is determined pursuant to this section that the use of water in the cutting or grinding is not feasible:

- a. The employer shall use engineering and work practice controls to control the dust, such as a vacuum with high efficiency particulate air filter, or other dust control system;
- b. Any dry cutting which occurs shall be done in a designated area away from craft workers if possible; and
- c. The employer shall provide workers with full face respirators as part of a complete respiratory program which includes training, the proper selection of respiratory cartridges and fit-testing to ensure that the workers are able to wear the respirators.

The provisions of this section shall not apply to emergency service personnel responding to emergency situations.

2. This act shall take effect immediately.

Approved December 9, 2004.

*(continued)*

## 4. Do Not Dry Cut! *(continued)*

### Silicosis

Silicosis is caused by exposure to respirable crystalline silica dust. Crystalline silica is a basic component of soil, sand, granite, and most other types of rock, and it is used as an abrasive blasting agent. Silicosis is a progressive, disabling, and often fatal lung disease. Cigarette smoking adds to the lung damage caused by silica.

#### Effects of Silicosis

- Lung cancer – Silica has been classified as a human lung carcinogen.
- Bronchitis/Chronic Obstructive Pulmonary Disorder.
- Tuberculosis – Silicosis makes an individual more susceptible to TB.
- Scleroderma – a disease affecting skin, blood vessels, joints and skeletal muscles.
- Possible renal disease.

#### Symptoms of Silicosis

- Shortness of breath; possible fever.
- Fatigue; loss of appetite.
- Chest pain; dry, nonproductive cough.
- Respiratory failure, which may eventually lead to death.

#### Sources of Exposure

- Sandblasting for surface preparation.
- Crushing and drilling rock and concrete.
- Masonry and concrete work (e.g., building and road construction and repair).
- Mining/tunneling; demolition work.
- Cement and asphalt pavement manufacturing.

#### Preventing Silicosis

- Use all available engineering controls such as blasting cabinets and local exhaust ventilation.
- Avoid using compressed air for cleaning surfaces.
- Use water sprays, wet methods for cutting, chipping, drilling, sawing, grinding, etc.
- Substitute non-crystalline silica blasting material.
- Use respirators approved for protection against silica; if sandblasting, use abrasive blasting respirators.
- Do not eat, drink or smoke near crystalline silica dust.
- Wash hands and face before eating, drinking or smoking away from exposure area.

## 5. Skin Diseases and Disorders in Construction

Work-related skin disorders can be severe enough to force workers to miss work for several days or to change occupations. Skin disorders are a major problem for workers that are regularly exposed to cement.

Cement has many properties which are damaging to skin:

- Cement is caustic (it can burn you)
- Cement is hygroscopic (it pulls moisture from the skin)
- Cement is abrasive
- Cement may contain sensitizing chemicals and metals, such as hexavalent chromium

In the U.S. more than 1,300,000 workers in 30 occupations are regularly exposed to wet cement. Cement burns, cement dermatitis, and hexavalent chromium allergies are a major skin health problem suffered by workers that work with concrete and other wet cement products.

Some of the jobs that expose workers to cement include:

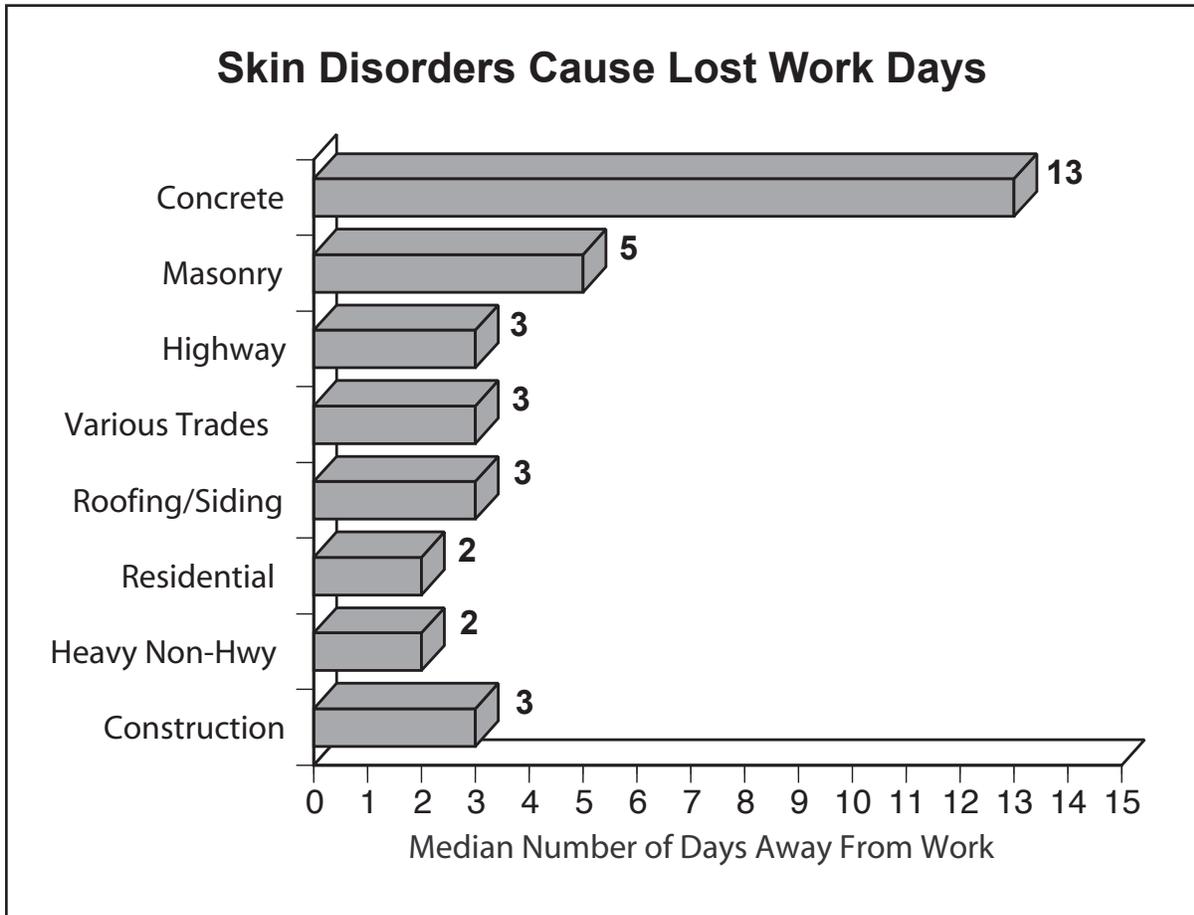
- tending concrete pour
- mixing and spreading grout
- preparing cement underlayer for terrazzo
- hosing out ready mixed concrete truck, mixer, and chute
- using mortar to set brick, block, and other masonry
- dismantling formwork contaminated by Portland cement
- pouring, leveling, smoothing, and finishing concrete
- attaching tiles to walls, floors, and ceilings
- mixing mortar and providing it to other workers
- mixing and applying plaster, stucco, and EIFS
- spraying Portland cement products such as fireproofing, gunite, or shotcrete

*(continued)*

## 5. Skin Diseases and Disorders in Construction *(continued)*

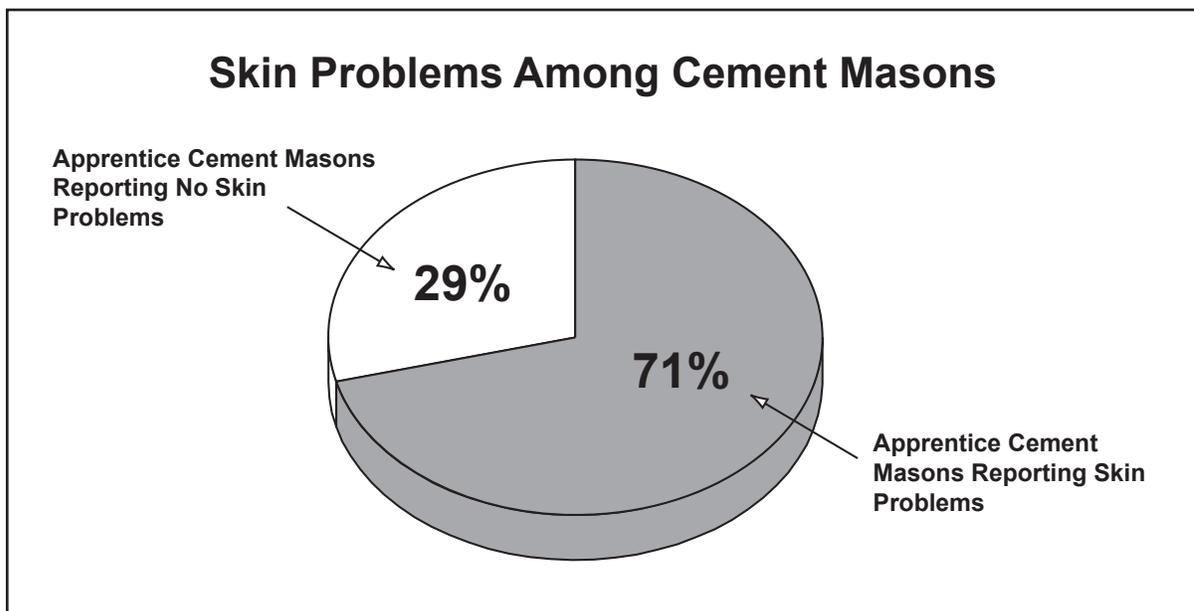
### Lost Work Days

Compared with other construction workers, skin disorders cause concrete workers to lose many more work days.



### The Problem Is Widespread

A study of apprentice masons with an average of more than 3 years of experience found that 71% reported one or more skin problems. Only 29% reported no skin problems. Only 7% of those with skin problems reported lost time or doctor visits for their problems. An overwhelming majority with skin problems, (93%) continued to work without seeking medical treatment—setting themselves up for lifelong health problems.



Sources: The Center to Protect Workers Rights, *An Employer's Guide to Protection*, 2000, <http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>. *Cement Hazards and Controls: Health Risks and Precautions in Using Portland Cement*, Construction Safety Magazine, Volume 12, Number 2, Summer 2001, <http://www.cdc.gov/elcosh/docs/d0500/d000513/d000513.html>.

## 6. Dermatitis and Cement Burns

Concrete is used in masonry, floor laying and other occupations. It is a mix of *portland cement*\* (calcium, silica, iron, and alumina) sand, aggregate and water. Fly ash, gypsum, and blast-furnace slag may be added to produce blended-cement products. Contact with wet concrete can cause both irritant and allergic contact dermatitis.

### Dermatitis

Irritant dermatitis can have acute (short term) or chronic (long term) effects and is caused by the alkaline and abrasive properties of concrete. Irritant dermatitis can also be caused by solvents, soaps, asphalt, dust, fiberglass, abrasives, and mechanical trauma or friction.

Allergic dermatitis may be caused by persistent contact with hexavalent chromium and it is found in most portland cement. Hexavalent chromium is water soluble meaning it can penetrate the skin. Five to 15 % of workers that come in contact with portland cement that contains hexavalent chromium suffer allergic contact dermatitis at a rate well over 25 times the rate for allergic dermatitis in the general population. Allergic contact dermatitis that develops after cement exposure may persist in 20 to 40% of workers who have reacted to hexavalent chromium, even without further exposures to the substance.

### Cement Burns

An acid will burn skin immediately. Cement is sneakier. You can work with wet cement on the skin for hours without feeling any discomfort. But the alkaline burn of the cement is damaging the skin microscopically. That damage may be just a cement burn or it also may be the cumulative injury that leads to irritant or allergic dermatitis.

**\*Portland cement** is not a brand name, it is a the generic term for the type of cement used in virtually all concrete.

Sources: The Center to Protect Workers Rights, *An Employer's Guide to Protection*, 2000, <http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>. *Cement Hazards and Controls: Health Risks and Precautions in Using Portland Cement*, Construction Safety Magazine, Volume 12, Number 2, Summer 2001, <http://www.cdc.gov/elcosh/docs/d0500/d000513/d000513.html>.

If you feel a cement burn starting go immediately for emergency treatment. Don't assume the burn will not get worse. By the time you become aware of the burn, much damage has already been done and further damage is difficult to stop. Medical experts recommend flushing the skin with lots of clean water. Some suggest adding vinegar, citrus, or a buffer to the water to help neutralize the caustic effect.

### **Skin Problems From Exposures to Wet Concrete**

- **Dry skin** (a mild form of irritant contact dermatitis) may include scaling, itchiness, burning, redness. Dry skin may be called xerosis. A cement exposure can lead directly to dry skin or irritation.
- **Irritant contact dermatitis (ICD)** can be acute or chronic. It can include stinging, pain, itching, blisters, dead skin, scabs, scaling, fissures, redness, swelling, bumps, and watery discharge. Sometimes irritation leads to infection. Cement exposure can lead directly to ICD or skin damage without first causing dry skin.
- **Allergic contact dermatitis (ACD)** is an immune response. It is like other allergies but it involves the skin. ACD includes many symptoms of ICD. ACD is difficult to cure. The allergy may last a lifetime. Cement exposure can lead directly to ACD. This can happen without any warnings, such as local irritation.
- **Caustic burns (cement burns)** are alkali burns. They should be referred to a medical specialist without delay. By the time you become aware of a burn, much damage has been done and further damage is difficult to stop. Cement burns look like other burns. They produce blisters, dead or hardened skin, or black or green skin. Cement burns also can lead to allergic dermatitis.

## 7. What Makes Cement Hazardous?

The composition of cement may vary from region to region but the alkaline, abrasive, and hygroscopic properties of cement in concrete, mortar, grout, plaster, stucco, and other products are universal.

### Wet Cement Is Caustic

Wet cement is an alkali, or caustic. A caustic is any strongly alkaline material with a corrosive or irritating effect on living tissue. Alkalinity is essential in the development of irritant contact dermatitis (ICD) from cement.

pH is a measure of the alkalinity or acidity of a material. Pure water has a pH of 7 and is considered pH-neutral. Strong alkalis are pH 12 to 14. Cement is extremely alkaline, or caustic, with a pH value of 12 to 13. Strong acids are pH 1 to 3.

Strong Acid				Neutral				Strong Alkaline (Caustic)						
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sulfuric Acid			Healthy Skin				Water				Cement			
				Orange										

### pH Values

Like the earthquake scale, the pH scale is logarithmic. So the intervals between numbers are not equal. Every whole number is a 10-fold change in alkalinity or acidity. For example:

- Cement (pH 12-13) is up to 1,000,000,000 times more alkaline than human skin (pH 4.5)
- pH 13 is 1,000,000 times more alkaline than pH 7.

### **The pH Of Healthy Skin**

Normal skin is pH 4.5 to 5.5. The slightly acidic pH of normal skin helps it to resist bacterial infection. Bacteria don't like acidic environments. Contact with wet cement changes skin pH to alkaline. At alkaline pH, skin barrier repair is slowed, damage is prolonged, and skin problems are worsened.

### **Strong Acids**

Acids are a large class of chemicals with pH values ranging from less than 7 to less than 1. Acids with pH 1 are one million times more acidic than pure water. Hydrochloric acid (HCl), nitric acid (HNO<sub>3</sub>), and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) are all examples of strong acids that burn skin immediately.

### **Strong Alkalies**

Strong alkalies can be more dangerous because they damage skin slowly without immediate pain. An alkali can remain on skin for hours before a burn is felt. Alkalinity also contributes greatly to skin absorption of the hexavalent chromium (Cr<sup>6+</sup>) in cement.

Sources: The Center to Protect Workers Rights, *An Employer's Guide to Protection*, 2000, <http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>. *Cement Hazards and Controls: Health Risks and Precautions in Using Portland Cement*, Construction Safety Magazine, Volume 12, Number 2, Summer 2001, <http://www.cdc.gov/elcosh/docs/d0500/d000513/d000513.html>.

## 8. PPE for Cement

To protect yourself from cement and cement mixture hazards, wear the following:

- **Alkali (caustic)-resistant gloves** – Check the manufacturer’s label on the glove packaging to make sure they are alkali-resistant. Manufacturers often recommend butyl gloves or nitrile gloves for caustics like cement. (For more information on gloves see the PPE Activity.)
- **Coveralls** – They should have long sleeves and full-length trousers. Pull sleeves down over gloves and tuck pants inside boots and duct-tape at the top to keep mortar and concrete out.
- **Waterproof boots** – They should be high enough to prevent concrete from flowing in when you must stand in fresh concrete.
- **Respirators** – Use a P, N, or R 95 respirator when cement dust can’t be avoided. (See the PPE Activity for more information on respirators.)
- **Eye protection** – Wear safety glasses with sideshields or goggles, under extremely dusty conditions use tight-fitting unvented or indirectly vented goggles. Don’t wear contact lenses when handling cement or cement products.

## **If You Are Exposed to Wet Cement/Cement Mixtures**

Wash wet concrete, mortar, cement, or cement mixtures from your skin immediately. Flush eyes with clean water immediately after contact. Indirect contact through clothing can be as serious as direct contact, so promptly rinse out wet concrete, mortar, cement, or cement mixtures from clothing. Seek immediate medical attention if you have persistent or severe discomfort.

Sources: The Center to Protect Workers Rights, *An Employer's Guide to Protection*, 2000, <http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>. *Cement Hazards and Controls: Health Risks and Precautions in Using Portland Cement*, Construction Safety Magazine, Volume 12, Number 2, Summer 2001, <http://www.cdc.gov/elcosh/docs/d0500/d000513/d000513.html>.

## 9. Hygiene Essentials

Most workers that work with cement already wear gloves. But, to be effective, glove wear must include proper hygiene practices. Glove wear without good hygiene practices is no more protective than no gloves at all. In fact, it can make problems worse.

### **Wash Your Hands**

Wash your hands before work, whenever you break, and at the end of the day. Don't use abrasive solvent cleaning products. These include waterless hand cleaners like the alcohol-based gels or citrus cleaners. Such cleaners are not suitable for cement exposure. Wash with pH-neutral soap and clean running water

### **Wash Hands Before Putting On Gloves**

You should also wash your hands and dry them thoroughly before putting on gloves. If you remove gloves during work, then you should wash again with clean water and pH-neutral or acidic soap. Don't rinse your hands in tool rinse buckets.

### **Use pH Neutral or Acidic Soaps at Home**

Wash with pH-neutral or acidic soaps. Concrete and mason workers who wash with alkaline soaps unknowingly damage their skin with alkalis. During the day they are exposed to caustic cement. At home they are exposed to caustic soap. If you wash with pH-neutral or acidic soaps at home, it will help to heal your skin. The table on the next page lists pH values for 39 soaps. Use only pH-neutral or slightly acidic soaps (pH 5-7).

### **Avoid Skin Softening Products At Work**

Skin-softening products can seal cement to skin, increase the skin's ability to absorb contaminants, and/or irritate the skin. Skin-softening products should be applied only to clean skin in clean environments. You can use these products, if desired, at home after showering or bathing with pH-neutral or slightly acidic soap.

But be careful! Some skin-softening products contain fragrances, lanolin, or other chemicals that can cause allergic contact dermatitis (ACD). **NOTE:** Never use petroleum jelly or other emollients to treat cement burns. Applying such products can intensify burns by trapping the cement against the skin.

Soap	pH	Liquid Soaps	pH
Basis	9	Aloe Vera 40	6
Caress	7	Cetaphil	6
Clearly Natural	9	Dial	6
Coast	9	Dove	6
Dial	10	Gillette Wash	6
Dove	6	Gojo Orange	5
Grandma's Oatmeal	10	Gojo Cream	8
Irish Spring	10	Ivory	6
Ivory	10	Jergens	6
Jergens	10	Joy	6
Kiss My Face	11	Lever 2000	6
Lava	9	Neutrogena Rainbath	6
Lever 2000	9	Noxema	7
Neutrogena	9	Palmolive	7
Oil of Olay	7	pHisoderm	5
Palmolive	10	Softsoap	6
Safeguard	9		
Shield	9		
Tom's of Maine	10		
Tone	10		
Vermont Country	9		
Yardley	10		
Zest	10		

### Don't Use Barrier Creams

Barrier creams or 'invisible gloves' are not recommended for cement work. The abrasive cement probably breaks the seal of the barrier cream. Also, reapplying the cream in the work area may seal cement to the skin.

*(continued)*

## 9. Hygiene Essentials *(continued)*

### **Don't Wear Jewelry at Work**

Cement can collect under rings, watches, or necklaces. Wet cement trapped against skin for long periods is hazardous.

### **Protect Your Family From Cement Dust Exposers**

If you get in your car with cement dust on your clothes, the dust left on your car seat can expose your family to the hazards of cement. If you wash your work clothes with your family's clothes or if you sit in a chair at home before changing out of your work clothes you can expose your family to the hazards of cement.

To avoid the risks of exposing family members, remove your work clothes and bring them home in a separate container. A trash bag works great. This practice keeps cement out of the car or truck interior. Wash the contaminated clothes separately. After washing your work cloths, run the washer through a rinse cycle to make sure all the cement residue is removed.

### **See A Doctor**

If you have a persistent skin problem, even a minor one, see a doctor. Make sure you tell the doctor that you work with cement or cement related mixtures. The goal is to provide medical treatment for a health problem before it becomes chronic and untreatable.

<b>Best Practices Checklist</b>	
<b>AT HOME</b>	
✓	Use pH-neutral soap at home
✓	Launder work clothes separately
<b>AT WORK</b>	
✓	Wash with clean running water and pH-neutral soap
✓	Wear correct gloves
✓	Wash before putting on gloves
✓	Wash again whenever gloves are removed
✓	Use disposable gloves or clean reusable gloves daily
✓	Remove gloves properly
✓	Wear glove liners
✓	No jewelry at work
✓	Long sleeves buttoned or taped inside gloves
✓	Rubber boots with pants taped inside for concrete work
✓	Never let cement remain on skin or clothes
✓	Avoid barrier creams
✓	Avoid skin softening products at work
✓	Change out of work clothes before leaving jobsite
✓	See a doctor for any persistent skin problem

Sources: The Center to Protect Workers Rights, *An Employer's Guide to Protection*, 2000, <http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>. *Cement Hazards and Controls: Health Risks and Precautions in Using Portland Cement*, Construction Safety Magazine, Volume 12, Number 2, Summer 2001, <http://www.cdc.gov/elcosh/docs/d0500/d000513/d000513.html>.

## Summary

1. Construction work of all kinds is known to be hazardous to workers' lungs. And for a laborer, the risk of dying from diseases like silicosis, asbestosis, or respiratory conditions due to chemical fumes or vapors is 26% higher than for the rest of the population.
2. Exposures to silica dust can lead to a disease called silicosis—a serious and incurable respiratory disease. It can result when particles of crystalline silica are inhaled and become embedded in the lung. The disease can be fatal. It is estimated that about 250 workers die each year from silica exposure.
3. Water is the most efficient means to control dust from cutting concrete products. Bench saws for blocks and bricks typically have ports on the upper blade guard where water supply lines can be attached.
4. Respirators are often ineffectively or not properly used and as a result, they do not provide the same level of protection as wet cutting. However, if exposures to crystalline silica cannot be sufficiently reduced by wet cutting or ventilation, you should wear appropriate respiratory protection.
5. **Dust masks are not respirators** and they **ARE NOT** to be used for protection against airborne toxic particulate matter (such as silica dust) or for gases or vapors. They are never to be used as protection from illness or injury.
6. In 2004, the Bricklayers Union and other labor organizations in New Jersey worked with legislators to reduce worker exposures to silica by passing a law that prohibits dry cutting.
7. Skin disorders are a major problem for workers that are regularly exposed to cement.
8. Contact with wet concrete can cause both irritant and allergic contact dermatitis. Wet cement can also cause caustic burns that progress. This means they get worse even without more exposure.

If you feel a cement burn starting, go immediately for emergency treatment in an ER or see a burn specialist.

9. Wet cement is an alkali, or caustic. A caustic is any strongly alkaline material with a corrosive or irritating effect on living tissue. Alkalinity is essential in the development of irritant contact dermatitis (ICD) from cement.
10. When working with wet cement you should wear alkali resistant gloves, coveralls with long sleeves and full-length trousers, waterproof boots and suitable respiratory and eye protection.
11. Maintain good hygiene practices when working concrete and masonry jobs.



# Evaluation

## Activity 12: Concrete and Masonry Safety

1. How important is this Activity for day laborers?

**Please circle one number.**

<b>Activity Is Not Important</b>			<b>Activity Is Very Important</b>	
1	2	3	4	5

2. Please **put an “X”** by the factsheets you feel are the most important.

	1. Lung Diseases in Construction		6. Dermatitis and Cement Burns
	2. Silica Dust		7. PPE for Cement
	3. Reducing the Risk of Silica Dust Exposures		8. Atmospheric Hazards
	4. Do Not Dry Cut!		9. Hygiene Essentials
	5. Skin Diseases and Disorders in Construction		

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.				

4. What would you suggest be done to improve this Activity?

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# **Activity 13: Confined Spaces**

## **Purpose**

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To learn more about the multiple hazards of confined spaces and what you should do in an emergency situation.

This Activity has three tasks.

## Task 1

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Any one of us could be the first to spot a potential emergency at a worksite. We all must know what to do to protect ourselves and co-workers in an emergency.

Below you will find an emergency scenario and on the next page a list of eight procedures (listed alphabetically) that are typical actions to follow when there is an emergency. These eight procedures are printed on sets of cards that the trainers will pass out to your groups. The cards list the actions that you would take as the first person to identify that an emergency situation exists.

**Read the scenario below and then arrange the cards in the order of the steps you would take to respond to the emergency. What would you do first, second, third, etc.**

To replicate some of the confusion of an emergency situation, your group will have only **five minutes** to arrange the cards.

### **Scenario:**

A contractor has hired Felix and his close friend Ramon to work at a construction site inside a manhole. Ramon climbs into the manhole. From outside the manhole Felix calls out his name but he does not respond. Felix flashes a light into the manhole and sees Ramon lying face down and not moving.

If you were Felix what would you do?

---

## **Eight Emergency Response Actions:** (listed alphabetically)

<b>ALERT (others nearby)</b>	Tell a nearby co-worker or anyone else nearby that there's a problem; get help.
<b>CONTROL (the hazard)</b>	Control or contain any spill or leak of hazardous material that is part of the incident.
<b>CRITIQUE</b>	Review the response to determine how to improve procedures for the next time.
<b>DECONTAMINATE (the injured)</b>	Wash or rinse the contamination off the injured person
<b>EVACUATE</b>	Make sure all unnecessary and uninvolved personnel are cleared from the problem area.
<b>NOTIFY (government agencies)</b>	Make a phone call to the appropriate government agency to let them know an incident has occurred (EPA, OSHA, DOT, etc.)
<b>RESCUE (the injured)</b>	Get in and get the downed person(s) out (so they can receive medical attention).
<b>SIZE UP (the situation)</b>	Take time to think through the situation as you see it and decide on what you will do.

## **Task 2**

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Now review the factsheets on pages 374-377 and see if you change your mind about what to do first.

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## **Eight Emergency Response Actions:** (listed alphabetically)

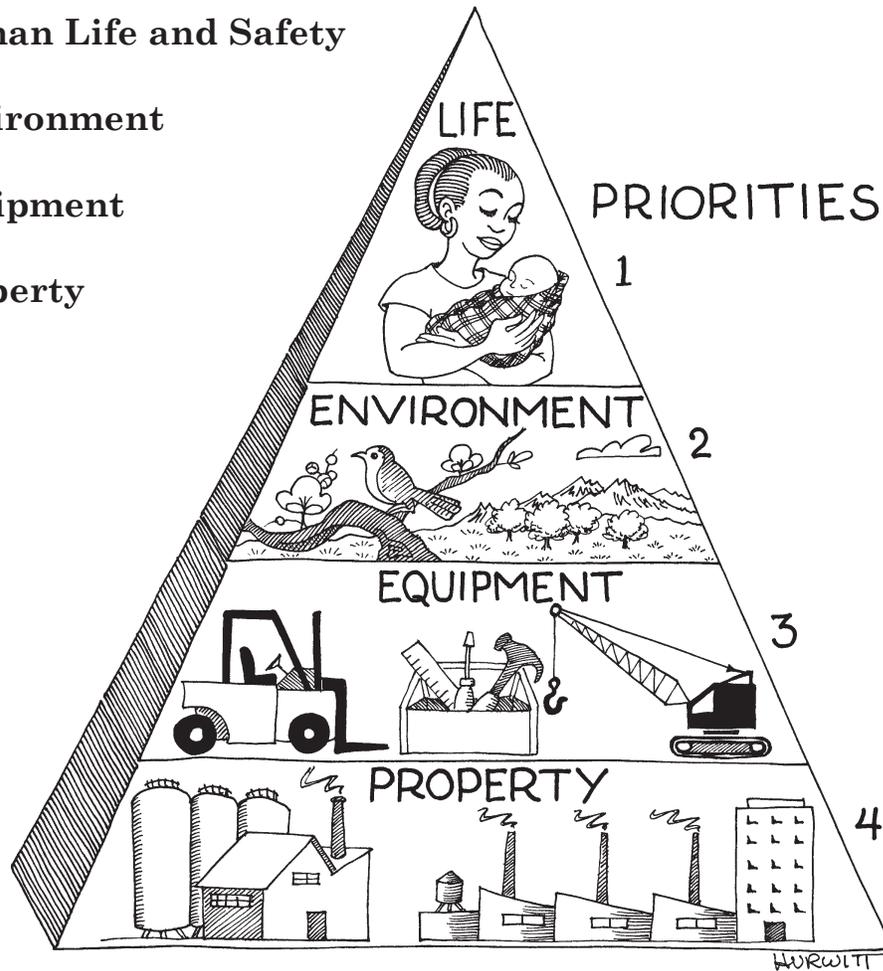
<b>ALERT (others nearby)</b>	Tell a nearby co-worker or anyone else nearby that there's a problem; get help.
<b>CONTROL (the hazard)</b>	Control or contain any spill or leak of hazardous material that is part of the incident.
<b>CRITIQUE</b>	Review the response to determine how to improve procedures for the next time.
<b>DECONTAMINATE (the injured)</b>	Wash or rinse the contamination off the injured person
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<b>RESCUE (the injured)</b>	Get in and get the downed person(s) out (so they can receive medical attention).
<b>SIZE UP (the situation)</b>	Take time to think through the situation as you see it and decide on what you will do.

# 1. Setting Priorities: Life Comes First

## Getting Our Priorities Straight

Emergency responders should act to protect:

1. Human Life and Safety
2. Environment
3. Equipment
4. Property



### Life Comes First

The first priority is to **protect human life and rescue the injured where possible.**

Sounds easy, right? Unfortunately, it is not easy to live by this simple rule during an emergency because of the following:

### **We try a rescue when we shouldn't.**

Human nature is such that we cannot stand to see a fellow worker go down and not try to jump in and rescue. Unfortunately, on some jobsites this instinct will almost always kill us.

According to a NIOSH study of **confined spaces** facilities, over 60 percent of all fatalities were **would-be rescuers becoming casualties because they jumped in to rescue a co-worker.**

It's hard, but we need to learn to think before we jump in. Sometimes "protecting life first" means your own. This is done by isolating the area and **keeping everyone out until people with proper training and protective equipment arrive.**

### **Protecting the Environment**

Sometimes emergency response actions taken to contain a spill or fire can result in widespread environmental contamination.

When dealing with hazardous substances, **minimizing the contamination and adverse effects to the environment**—air emissions, leaks to the bodies of water into flood control or sewer lines—is a higher priority than putting out a fire to save a facility.

### **Protecting Equipment and Property**

Only when life and the environment are protected should we move to protect equipment, buildings and structures.

## 2. Alert, Think, Then Act: Emergency Response Procedures

The following six procedures always apply to an emergency situation and should be done in the following order:

1. **Alert others nearby.** This is always the first action to take. Notify others that an emergency is taking place so that on-site and off-site help can be called immediately.
2. **Size up the situation.** Before you make any move, think first—do not become a casualty yourself. Consider the options: evacuation, rescue, hazard control, etc.
3. **Evacuate.** Get everyone who may be in harm's way out of the problem area and wait for people with proper training and equipment to arrive.
4. **Rescue the injured. Your first priority is to protect your health and safety; then assist or obtain assistance for the injured.** In almost all situations you will need the help of others, specialized equipment, and proper personal protective equipment before any rescue can be attempted. Decontamination of the person is a case-specific decision depending on how toxic the chemical is and how life threatening the situation is. Whenever handling an injured and contaminated person, be sure that the emergency medical, ambulance, and hospital personnel are kept informed. Some states and communities have laws or policies prohibiting transportation of a contaminated person who has not been decontaminated.

- 5. Control the hazard.** The next priority is to contain or control the hazard. In most cases, this should be done by the emergency response team because they have the training, experience and equipment to do the job safely. Prompt equipment shutdown or isolation are steps trained personnel may take to minimize the hazards. **Protecting life and the environment is a higher priority than saving the facility or property.**
- 6. As a follow-up, critique your response.** After an incident, always critique the responses to identify ways to improve response procedures for the next time. This should include the need for more training, drills, equipment or modification of the emergency response plan.

## **Task 3**

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It was later determined that Ramon's death was the result of a lack of oxygen in the manhole. If you were hired to do the same job what would you do to make sure the manhole is safe to work in?

In your groups review the factsheets on pages 380-397. Then based on your own experience and the factsheets, make a list of questions that you would ask the contractor before entering the manhole and answer the question that follows.

---

**A. Questions you would ask the contractor. (Please make a list.)**

1.

2.

3.

4.

5.

6.

**B. How would you respond to a contractor that tells you the confined space rules and regulations do not apply to construction contractors?**

### 3. What Is a Confined Space?

A **Confined Space** includes any space large enough and shaped so that a worker can enter and perform assigned work along with one of the following characteristics:

- The space has limited or restricted openings for entry and exit
- The space is not designed for continuous worker occupancy

Examples of Confined Spaces	
Storage Tanks	Ventilation and Exhaust Ducts
Pits	Sewers
Silos	Tunnels
Vats	Utility Vaults
Degreasers	Pipelines
Reaction or Process Vessels	Firewalls
Boilers	

## 4. Hazards of Confined Space Work

Confined spaces can be hazardous because they often contain airborne, mechanical or physical hazards. Asphyxiation is the leading cause of death in confined spaces, according to OSHA statistics. While hazards may already exist before you enter a confined space, other hazards can be created by the work activity. That's why pre-entry and continuous or repeated monitoring are essential.

### **Confined spaces are hazardous because they may:**

- have less than 19.5 percent oxygen or greater than 23.5 percent oxygen (See Factsheet 5 for more information)
- have contaminants in the air that make the atmosphere toxic (See Factsheet 6 for more information)
- have flammable / combustible / explosive atmospheres present or generated by the work activity
- not be protected against entry of water, gas, steam, toxic or corrosive chemicals, or radiation contamination and fields that could trap, suffocate or otherwise harm a worker
- have mechanical hazards of moving machinery that can harm a worker if activated during occupancy of the confined space
- have physical hazards, causing slips, falls or engulfment
- have poor natural ventilation
- restrict entry for rescue purposes
- have extreme temperatures

Source: Workers Compensation Board of BC, Hazards of Confined Spaces for Municipalities and the Construction Industry, [www.WorkSafebc.com](http://www.WorkSafebc.com).

## 5. Atmospheric Hazards: Too Much or Too Little Oxygen

### Oxygen Deficiency (Too Little)

Many confined-space emergencies, are caused by reduced levels of oxygen in the air. Oxygen deficiency can be a killer in emergency response situations.

#### What Causes Oxygen Deficiency?

Some of the common causes of oxygen deficiency include:

- Oxygen is used up during combustion—for example, by propane space heaters, during cutting or welding, and by internal combustion engines
- Oxygen can be replaced by other gases—for example, welding gases or gases forced into the space to prevent corrosion
- Micro-organisms use up oxygen—for example, in sewer lines and fermentation vessels.

### Physiological Effects

The body requires oxygen to live. If the oxygen concentration in the air decreases, the body reacts in various ways. Death occurs rapidly when the oxygen level decreases to six percent.

The legal limit is never to work in an atmosphere with less than 19.5 percent oxygen. As the chart below shows, decreasing oxygen levels can greatly impair our judgment, making us victims rather than helpers in an emergency situation.

<b>Physiological Effects of Oxygen Deficiency</b>	
<b>%Oxygen (by volume) at Sea Level</b>	
21-19	Nothing abnormal.
16-12	Loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination.
12-10	Very faulty judgement, very poor muscular coordination, intermittent respiration. Muscular exertion causes fatigue that may cause permanent heart damage.
10-6	Nausea, vomiting, inability to perform vigorous movements, or loss of all movement, unconsciousness, followed by death.
Less than 6	Spasmodic breathing, convulsive movements, death in minutes.

### **Too Much Oxygen**

Too much oxygen is not as common a hazard in confined spaces but when it occurs it greatly increases the risk of fire or explosion. Materials that would not normally catch fire or burn in normal air may do so very quickly and easily in confined spaces where there oxygen levels are high.

The only way to know how much oxygen is present in a confined space is to use an oxygen monitor. It must be in good working order and properly maintained and calibrated. The alarm must be set at the right level. Someone trained to use the monitor must test the air before anyone enters a confined space.

Sources: Workers Compensation Board of BC, Hazards of Confined Spaces for Municipalities and the Construction Industry, [www.WorkSafebc.com](http://www.WorkSafebc.com). OSHA Regulation: Permit-Required Confined Spaces - 1910.146; Fire Fighting Fundamentals, Seattle Fire Department and Washington State Fire Service Training, Seattle, WA, 1989.

## 6. Atmospheric Hazards: Toxic Gases

Gases in the air can result in an atmosphere that is toxic to workers and may result in injury or death. Some toxic gases typically found in confined spaces are listed below.

<b>Beware of Toxic Gases in Confined Spaces</b>		
<b>Contaminant (Gas)</b>	<b>The Danger</b>	<b>Looks or Smells Like</b>
Argon (Ar)	Displaces oxygen May accumulate at bottom	Colorless, odorless
Carbon dioxide (CO <sub>2</sub> )	Displaces oxygen Toxic May accumulate at bottom	Colorless, odorless
Carbon monoxide (CO)	Toxic—asphyxiant (causing suffocation)	Colorless, odorless (No Warning)
Chlorine (Cl <sub>2</sub> )	Toxic—lung and eye irritant May accumulate at bottom	Greenish yellow color and sharp pungent odor
Gasoline Vapours	Fire and explosion May accumulate at bottom	Colorless with a sweet odor
Hydrogen sulfide (H <sub>2</sub> S)	Extremely flammable Very toxic—causes lung failure May accumulate at bottom	Colorless with rotten egg odor
Methane (CH <sub>4</sub> )	Fire and explosion May accumulate at top	Colorless, odorless (No Warning)
Nitrogen (N <sub>2</sub> )	Displaces oxygen	Colorless, odorless (No Warning)
Nitrogen dioxide (NO <sub>2</sub> )	Toxic—severe lung irritant May accumulate at bottom	Reddish brown, pungent odor
Sulfur dioxide (SO <sub>2</sub> )	Toxic—severe lung irritant May accumulate at bottom	Colorless, rotten suffocating odor
Oxygen (O <sub>2</sub> )	Low levels—asphyxiant High levels—causes spontaneous combustion, explosion	colorless, odorless

## **Monitoring and Removal**

The concentration of a substance inside a confined space is determined by using a calibrated and properly set up air monitor with the correct sensor. The monitor will sound an alarm before an exposure limit is reached.

In most cases, fans are used to ventilate the space and bring in clean outside air. Air testing and ventilation are the best ways to ensure that workers are not placed at risk from hazardous gases. Harmful substances must be eliminated whenever possible.

## 7. OSHA Enforcement and Confined Spaces in Construction

### For Maintenance and Repairs

OSHA's general industry confined space standard (29 CFR 1910.146) specifically states that *"This section does not apply to agriculture, to construction, or to shipyard employment."* As a result many construction contractors believe they are not required to comply with the OSHA's confined space rules and regulations. However, **when contractors contract work in existing confined space for the purpose of doing maintenance or repairs, they are covered by the standard.**

The host employer (the party that owns and/or maintains the confined space) is responsible for informing the contractor of the following:

- the hazards associated with the confined space
- the precautions that must be taken
- the proper entry
- the need (if required) for a confined space entry permit

The contractor will be responsible for your safety and for training you in the host employer's confined space program prior to allowing you to enter the space.

### **For New Construction**

In situations where the work is considered new construction, the confined space general industry standard does not apply but the General Duty Clause, section 5(a)(1) of the OSH Act does apply. It states that every employer (and that would include all contractors) has a general duty to *“provide...each of their employees with employment and a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm...”*

**In short, construction contractors are required to take the necessary precautions to insure that the hazards associated with a confined space are controlled at all times.**

Sources: National Safety Council, Complete Confined Space Handbook. Smart Mark, Residential Construction, Confined Spaces, 2000.

## 8. Non-Permit and Permit Required Confined Spaces and Procedures

A *non-permit* confined space does not contain any hazard capable of causing death or serious physical harm. If the space has hazards that could cause death or harm, you need a permit to enter it.

If a contractor takes you to a jobsite to work in a confined space that is owned or maintained by an employer and the space contains one of the following conditions:

- A hazardous atmosphere or material that could engulf a worker
- Conditions inside the confined space that could trap or asphyxiate a worker (such as inwardly converging walls or sloped floor)
- Any other recognized serious safety or health hazard

It is considered a *permit-required* confined space, or “permit space,” and the employer is required to inform the contractor that entry into the space is only allowed through compliance with a permit space program that meets the requirements of the confined space standard.

### Employer Requirements

To make the contractor’s entry into the permit-required space safe, the employer must:

- Provide to the contractor information on the elements that make the space in question a permit space, including hazards identified
- Provide to the contractor information on any precautions or procedures that the employer has implemented in or near permit spaces where contractor employees will be working

- Coordinate entry operations with the contractor when the employer's employees will be working in or near permit spaces
- Debrief the contractor at the conclusion of entry operations regarding the permit space program followed and regarding any hazards confronted or created in permit spaces during entry operations.

### **Contractor Requirements**

In addition to complying with the permit space requirements that apply to all employers, contractors must:

- Obtain any available information regarding permit space hazards and entry operations from the host employer
- Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces
- Inform the host employer of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation

*(continued)*

Sources: OSHA Regulation: Permit-Required Confined Spaces - 1910.146 Mark H. Stromme, J.J. Keller & Associates, Inc., *Contractors Beware: OSHA's General Industry Confined Space Standard May Apply to You*, 2003.

# 8. Non-Permit and Permit Required Confined Spaces and Procedures *(continued)*

No 173

## CONFINED SPACE ENTRY PERMIT

1. PERMIT SPACE TO BE ENTERED: \_\_\_\_\_

2. PURPOSE FOR ENTRY: \_\_\_\_\_

3. DATE OF ENTRY: \_\_\_\_\_ DURATION OF ENTRY: \_\_\_\_\_

4. AUTHORIZED ENTRANTS:

I have been properly trained for safe entry into this tank and understand my duties.

5. ATTENDANTS:

I have been properly instructed of my duties and properly trained in case of an emergency.

6. ENTRY SUPERVISORS:

I certify that all necessary precautions have been taken to make this tank safe for entering and carrying on prescribed work during the specified time.

\_\_\_\_\_ maintenance foreman / assistant foreman  
 \_\_\_\_\_ production supervisor

7. HAZARDS OF THE PERMIT SPACE TO BE ENTERED.

	YES	NO	N/A
A: LACK OF OXYGEN	_____	_____	_____
B: COMBUSTIBLE GASES	_____	_____	_____
C: COMBUSTIBLE DUSTS	_____	_____	_____
D: COMBUSTIBLE VAPORS	_____	_____	_____
E: TOXIC GASES	_____	_____	_____
F: TOXIC VAPORS	_____	_____	_____
G: CHEMICAL CONTACT	_____	_____	_____
H: ELECTRICAL HAZARDS	_____	_____	_____
I: MECHANICAL HAZARDS	_____	_____	_____
J: TEMPERATURE	_____	_____	_____
K: OTHER	_____	_____	_____

8. ISOLATING THE PERMIT SPACE BEFORE ENTRY

- \_\_\_\_\_ CLEANED AND WASHED
- \_\_\_\_\_ LOCKOUT/TAGOUT
- \_\_\_\_\_ VENTILATION
- \_\_\_\_\_ BLANKING, BLOCKING, BLEEDING
- \_\_\_\_\_ EXTERNAL BARRICADES

9. ACCEPTABLE ENTRY CONDITIONS

I certify that the tank was washed, cleaned, purged, and neutralized (if necessary) and therefore is acceptable for entry. Also, production personnel were notified that tank entry will be in progress.

\_\_\_\_\_ plant manager/designee

**DO NOT DESTROY THIS PERMIT  
 AFTER CANCELLATION THIS ENTRY PERMIT MUST BE RETAINED  
 BY EMPLOYER FOR AT LEAST ONE YEAR.**

POSTED AT CONFINED SPACE

To be Filed in Engineering Department



## 9. OSHA Requires Training For Confined Spaces

The OSHA standard requires employers to train four groups of workers.

**Entrants** (*day laborers*) must be trained to recognize hazards, communicate regularly with attendants, use personal protective equipment properly, and exit a confined space without assistance (self-rescue).

**Attendants** must be trained to be aware at all times of how many workers are in the space, know and recognize the effects of hazards both within and outside the space, maintain contact with entrants, deal with unauthorized persons, summon rescue services, and be prepared to properly perform rescue duties, such as using retrieval lines.

**Entry supervisors** must be trained in how to determine acceptable entry conditions, prepare entry permits, and identify when to terminate or cancel a permit if conditions are no longer appropriate.

**Rescue team members** must get the same training as entrants and training in proper use of personal protective equipment and rescue equipment. At least one member of the rescue team must have training and be certified in basic first aid and CPR (cardiopulmonary resuscitation) skills. In addition, rescue teams must practice making confined-space rescues at least once a year.

## 10. Recommendations for Safe Entry: A Checklist

The following checklist was compiled from the OSHA standard and recommendations by NIOSH. It is helpful in determining if the space is safe. Do not enter a confined space unless it is necessary and until you have considered every question.

### 1. Permit

- Has a confined-space permit been issued?
- Was it completed and signed by a person qualified to authorize permits?
- Does it list all hazards or conditions that must first be evaluated?
- Does it list all needed protective measures (such as lockout, ventilation, PPE, special tools, escape and rescue procedures)?

### 2. Isolation and Lockout

- Have all employees and supervisors been notified?
- Has the space been isolated from other systems?
- Has electrical equipment been locked out?
- Have disconnects been used where possible?

*(continued)*

# 10. Recommendations for Safe Entry: A Checklist *(continued)*

## 2. Isolation and Lockout *(continued)*

- Has mechanical equipment been blocked, checked, and disengaged where necessary?
- Have lines under pressure been blanked and bled?
- Have all entrances to confined spaces been properly marked with warning signs?

## 3. Atmospheric Testing and Monitoring

- Has the air been checked for oxygen? (It must be at least 19.5 percent and not more than 23.5 percent.)
- Has the air been checked for toxic vapors or gases?
- Has the air been checked for flammable vapors? (It must not exceed 10 percent of the Lower Explosive Limit.)
- Did a qualified person do the testing?
- Were all monitoring instruments calibrated and used properly?

## 4. Ventilation

- Has the space been ventilated before entry?
- Could ventilating to reduce one hazard create another hazard? For example, solving an oxygen deficiency problem through ventilation may place a particular chemical within its explosive range.
- Will ventilation be continued during entry?

- Is the air intake for the ventilation system located in an area that is free of combustible dusts and vapors and toxic substances?
- If the atmosphere was found unacceptable and then ventilated, was it retested before entry?

### **5. Cleaning**

- Has the space been cleaned before entry?
- Was the space steamed?
- If so, was it allowed to cool?
- Are there pockets of residual material?

### **6. Respirators, PPE, Rescue Equipment, and Safe Tools**

- Does the entry permit list all required PPE?
- Is special clothing required and available (chemical suits, boots, gloves, goggles)?
- Is special rescue equipment required?
- Is respiratory protection required (supplied air, SCBA, or air purifying)?
- Are special tools (e.g. spark proof) required and available?
- Can you get through the opening of the space with a respirator and other PPE on?

*(continued)*

## 10. Recommendations for Safe Entry: A Checklist *(continued)*

### 7. Training

- Have you been trained in hazard recognition, methods of safe work in confined spaces, communication methods, use of PPE and self-rescue?
- Has the attendant been trained?
- Has the entry supervisor been trained?
- Have you been trained in self-rescue?
- Are you aware of the potential hazards for this confined space (slick surfaces, noise, extreme temperature)?

### 8. Standby Attendant

- Will there be a standby attendant on the outside in constant visual or auditory communication with person on the inside? (Name should be on permit.)
- Will the standby attendant be able to see and/or hear the person inside at all times?
- How many people in the space will the attendant be required to monitor?

## 9. Rescue

- Are there company procedures available to be followed in case of an emergency?
- Will members of the rescue team be able to reach you within three to five minutes?
- Is there at least one rescue person on all shifts certified in CPR and first aid?
- Have you been trained in self-rescue?
- Is rescue equipment (such as safety lines, hoists, and harnesses) available for use by the attendant or rescue team?

## 10. Communication

- Are there effective communication procedures for entrants and attendants to remain in constant contact?
- Is special communication equipment available, where needed?

Sources: OSHA *Confined Space Pre-entry Check List* - 1910.146, App D; "A Guide to Safety in...Confined Spaces," U.S. Department of Health and Human Services, NIOSH, July 1978 and OSHA Rule on Confined Space (58 FR 4462), April 15, 1993.

## Summary

1. According to a NIOSH study of **confined spaces** facilities, over 60 percent of all fatalities were **would-be rescuers becoming casualties because they jumped in to rescue a co-worker.**
2. It's hard, but we need to learn to think before we jump in. Sometimes "protecting life first" means your own. **This is done by isolating the area and keeping everyone out until people with proper training and protective equipment arrive.**
3. A **Confined Space** includes any space large enough and shaped so that a worker can enter and perform assigned work along with one of the following characteristics:
  - The space has limited or restricted openings for entry and exit
  - The space is not designed for continuous worker occupancy
4. Confined spaces can be hazardous because there are atmospheric, mechanical or physical hazards. Atmospheric hazards can include lack of oxygen or presence of a flammable, combustible or toxic substance. Other hazards include engulfment, slippery surfaces, and heat exhaustion.
5. Many confined-space emergencies, are caused by reduced levels of oxygen in the air. Oxygen deficiency can be a killer in emergency response situations. Too much oxygen is not as common a hazard in confined spaces but when it occurs it greatly increases the risk of fire or explosion.
6. Gases in the air can result in an atmosphere that is toxic to workers and may result in injury or death. The concentration of a substance inside a confined space is determined by using a calibrated and properly set up air monitor with the correct sensor. The monitor will sound an alarm before an exposure limit is reached.

7. When contractors contract work in an existing confined space for the purpose of doing maintenance or repairs, they are covered by the OSHA general industry confined space standard. In situations where the work is considered new construction, the confined space general industry standard does not apply but the General Duty Clause, section 5(a)(1) of the OSH Act does apply.
8. When you work in an permit-required confined space your contractor must work with the company that owns or maintains the space to insure that you are protected and that the proper procedures for working in the space are followed.
9. Your contractor is responsible for insuring that you have been properly trained before you enter a permit-required space.



# Evaluation Activity 13: Confined Spaces

1. How important is this activity for day laborers?

**Please circle one number.**

<b>Activity Is Not Important</b>			<b>Activity Is Very Important</b>	
1	2	3	4	5

2. Please **put an “X”** by the **one factsheet** you feel is the most important.

1. Setting Priorities: Life Comes First	6. Atmospheric Hazards: Toxic Gases
2. Alert, Think, Then Act: Emergency Response Procedures	7. OSHA Enforcement and Confined Spaces in Construction
3. What Is a Confined Space?	8. Non-Permit and Permit Required Confined Spaces and Procedures
4. Hazards of Confined Space Work	9. OSHA Requires Training For Confined Spaces
5. Atmospheric Hazards: Too Much or Too Little Oxygen	10. Recommendations for Safe Entry: A Checklist

3. Which summary point do you feel is most important?

**Please circle one number.**

<b>Most Important Summary Point</b>				
1.	2.	3.	4.	5.
6.	7.	8.	9.	

4. What would you suggest be done to improve this Activity?

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# Activity 14: Fire Safety

## **Purpose**

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To learn more about how we can reduce the risks of fires at construction sites.

This Activity has two tasks.

## Task 1

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Juan has been hired by a contractor to clean up and organize a storage room at a large construction site. The conditions in the storage room are as follows:

1. The storage room is not well ventilated—Juan smells a strong chemical odor as soon as he walks in.
2. Rags and other debris are scattered all over the floor.
3. The lids of chemical containers and adhesives are partially closed or just fused or stuck together.
4. Full and partially full containers of flammable and combustible liquids are obstructing the walkway.
5. Oxygen cylinders (used for welding) are stored below a cabinet that includes containers with NFPA hazard diamonds that have the number “4” printed in the red diamond and “OX” printed in the white diamond.
6. There are five chemical storage cabinets located in room.
7. There are no signs indicating that chemicals are being stored here.
8. One of the storage cabinets contains more than 60 gallons of flammable liquids and more than 120 gallons of combustible liquids.
9. A worker is pouring a flammable liquid into a smaller container. The liquid and smaller container are not bonded.

**In your groups, review Factsheets 1-8 on pages 406-419. Then based the factsheets and your own experience, help Juan improve the situation in the storage room. For each of the problems listed above write down the things Juan can do to reduce the risk of a fire in the storage room.**

- 
1. **Storage Room Ventilation:** Why is this a problem? What can Juan do or what should he recommend to the contractor?
  2. **Rags and other debris on the floor:** Why is this a problem?
  3. **Partially opened lids of containers containing chemicals and adhesives.** Why is this a problem and what should Juan do?
  4. **Containers are obstructing the walkway.** Why is this a problem? How should the containers be stored?
  5. **Oxygen cylinders stored below cabinet.** Where should the oxygen cylinders be stored? Should the containers with the number “4” printed in the red diamond of the NFPA label be stored with the ones that have an “OX” symbol in the white diamond? Why or why not?
  6. **Chemical storage cabinets.** How many storage cabinets can be located in one storage area?
  7. **Signs.** What type of signs should be visible in the chemical storage room?
  8. **Cabinet containing flammables and combustibles.** How many gallons of flammable and combustible liquids can be stored in one cabinet?
  9. **Pouring flammable liquid.** What is bonding and why is it important?

# 1. Construction Fires

Fires are a very real threat on any construction site and they are usually caused by one of the following:

- open burning
- hot work
- combustible waste
- smoking
- temporary heating
- electrical equipment
- the storage and use of flammable liquids and gases

## The Elements of a Fire

All fires and most explosions are chemical reactions. (Note: Some explosions are not due to chemical reactions.) For the reaction to occur, three things must be present:

- a **fuel** (wood, paper, oil, natural gas, etc.)
- an **ignition** source (flame, spark, electrical source, etc.)
- and **oxygen**

## 2. Flammables and Combustibles

Flammable and combustible liquids are liquids that can burn. They are classified, or grouped as either flammable or combustible, by their flashpoints. Flashpoint (FP) is the temperature at which a liquid chemical gives off enough vapor to catch on fire in the presence of an ignition source (e.g., spark or match) and oxygen. The lower the flashpoint, the greater the hazard.

Flashpoints	
Flashpoint less than 100°F	High Fire Risk (Flammable)
Flashpoint between 100°F and 200°F	Moderate Risk (Combustible)
Flashpoint greater than 200°F	Low Fire Risk (Combustible)

Generally, flammable liquids will ignite (catch on fire) and burn easily at normal working temperatures. Combustible liquids have the ability to burn at temperatures that are usually above working temperatures.

### Flashpoint: Acetone

Acetone (a liquid at normal temperature) has a flashpoint of  $-0.4^{\circ}\text{F}$ . This means that if a drum of liquid acetone is heated or is warmer than  $-0.4^{\circ}\text{F}$  (which is obviously the case in a work area), it will give off enough vapor that a fire could be caused by a spark, a lit match or some other ignition source.

**Any time you have a chemical whose flashpoint is less than the temperature surrounding it, you have reason to worry.**

*(continued)*

## 2. Flammables and Combustibles *(continued)*

Flammables/Combustibles/Oxidizers on Construction Sites	
Acetylene	Plastics/Adhesives
Acetone	Methanol
Cleaners (solvent-based)	Oxygen
Diesel Fuel	Paint (solvent-based)
Epoxy Resins	Particulate Matter (enclosed spaces)
Gasoline	Paint Stripper
Heptane	Pipe Joint Compound (solvent-based)
Hexane	Propane
Hydrogen Sulfide	Sealants
Kerosene	Solvent Based Glues
Liquefied Petroleum Gas (LP-Gas)	Turpentine

### Oxidizers

Oxidizers are chemicals that give off oxygen. That's important to know because **giving off oxygen feeds a fire**. Oxidizers can cause materials normally difficult to ignite, to burn at much higher temperatures.

Oxidizers can be extremely dangerous because they make it easier for a fire to start. Under normal circumstances, you probably couldn't start a fire in a pile of wood from the kind of spark or "shock" you get when you walk across a rug and then touch a metal doorknob. But if there is an oxidizer around and you have that kind of spark, there is a much greater fire hazard.

**Oxidizers must never be stored near or above combustible or flammable chemicals.**

<b>Examples of Oxidizers</b>	
<b>Class 1:</b> slightly increase the burning rate of combustible materials but do not cause spontaneous ignition when they come in contact with them.	
	aluminum nitrate
	hydrogen peroxide solutions (8% to 27.5% by weight)
	silver nitrate
	zinc peroxide
<b>Class 2:</b> increase the burning rate of combustible materials moderately and may cause spontaneous ignition when in contact with a combustible material	
	calcium chlorate
	nitric acid (concentration greater than 40% but less than 86%)
	sodium chlorite (40% or less by weight)
	sodium peroxide
<b>Class 3:</b> severely increase the burning rate of combustible materials they come in contact with and will cause sustained and vigorous decomposition if contaminated with a combustible material or if exposed to sufficient heat.	
	ammonium dichromate
	potassium bromate
	sodium chlorate
	hydrogen peroxide (52 to 91% by weight)
<b>Class 4:</b> can explode when in contact with certain contaminants or if exposed to slight heat, shock, or friction; will increase the burning rate of combustibles and can cause combustibles to ignite spontaneously.	
	ammonium permanganate
	hydrogen peroxide (greater than 91% by weight)
	perchloric acid solutions (greater than 72.5% by weight)
	tetranitromethane

Source: Canadian Centre for Occupational Health and Safety, OSH Answers, *What Are Flammables and Combustibles*, [www.ccohs.ca/oshanswers/prevention/flammable\\_static.html](http://www.ccohs.ca/oshanswers/prevention/flammable_static.html). Michigan Occupational Safety and Health Administration, Hazards Commonly Found on Construction Sites, OSC619, July 2005.

### 3. Storing Flammables and Combustibles

In general, store containers of flammable and combustible liquids separately, away from process, production, or work areas, and away from other materials. This separation will reduce the spread of any fire to other materials in storage. It will also protect the stored flammable and combustible liquids from exposure to fires in other areas, and accidental contact with incompatible materials.

#### The Storage Area

Store flammable and combustible liquids in areas that are:

- Well ventilated to reduce vapor concentrations
- Free of ignition sources
- Cool (temperature controlled) and dry
- Supplied with adequate fire fighting and spill clean-up equipment
- Away from elevators, building and room exits, or main aisles leading to exits
- Accessible by firefighters
- Labelled with suitable warning signs. For example: “No Smoking”

#### Storage Limits

Flammable or combustible liquids cannot be stored in exits, stairways, or areas used for the safe passage of people. You can store up to 25 gallons of flammable or combustible liquids in a room outside of an approved storage cabinet.

Flammables or combustible liquids of more than 25 gallons must be stored in an acceptable or approved cabinet that meets specific OSHA requirements. No more than 60 gallons of flammable or 120 gallons of combustible liquids can be stored in a storage cabinet and no more than three cabinets can be located in a single storage area.

## Containers and Portable Tanks

Keep containers closed when not in use and keep the amount of materials in storage as small as possible. It is a good practice to keep no more than one day's supply of flammable and combustible liquids in the immediate work area. Return any leftover material to the proper storeroom or storage cabinet at the end of the day.

You should always use approved containers and portable tanks when you store or handle flammable and combustible liquids. For one gallon or less of a substance use the original shipping container or a safety can that includes the following:

- a maximum 5-gallon capacity
- a spring-closing lid and spout
- a flame arrestor
- a relief for internal pressure
- a label that states the can has been approved by Underwriters Laboratory (UL), Factor Mutual (FM) or other recognized testing laboratories

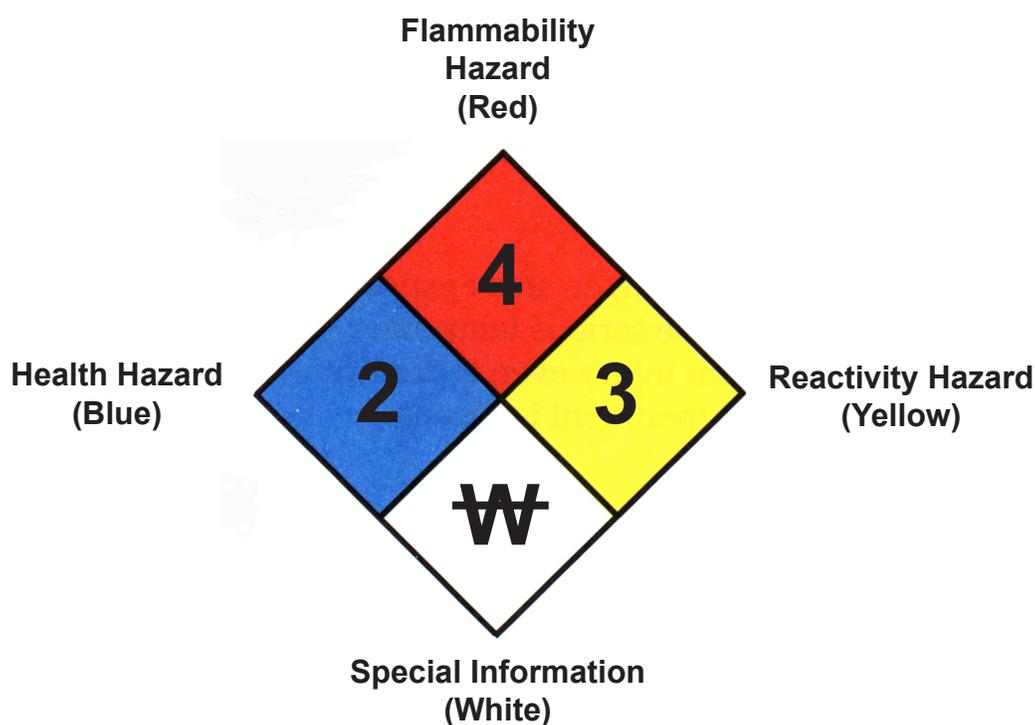
<b>Flammables/Combustibles Checklist</b>	
✓	Store flammable or explosive materials such as gasoline, oil and cleaning agents apart from other materials
✓	Keep flammable and explosive materials in proper containers with contents clearly marked
✓	Store full barrels in an upright position
✓	Keep gasoline and oil barrels on a barrel rack
✓	Store empty barrels separately
✓	Post signs prohibiting smoking, open flames and other ignition sources in areas where flammable and explosive materials are stored
✓	Ventilate all storage areas properly
✓	Ensure that all electric fixtures and switches are explosion-proof where flammable materials are stored
✓	Use grounding straps equipped with clamps on containers to prevent static electricity buildup ( for more information see Factsheet 5)

Source: Canadian Centre for Occupational Health and Safety, OSH Answers, What Are Flammables and Combustibles, [www.ccohs.ca/oshanswers/prevention/flammable\\_general.html](http://www.ccohs.ca/oshanswers/prevention/flammable_general.html).

## 4. NFPA Hazard Identification System

The National Fire Protection Association (NFPA) has developed a standardized system that uses numbers and color signs to define the basic hazards of specific material. You will see hazard diamonds like the one below on trucks, storage tanks, chemical drums and bottles of chemicals.

Health, flammability and reactivity are identified and rated on a scale of 0 (no hazard) to 4 (high hazard) depending on the degree of hazard presented. In addition, a special information/precaution symbol is used where necessary.



Source: <http://chemlabs.uoregon.edu/Safety/NFPA.html>

<b>NFPA 704 Hazard Identification System</b>		
<b>Red: Flammability Hazard</b>		
Rating	Description	Example
0	Material will not burn	water
1	Material must be pre-heated before ignition can occur	corn oil
2	Material must be moderately heated or exposed to relatively high ambient temperature before ignition can occur	diesel fuel oil
3	Liquids and solids that can be ignited under almost all ambient temperature conditions	gasoline
4	Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily	propane gas
<b>Blue: Health Hazard</b>		
Rating	Description	Example
0	Material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material	peanut oil
1	Material that on exposure would cause irritation but only minor residual injury	turpentine
2	Material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury	ammonia gas
3	Material that on short exposure could cause serious temporary or residual injury	chlorine gas
4	Material that on very short exposure could cause death or major residual injury	hydrogen cyanide
<b>Yellow: Reactivity Hazard</b>		
Rating	Description	Example
0	Material that in itself is normally stable, even under fire exposure conditions, and is not reactive with water	liquid nitrogen
1	Material that in itself is normally stable, but which can become unstable at elevated temperatures and pressures	phosphorus (red or white)
2	Material that readily undergoes violent chemical change at elevated temperatures and pressures or which reacts violently with water or which may form explosive mixtures with water	calcium metal
3	Material that in itself is capable of detonation or explosive decomposition or reaction but requires a strong initiating source or which must be heated under confinement before initiation or which reacts explosively with water	fluorine gas
4	Material that in itself is readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures	trinitrotoluene (TNT)
<b>White: Special Precautions–Protective Gear Required</b>		
Symbol	Description	Example
<del>W</del>	Material shows unusual reactivity with water (i.e. don't put water on it)	magnesium metal
ox	Material possesses oxidizing properties	ammonium nitrate (fertilizer)
<b>Other Symbols Commonly Used</b>		
ACID	Material is an acid	
ALK	Material is a base (alkaline)	
COR	Material is corrosive	
	Material is radioactive	

## 5. Grounding/Bonding Containers and Drums

Transferring a liquid from one metal container to another may result in static electrical sparks. To prevent the build up of static electricity and prevent sparks from causing a fire, it is important to bond metal dispensing and receiving containers together before pouring. Bonding is done by making an electrical connection from one metal container to the other. This ensures that there will be no difference in electrical potential between the two containers and, therefore, no sparks will be formed.

### **Bonding**

The best way to bond containers is to securely attach a special metal bonding strap or wire to both containers. Some liquid transfer pumps have self-bonding hoses. Bonding can also be done by keeping a solid metal-to-metal contact between the containers themselves or between a metal container and a conducting nozzle. These latter two methods are usually not reliable because a good electrical contact is often hard to make and maintain during the entire transfer.

### **Grounding**

This could be a buried metal plate, a metallic underground gas piping system, metal water pipes or a grounded, metal building framework. Bonding both containers and grounding one of them “drains off” static charges and prevents the discharge of sparks. All grounding and bonding connections must be bare metal to bare metal. Remove all dirt, paint, rust or corrosion from points of contact. Specially designed and approved bonding and grounding wire assemblies are available from safety equipment retailers.

## What Is Static Electricity?

Static electricity is the electric charge generated when there is friction between two things made of different materials or substances, like clothes tumbling in a dryer. Static electricity is what causes the sparks when you comb your hair or touch a metal object, like a doorknob, after walking across a carpet on a cold, dry day.

Electric charges can build up on an object or liquid when certain liquids (e.g., petroleum solvents, fuels) move in contact with other materials. This can occur when liquids are poured, pumped, filtered, agitated, stirred or flow through pipes. This buildup of electrical charge is called static electricity. Even when liquids are transported or handled in non-conductive containers, something rubbing the outside surface of the container may cause a static charge to build up in the liquid. The amount of charge that develops depends, in part, on how much liquid is involved and how fast is it flowing or is being agitated or stirred.

Source: Canadian Centre for Occupational Health and Safety, OSH Answers, What Are Flammables and Combustibles, [www.ccohs.ca/oshanswers/prevention/flammable\\_general.html](http://www.ccohs.ca/oshanswers/prevention/flammable_general.html). Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 6. Liquefied Petroleum Gas (LP-Gas)

Make sure that LP-Gas cylinders and other flammable materials are properly stored. LP-Gas supplies should be turned off at the cylinder when not in use. This is particularly important during off hours. Also, make sure that LP-Gas equipment and fittings are properly maintained. Damaged hoses and fittings or makeshift connections are extremely dangerous because they can easily lead to leaks. If there is any suspicion that LP-Gas is leaking, stop using it and find the leak. Leaks can be identified by hissing, smell or using soapy water, but never with a naked flame.

<b>Other Precautions for LP-Gas</b>	
✓	Never weld on LP-Gas containers
✓	Don't point radiant or blower heaters toward LP-Gas containers within 20 feet
✓	Store, transport, and use LP-Gas only in approved containers
✓	LP-Gas should be stored outside buildings in well ventilated and secure areas

Source: OSHA 29 CFR 1926.153, Liquefied Petroleum Gas (LP-Gas). Building and Construction Trades Dept., Construction Industry Partnership, The Smart Mark Residential Construction Health and Safety Training Program, 2000.

## 7. Housekeeping

Good housekeeping is important wherever any chemicals, including flammable and combustible liquids, are used.

- Keep all areas where these liquids are stored, handled or used clear of burnable materials
- Provide drip trays and empty them often wherever recurring leakages occur
- Clean up liquid spills immediately
- Remove any obstructions that prevent containers with lids held open by fusible links from closing fully
- Make sure that flammable and combustible liquids are not left where they could block or otherwise prevent people from escaping in case of a fire
- Do not use safety containers that are damaged in any way. If repairs using approved parts cannot restore safety containers to a safe condition, discard the containers once they have been properly cleaned.

*(continued)*

## 7. Housekeeping *(continued)*

<b>Construction Site Housekeeping</b>	
✓	The job site should be clear of all kinds of refuse, debris, and process waste
✓	The job site should have a clearly identified perimeter (fence or other border) that prohibits public traffic from entering the site
✓	Waste and excess debris or scrap should be swept up and removed from the site daily
✓	Areas in and around the building site should be kept free from accumulated packing materials such as empty wooden crates, straw, plastic products, paper, etc.
✓	Store paint, lacquer, flammable solvents, thinners, and other flammables in appropriate areas. (The area should be clearly labeled for this purpose)
✓	Flammable liquids should be carried in safety containers, not in open tins, buckets, etc.
✓	Flammable liquids should be handled only at a safe distance from possible sources of ignition
✓	Heating appliances should be kept at a safe distance from woodworking and combustible building items
✓	Portable heaters should be securely guarded and placed or fixed so that they cannot be knocked over
✓	Metal bins or dumpsters with lids should be provided for disposal of combustible waste materials such as oily rags
✓	Storage areas must be accessible to firefighters
✓	There must be clear spaces around stacks of stored materials and adequate gangways between them
✓	Keep stairways, passageways and gangways free of material, supplies and obstructions
✓	Secure loose or light material that is stored on roofs or on open floors
✓	If sprinkler systems are installed, stacks of material must be arranged so they do not impede the effective operation of the sprinklers

Sources: Canadian Centre for Occupational Health and Safety, OSH Answers, What Are Flammables and Combustibles, [www.ccohs.ca/oshanswers/prevention/flammable\\_general.html](http://www.ccohs.ca/oshanswers/prevention/flammable_general.html). Johnson, Linda F., Preventing Construction Fires, Occupational Health and Safety, February 2001.

## 8. Evacuation and Escape

Open construction sites usually offer many means of escape. However, some sites can pose particular problems because the routes in and out may be incomplete and obstructions may be present. There should be planned exit routes on every job and all workers on the site should know them. In enclosed buildings people can easily become trapped, especially where they are working above or below ground level. In such cases means of escape need careful consideration.

Make sure that:

- wherever possible, there are at least two escape routes in different directions
- travel distances to safety are reduced to a minimum
- enclosed escape routes, for example corridors or stairwells, can resist fire and smoke ingress from the surrounding site. Where fire doors are needed make sure they are provided and kept closed (self-closing devices should be fitted to doors on enclosed escape routes)
- escape routes and emergency exits are clearly signed
- escape routes and exits are kept clear (Emergency exits should never be locked when people are on the site.)
- emergency lighting is installed if necessary to enable escape (This is especially important in enclosed stairways in multi-storey structures which will be in total darkness if the normal lighting fails during a fire.)
- an assembly point is identified where everyone can gather and be accounted for

## Task 2

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Jim is a forklift operator at a large construction site. While finishing his lunch he looks up and sees smoke pouring out of the trailer where the contractor's office is located. He quickly grabs the CO<sub>2</sub> extinguisher from his forklift, runs to the trailer, opens the office door, and attempts to put out the fire.

Juan, who is working in the chemical storage area, sees the smoke and Jim running into the trailer. He immediately grabs a multi-purpose (A, B and C rated) extinguisher from the chemical storage room and runs into the trailer to help Jim put out the fire.

### **Other Background Information:**

1. The contractor's office makes up half of the trailer. It is 10ft x 10ft and completely enclosed. The doorway into the contractor's office is the exit.
2. The fire is burning in the waste paper basket in the immediate left corner of the room and has quickly spread to empty boxes that are piled up to the top of the ceiling.
3. Smoke is quickly filling the room and visibility is poor.
4. Jim, who has not been trained to operate a fire extinguisher moves away from the exit and faces the flames.
5. Juan, who has been trained to use a portable fire extinguisher, turns to his left (where the fire is located) and attempts to put out the flames while keeping close to the exit.
6. After pulling the pin on the extinguisher, Jim grabbed the horn part of the extinguisher discharge line, moved in close to the fire, pointed at the flames and squeezed the extinguisher lever.

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**In your groups review the Factsheets 9-12 on pages 422-429. Then using the factsheets and your own experience, make a list of your agreements and disagreements with the way Juan and Jim handled the situation. In your responses, please state why you agree or disagree and use the factsheets to support your positions.**

**Do you agree or disagree with the way Jim handled the situation?**

Agreements:

Disagreements:

**Do you agree or disagree with the way that Juan handled the situation?**

Agreements:

Disagreements:

**Given the conditions, would you have attempted to put out this fire? Why or why not?**

## 9. Fire Extinguishers

Prior to fighting any fire with a portable fire extinguisher you must perform a risk assessment that evaluates the fire size, the fire fighters' evacuation path, and the atmosphere in the vicinity of the fire (*see the Fight or Flee table on the next page*). Attempting to extinguish even a small fire carries some risk and **you should never attempt to operate a fire extinguisher if you have not received the proper training.**

### Fire Extinguisher Functions

Portable fire extinguishers have two functions: to control or extinguish small or incipient (early) stage fires and to protect evacuation routes that a fire may block directly or indirectly with smoke or burning/smoldering materials.

To put out a fire with a portable extinguisher, a person must have immediate access to the extinguisher, know how to turn on the unit, and know how to apply the agent effectively. Fires can increase in size and intensity in seconds, blocking the exit path of the fire fighter and creating a hazardous atmosphere. In addition, portable fire extinguishers contain a limited amount of extinguishing agent and can be discharged in a matter of seconds. Therefore, individuals should attempt to fight only very small or early stage fires.

### How a Fire Extinguisher Works

Portable fire extinguishers apply an extinguishing agent that will either cool burning fuel, displace or remove oxygen, or stop the chemical reaction so a fire cannot continue to burn. A fire extinguisher works much like a can of hair spray. When the handle of an extinguisher is compressed, it opens an inner canister of high-pressure gas that forces the extinguishing agent from the main cylinder through a siphon tube and out the nozzle.

<b>Fight or Flee?</b>		
<b>Risk Assessment Question</b>	<b>Characteristics of incipient (early) stage fires or fires that can be extinguished with portable fire extinguishers</b>	<b>Characteristics of fires that SHOULD NOT be fought with a portable fire extinguisher (beyond early stage) - evacuate immediately</b>
<i>Is the fire too big?</i>	The fire is limited to the original material ignited, it is contained (such as in a waste basket) and has not spread to other materials. The flames are no higher than the firefighter's head.	The fire involves flammable solvents, has spread over more than 60 square feet, is partially hidden behind a wall or ceiling, or can not be reached from a standing position.
<i>Is the air safe to breathe?</i>	The fire has not depleted the oxygen in the room and is producing only small quantities of toxic gases. No respiratory protection equipment is required.	Due to smoke and products of combustion, the fire can not be fought without respiratory protection.
<i>Is the environment too hot or smoky?</i>	Heat is being generated, but the room temperature is only slightly increased. Smoke may be accumulating on the ceiling, but visibility is good. No special personal protective equipment is required.	The radiated heat is easily felt on exposed skin making it difficult to approach within 10-15 feet of the fire (or the effective range of the extinguisher). One must crawl on the floor due to heat or smoke. Smoke is quickly filling the room, decreasing visibility.
<i>Is there a safe evacuation path?</i>	There is a clear evacuation path that is behind you as you fight the fire.	The fire is not contained, and fire, heat, or smoke may block the evacuation path.

Sources: OSHA, Evacuation Plans and Procedures, eTools, [http://www.osha.gov/SLTC/etools/evacuation/portable\\_relation.html](http://www.osha.gov/SLTC/etools/evacuation/portable_relation.html)

## 10. Types of Fire Extinguishing Systems

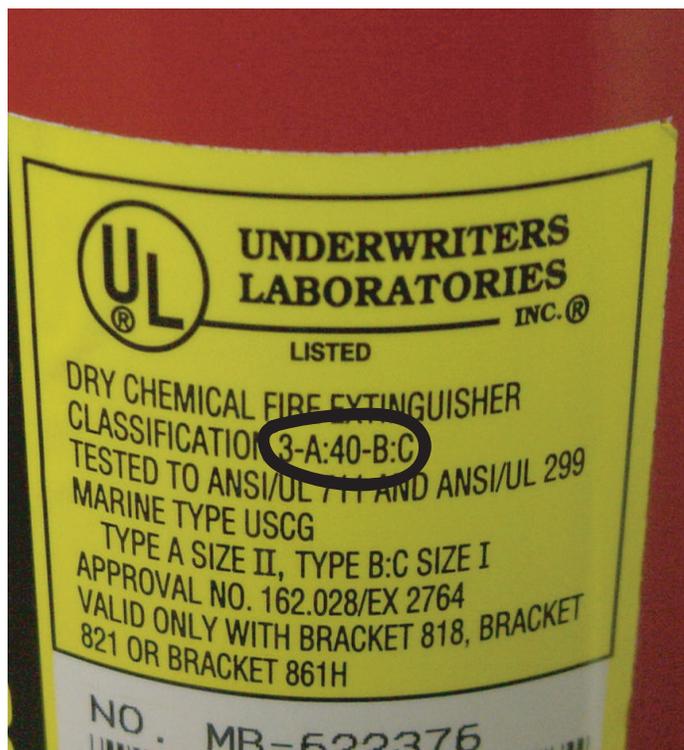
All portable fire extinguishers are classified based on the type and size of fire they will put out. This information is included on the fire extinguisher's label.

In the example below the letters A, B, and C (circled) tell you that this is a *multi-purpose dry chemical extinguisher*. The tables on page 426-427 describe the other types of extinguishers and the types of fires they are designed for.



The same label also includes information on the amount of dry chemical stored in the extinguisher. The number in front of the A indicates how much water the extinguisher is equal to and represents 1.25 gallons of water for every unit of one. In this case, a 3-A rated extinguisher would be equal to 3.75 gallons of water (3 x 1.25).

The number in front of the B represents the area in square feet of a class B fire that a non-expert user should be able to extinguish. Using this example, a non-expert user should be able to put out a flammable liquid fire that is as large as 40 square feet.



*(continued)*

## 10. Types of Fire Extinguishing Systems *(continued)*

Types of Fire Extinguishers			
Extinguisher Label	Type of Fire	Description	Do Not Use
<p><b>A</b> Air-pressurized water extinguishers (APW)</p> 	<p><b>Ordinary Combustibles—</b> Fires in paper, cloth, wood, rubber, and many plastics require a water type extinguisher labeled A.</p>	<p>Water is one of the most commonly used extinguishing agents for type A fires. You can recognize an APW by its large silver container. They are filled about two-thirds of the way with ordinary water, then pressurized with air. In some cases, detergents are added to the water to produce a foam. They stand about two to three feet tall and weigh approximately 25 pounds when full.</p> <p>APWs extinguish fire by cooling the surface of the fuel to remove the “heat” element of the fire triangle.</p> <p>APWs are designed for Class A (wood, paper, cloth, rubber, and certain plastics) fires only.</p>	<p><b>Never use water to extinguish flammable liquid fires.</b> Water is extremely ineffective at extinguishing this type of fire and may make matters worse by spreading the fire.</p> <p><b>Never use water to extinguish an electrical fire.</b> Water is a good conductor and may lead to electrocution if used to extinguish an electrical fire. Electrical equipment must be unplugged and/or de-energized before using a water extinguisher on an electrical fire.</p>
<p><b>B and C</b> Carbon Dioxide (CO<sub>2</sub>)</p> 	<p><b>Flammable Liquids—</b> Fires in oils, gasoline, some paints, lacquers, grease, solvents, and other flammable liquids require an extinguisher labeled B.</p>	<p>This type of extinguisher is filled with CO<sub>2</sub>, a non-flammable gas under extreme pressure. These extinguishers put out fires by displacing oxygen. Also, when you use this extinguisher pieces of dry ice shoot from the horn, which also has a cooling effect on the fire. CO<sub>2</sub> cylinders are red and range in size from five to 100 pounds or larger.</p> <p>CO<sub>2</sub> extinguishers will frequently be found in industrial vehicles, mechanical rooms, offices, computer labs, and flammable liquid storage areas.</p>	<p>Never use CO<sub>2</sub> extinguishers in a confined space while people are present without proper respiratory protection.</p> <p>Also, CO<sub>2</sub> extinguishers are not recommended for Class A fires because they may continue to smolder and re-ignite after the CO<sub>2</sub> dissipates.</p>

<b>Types of Fire Extinguishers</b> <i>(continued)</i>			
<b>Extinguisher Label</b>	<b>Type of Fire</b>	<b>Description</b>	<b>Do Not Use</b>
<b>B and C</b> Dry Chemical 	<b>Electrical Equipment</b> Fires in wiring, fuse boxes, energized electrical equipment, computers, and other electrical sources require an extinguisher labeled C.	<p>Dry chemical extinguishers put out fires by coating the fuel with a thin layer of fire retardant powder, separating the fuel from the oxygen. The powder also works to interrupt the chemical reaction, which makes these extinguishers extremely effective.</p> <p>Dry chemical extinguishers are usually rated for class B and C fires and may be marked multiple purpose for use in A, B, and C fires. They contain an extinguishing agent and use a compressed, non-flammable gas as a propellant.</p> <p>Dry Chemical extinguishers will have a label indicating they may be used on Class A, B, and/or C fires.</p> <p>These extinguishers will be found in a variety of locations including: public hallways, laboratories, mechanical rooms, break rooms, chemical storage areas, offices, commercial vehicles, and other areas with flammable liquids.</p>	—
<b>A, B and C</b> Multi-purpose dry chemical 	<b>Ordinary Combustibles, Flammable Liquids, or Electrical Equipment</b>	<p>Multi-purpose dry chemical is suitable for use on Class A, B, and C. They are red in color, and range in size from five pounds to 20 pounds.</p>	—
<b>D</b> Special for metals	<b>Magnesium Sodium type metals</b>	<p>Combustible metals such as magnesium and sodium require special extinguishers labeled D.</p>	

Sources: OSHA, Evacuation Plans and Procedures, eTools, [http://www.osha.gov/SLTC/etools/evacuation/portable\\_about.html#Types](http://www.osha.gov/SLTC/etools/evacuation/portable_about.html#Types)

## 11. Using a Fire Extinguisher

The following steps should be followed when responding to an early stage fire:

- Step 1:** Sound the fire alarm and call the fire department, if appropriate.
- Step 2:** Identify a safe evacuation path before approaching the fire. Do not allow the fire, heat, or smoke to come between you and your evacuation path.
- Step 3:** Select the appropriate type of fire extinguisher.
- Step 4:** Discharge the extinguisher within its effective range using the **P.A.S.S. Technique** (See the explanation below).
- Step 5:** Back away from an extinguished fire in case it flames up again.
- Step 6:** Evacuate immediately if the extinguisher is empty and the fire is not out or if the fire progresses beyond the early stages.

### The P.A.S.S. Technique

**P**ull the Pin at the top of the extinguisher. The pin releases a locking mechanism and will allow you to discharge the extinguisher.

**A**im at the base of the fire, not the flames. This is important - in order to put out the fire, you must extinguish the fuel. (**Note: Do not touch the plastic discharge horn on a CO<sub>2</sub> extinguisher, it gets very cold and may damage skin.**)

**S**queeze the lever slowly. This will release the extinguishing agent in the extinguisher. If the handle is released, the discharge will stop.

**S**weep from side to side. Using a sweeping motion, move the fire extinguisher back and forth until the fire is completely out. Operate the extinguisher from a safe distance, several feet away, and then move towards the fire once it starts to diminish. Be sure to read the instructions on your fire extinguisher - different fire extinguishers recommend operating them from different distances.

**If you have the slightest doubt about your ability to fight a fire....EVACUATE IMMEDIATELY!**

Sources: OSHA, Evacuation Plans and Procedures, eTools, [http://www.osha.gov/SLTC/etools/evacuation/portable\\_about.html#drychem](http://www.osha.gov/SLTC/etools/evacuation/portable_about.html#drychem). *Fire Extinguisher: 101*, [www.fire-extinguisher101.com/using.html](http://www.fire-extinguisher101.com/using.html)

## 12. Fighting a Fire Safely

All fires can be very dangerous and life-threatening. Your safety should always be your primary concern when attempting to fight a fire.

Before deciding to fight a fire, be certain that:

- The fire is small and not spreading. A fire can double in size within two or three minutes.
- You have the proper fire extinguisher for what is burning.
- The fire won't block your exit if you can't control it. A good way to ensure this is to keep the exit at your back.
- You know your fire extinguisher works.
- You know how to use your fire extinguisher. There's not enough time to read instructions when a fire occurs.

To Fight a Fire Safely:

- Always stand with an exit at your back.
- Stand several feet away from the fire, moving closer once the fire starts to diminish.
- Use a sweeping motion and aim at the base of the fire.
- If possible, use a "buddy system" to have someone back you up or call for help if something goes wrong.
- Be sure to watch the area for awhile to ensure it doesn't re-ignite.

## Summary

1. Fires are a very real threat on any construction site. All fires and most explosions are chemical reactions. For the reaction to occur, three things must be present: a **fuel** (wood, paper, oil, natural gas, etc.); an **ignition** source (flame, spark, electrical source, etc.); and **oxygen**.
2. Flammable and combustible liquids are liquids that can burn. They are classified by their flashpoints. Flashpoint (FP) is the temperature at which a liquid chemical gives off enough vapor to catch on fire in the presence of an ignition source (e.g., spark or match) and oxygen. The lower the flashpoint, the greater the hazard.
3. Oxidizers are chemicals that give off oxygen and **oxygen feeds a fire**. Oxidizers can cause materials normally difficult to ignite, to burn at much higher temperatures. **Oxidizers must never be stored near or above combustible or flammable chemicals**.
4. In general, store containers of flammable and combustible liquids separately, away from process, production, or work areas, and away from other materials.
5. The National Fire Protection Association (NFPA) has developed a standardized system that uses numbers and color signs to define the basic hazards of specific material. Health, flammability and reactivity are identified and rated on a scale of 0 (no hazard) to 4 (high hazard) and a special information/precaution symbol is used where necessary.
6. In flammable liquid storage and dispensing areas, *ground* dispensing drums. Grounding is done by connecting the container to an already grounded object that will conduct electricity. It is also important to bond metal dispensing and receiving containers together before pouring. Bonding is done by making an electrical connection from one metal container to the other.

7. Make sure that LP Gas cylinders and other flammable materials are properly stored.
8. Good housekeeping is important wherever any chemicals, including flammable and combustible liquids, are used.
9. There should be planned exit routes on every job and all workers on the site should know them. In enclosed buildings make sure there are at least two escape routes in different directions.
10. Prior to fighting any fire with a portable fire extinguisher you must perform a risk assessment that evaluates the fire size, the fire fighters' evacuation path, and the atmosphere in the vicinity of the fire. Attempting to extinguish even a small fire carries some risk and **you should never attempt to operate a fire extinguisher if you have not received the proper training.**
11. All portable fire extinguishers are classified based on the type and size of fire they will put out. This information is included on the fire extinguisher's label.
12. All fires can be very dangerous and life-threatening. Your safety should always be your primary concern when attempting to fight a fire.



# Evaluation

## Activity 14: Fire Safety

1. How important is this Activity for day laborers?

**Please circle one number.**

<b>Activity Is Not Important</b>			<b>Activity Is Very Important</b>	
1	2	3	4	5

2. Please **put an “X”** by the factsheets you feel are the most important.

	1. Construction Fires		7. Housekeeping
	2. Flammables and Combustibles		8. Evacuation and Escape
	3. Storing Flammables and Combustibles		9. Fire Extinguishers
	4. NFPA Hazard Identification System		10. Types of Fire Extinguishing Systems
	5. Grounding/Bonding Containers and Drums		11. Using a Fire Extinguisher
	6. Low Pressure Gas		12. Fighting a Fire Safely

3. Which summary point do you feel is most important?

**Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.			

4. What would you suggest be done to improve this Activity?

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# Appendix A: Chemical Protective Gloves

The table below is from the U.S. Department of Energy's *Occupational Safety and Health Technical Reference Manual*. It rates various gloves as being protective against specific chemicals and can help you select the most appropriate gloves for the jobs you work on that involve working with or around dangerous chemicals. The ratings are abbreviated as follows: **VG**: Very Good; **G**: Good; **F**: Fair; **P**: Poor (not recommended). Chemicals marked with an asterisk (\*) are for limited service.

Chemical	Neoprene	Latex/Rubber	Butyl	Nitrile
Acetaldehyde*	VG	G	VG	G
Acetic acid	VG	VG	VG	VG
Acetone*	G	VG	VG	P
Ammonium hydroxide	VG	VG	VG	VG
Amy acetate*	F	P	F	P
Aniline	G	F	F	P
Benzaldehyde*	F	F	G	G
Benzene*	P	P	P	F
Butyl acetate	G	F	F	P
Butyl alcohol	VG	VG	VG	VG
Carbon disulfide	F	F	F	F
Carbon tetrachloride*	F	P	P	G
Castor oil	F	P	F	VG
Chlorobenzene*	F	P	F	P
Chloroform*	G	P	P	F
Chloronaphthalene	F	P	F	F
Chromic acid (50%)	F	P	F	F
Citric acid (10%)	VG	VG	VG	VG
Cyclohexanol	G	F	G	VG
Dibutyl phthalate*	G	P	G	G
Diesel fuel	G	P	P	VG
Diisobutyl ketone	P	F	G	P
Dimethylformamide	F	F	G	G
Diocetyl phthalate	G	P	F	VG
Dioxane	VG	G	G	G

(continued)

## Protective Gloves Chart (continued)

Epoxy resins, dry	VG	VG	VG	VG
Ethyl acetate*	G	F	G	F
Ethyl alcohol	VG	VG	VG	VG
Ethyl ether*	VG	G	VG	G
Ethylene dichloride*	F	P	F	P
Ethylene glycol	VG	VG	VG	VG
Formaldehyde	VG	VG	VG	VG
Formic acid	VG	VG	VG	VG
Freon 11	G	P	F	G
Freon 12	G	P	F	G
Freon 21	G	P	F	G
Freon 22	G	P	F	G
Furfural*	G	G	G	G
Gasoline, leaded	G	P	F	VG
Gasoline, unleaded	G	P	F	VG
Glycerin	VG	VG	VG	VG
Hexane	F	P	P	G
Hydrazine (65%)	F	G	G	G
Hydrochloric acid	VG	G	G	G
Hydrofluoric acid (48%)	VG	G	G	G
Hydrogen peroxide (30%)	G	G	G	G
Hydroquinone	G	G	G	F
Isooctane	F	P	P	VG
Kerosene	VG	F	F	VG
Ketones	G	VG	VG	P
Lacquer thinners	G	F	F	P
Lactic acid (85%)	VG	VG	VG	VG
Lauric acid (36%)	VG	F	VG	VG
Lineolic acid	VG	P	F	G
Linseed oil	VG	P	F	VG
Maleic acid	VG	VG	VG	VG
Methyl alcohol	VG	VG	VG	VG
Methylamine	F	F	G	G
Methyl bromide	G	F	G	F
Methyl chloride*	P	P	P	P

Methyl ethyl ketone*	G	G	VG	P
Methyl isobutyl ketone*	F	F	VG	P
Methyl methacrylate	G	G	VG	F
Monoethanolamine	VG	G	VG	VG
Morpholine	VG	VG	VG	G
Naphthalene	G	F	F	G
Napthas, aliphatic	VG	F	F	VG
Napthas, aromatic	G	P	P	G
Nitric acid*	G	F	F	F
Nitric acid, red and white fuming	P	P	P	P
Nitromethane (95.5%)*	F	P	F	F
Nitropropane (95.5%)	F	P	F	F
Octyl alcohol	VG	VG	VG	VG
Oleic acid	VG	F	G	VG
Oxalic acid	VG	VG	VG	VG
Palmitic acid	VG	VG	VG	VG
Perchloric acid (60%)	VG	F	G	G
Perchloroethylene	F	P	P	G
Petroleum distillates (naphtha)	G	P	P	VG
Phenol	VG	F	G	F
Phosphoric acid	VG	G	VG	VG
Potassium hydroxide	VG	VG	VG	VG
Propyl acetate	G	F	G	F
Propyl alcohol	VG	VG	VG	VG
Propyl alcohol (iso)	VG	VG	VG	VG
Sodium hydroxide	VG	VG	VG	VG
Styrene	P	P	P	F
Styrene (100%)	P	P	P	F
Sulfuric acid	G	G	G	G
Tannic acid (65)	VG	VG	VG	VG
Tetrahydrofuran	P	F	F	F
Toluene*	F	P	P	F
Toluene diisocyanate (TDI)	F	G	G	F

(continued)

## Protective Gloves Chart (continued)

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Trichloroethylene*	F	F	P	G
Triethanolamine (85%)	VG	G	G	VG
Tung oil	VG	P	F	VG
Turpentine	G	F	F	VG
Xylene*	P	P	P	F

**Note:** When selecting chemical-resistant gloves be sure to consult the manufacturer's recommendations, especially if the gloved hand(s) will be immersed in the chemical.

Protective gloves should be inspected before each use to ensure that they are not torn, punctured, or defective in any way. A visual inspection will help detect cuts or tears. Gloves that are discolored or stiff may be defective because of excessive use or degradation from chemical exposures (see the PPE Activity for more information on degradation).

Reuse of chemical-resistant gloves should be evaluated carefully. A decision to reuse chemically-exposed gloves should take into consideration the toxicity of the chemicals involved, the duration of the exposure, storage and temperature.





# Appendix B: Silica Exposure

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## **“Crystalline Silica Exposure” Health Hazard Information for General Industry Employees**

### ***What is crystalline silica?***

Crystalline silica is a basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica. Cristobalite and tridymite are two other forms of crystalline silica. All three forms may become respirable size particles when workers chip, cut, drill, or grind objects that contain crystalline silica.

### ***What are the hazards of crystalline silica?***

Silica exposure remains a serious threat to nearly 2 million U.S. workers, including more than 100,000 workers in high risk jobs such as abrasive blasting, foundry work, stonecutting, rock drilling, quarry work and tunneling. Crystalline silica has been classified as a human lung carcinogen. Additionally, breathing crystalline silica dust can cause **silicosis**, which in severe cases can be disabling, or even fatal. The respirable silica dust enters the lungs and causes the formation of scar tissues, thus reducing the lungs' ability to take in oxygen. There is no cure for silicosis. Since silicosis affects lung function, it makes one more susceptible to lung infections like **tuberculosis**. In addition, smoking causes lung damage and adds to the damage caused by breathing silica dust.

### **What are the symptoms of silicosis?**

Silicosis is classified into three types: chronic/classic, accelerated, and acute.

**Chronic/classic silicosis**, the most common, occurs after 15-20 years of moderate to low exposures to respirable crystalline silica. Symptoms associated with chronic silicosis may or may not be obvious: therefore, workers need to have a chest x-ray to determine if there is lung damage. As the disease progresses, the worker may experience shortness of breath upon exercising and have clinical signs of poor oxygen/carbon dioxide exchange. In the later stages, the worker may experience fatigue, extreme shortness of breath, chest pain, or respiratory failure.

**Accelerated silicosis** can occur after 5-10 years of high exposures to respirable crystalline silica. Symptoms include severe shortness of breath, weakness, and weight loss. The onset of symptoms takes longer than in acute silicosis.

**Acute silicosis** occurs after a few months or as long as two years following exposures to extremely high concentrations of respirable crystalline silica. Symptoms of acute silicosis include severe disabling shortness of breath, weakness, and weight loss, which often leads to death.

### ***Where are general industry employees exposed to crystalline silica dust?***

The most severe exposures to crystalline silica result from abrasive blasting, which is done to clean and smooth irregularities from molds, jewelry, and foundry castings, finish tombstones, etch or frost glass, or remove paint, oils, rust, or dirt from objects needing to be repainted or treated. Other exposures to silica dust occur in cement and brick manufacturing, asphalt paving manufacturing, china and ceramic manufacturing, and the tool and die, steel and foundry industries. Crystalline silica is used in manufacturing, household abrasives, adhesives, paints, soaps, and

*(continued)*

## Silica Exposure (continued)

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glass. Additionally, crystalline silica exposures occur in the maintenance, repair and replacement of refractory brick furnace linings.

### **How is OSHA addressing exposure to crystalline silica?**

OSHA has an established Permissible Exposure Limit, or PEL, which is the maximum amount of crystalline silica to which workers may be exposed during an 8-hour shift (29 CFR 1926.55, 1910.1000). OSHA also requires hazard communication training for workers exposed to crystalline silica, and requires a respirator program until engineering controls are implemented. Additionally, OSHA has a National Emphasis Program (NEP) for crystalline silica exposure to identify, reduce, and eliminate health hazards associated with occupational exposures.

### **What can employers/employees do to protect against exposures to crystalline silica?**

- Replace crystalline silica materials with safer substitutes, whenever possible.
- Provide engineering or administrative controls, where feasible, such as local exhaust ventilation, and blasting cabinets. Where necessary to reduce exposures below the PEL, use protective equipment or other protective measures.
- Use all available work practices to control dust exposures, such as water sprays.
- Wear only a N95 NIOSH-certified respirator, if respirator protection is required. Do not alter the respirator. Do not wear a tight-fitting respirator with a beard or mustache that prevents a good seal between the respirator and the face.
- Wear only a Type CE abrasive-blast supplied-air respirator for abrasive blasting.
- Wear disposable or washable work clothes and shower if facilities are available. Vacuum the dust from your clothes and change into clean clothing before leaving the work site.
- Participate in training, exposure monitoring, and health screening and surveillance programs to monitor any adverse health effects caused by crystalline silica exposures.
- Be aware of the operations and the job tasks creating crystalline silica exposures in your workplace environment and know how to protect yourself.
- Be aware of the health hazards related to exposures to crystalline silica. Smoking adds to the lung damage caused by silica exposures.
- Do not eat, drink, smoke, or apply cosmetics in areas where crystalline silica dust is present. Wash your hands and face outside of dusty areas before performing any of these activities.
- Remember: If it's silica, it's not just dust.

For more information, contact your local OSHA office (listed in the telephone directory under United States Government – Department of Labor – Occupational Safety and Health Administration) or visit OSHA's website at <http://www.osha.gov>.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

**For more complete information:**  
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