For more information on
water well safety contact:

NIOSH Pittsburgh Research Laboratory

Dana C. Reinke
412.386.6673
DReinke@cdc.gov

David K. Ingram
412.386.6547
DIngram@cdc.gov

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CDC Workplace Safety and Health

Water Well BISS SAFETY

Health and Safety Information for the Water Well Industry

Print Design and Layout: **David L. Caruso, NIOSH**

Volume 1: **Hearing Loss Prevention, Electrical Safety, Training Younger Workers**

National Institute for Occupational Safety and Health
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Other Sources of Information

NIOSH Home Page http://www.cdc.gov/niosh/homepage.html

Electronic Library of Construction Occupational Safety and Health http://www.cdc.gov/elcosh/index.html

National Ground Water Association http://www.ngwa.org/

Dig Safely Campaign http://www.digsafely.com/index.htm

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Wiehagen B, Conrad D, Friend T, Rethi L [2002]. Considerations in training on-the-job trainers. In: Peters RH, ed. Strategies for improving miners' training. Pittsburgh, PA: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2002–156, IC 9463, pp. 27–34.

3. Training

Teach the employee the knowledge and skills to perform the job. The training should cover the tasks defined in the job analysis. This training takes place every day at the worksite. By adding a job analysis into the driller–helper "apprentice model," new workers learn the skills needed to do the job correctly. Also, experienced workers may learn easier, better, or safer ways to perform certain tasks associated with well drilling.

4. Evaluation

The final and ongoing step is evaluating the helper's ability to do the job correctly and safely. The job analysis can be used again in this step to make sure new employees perform all the tasks connected with the work. A company owner, safety director, or drill operator can use the job analysis as a checklist to measure an inexperienced worker's knowledge and skill about particular tasks related to the job. Using a job analysis as an evaluation tool also serves to check if the driller is teaching the helper the correct, safe, and best way to perform work tasks.

Figure 6. *Training younger workers includes more than teaching job–related skills; hazard recognition and health and safety topics should also be discussed. Here a worker operates a rig in muddy conditions that could present a slip/trip hazard.*

Information Circular 9483

Water Well Safety Bits: Health and Safety Information for the Water Well Industry

By Dana C. Reinke

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Pittsburgh Research Laboratory
Pittsburgh, PA

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apprentice system. The informal style of the apprentice driller–helper training model can be reorganized into a more structured on–the–job training program (Fig. 5). Such a program draws on the experiences of the company's workforce. It also helps improve the consistency of training for job skills and safety practices taught to new workers (Wiehagen et al., 2002). The following list describes how to develop a structured on–the–job training program.

1. Perform a Job Analysis

A job analysis is a written list of the tasks associated with doing a particular job. In drilling, describing the steps associated with adding rod to the drill steel would be an example of a task associated with the job. How to hammer casing or fish a lost drill bit out of a hole would also be job tasks.

Develop a written list of job tasks. Ask drillers in your company if the tasks listed are correct and accurately reflect how to perform the job. While each driller may do the job a little differently, some tried–and–true methods are required to perform certain tasks safely and correctly. You may find a separate analysis is needed for different drilling jobs (e.g., a residential well or a monitoring well). Also remember to include the tasks of both the helper and the driller.

2. Assessment

Determine what job content is already known by the trainee. In the water well industry, inexperienced workers start as helpers and learn from the driller with whom they work. The written job analysis serves as a checklist to see if the inexperienced worker really knows the tasks associated with the job. This assessment helps the company make sure that new workers are learning the skills required. It also helps the driller find out if their helper is learning how to perform job tasks safely and correctly. It can take a helper 2 to 5 years to become an experienced driller. Job analysis is like a check-up that lets the helper know how to perform all aspects of the job correctly and safely.

Generation Xers are those workers born between 1960-1980. Workers in this cohort range in age from their early 40s to early 20s and are already part of the workforce. Even so, this group is part of the industry's future. They will replace many of the most experienced drillers in the next 5 to 10 years, as older workers retire. Workers born after 1980 fall into the newest cohort, called Generation Y or Generation Nexters. These workers are just entering the industry and come to work with a different set of life experiences. These life experiences will impact how they learn and work (Fig. 4).

NIOSH researchers studied training preferences of workers in the mining industry. The study found that Generation X and Y workers preferred hands–on practice in a classroom or worksite when learning a new skill (Mallett and Reinke, 2002). The driller–helper "apprentice model" matches the type of learning desired by younger workers. Company owners can tap into the skills of experienced workers to improve the driller-helper

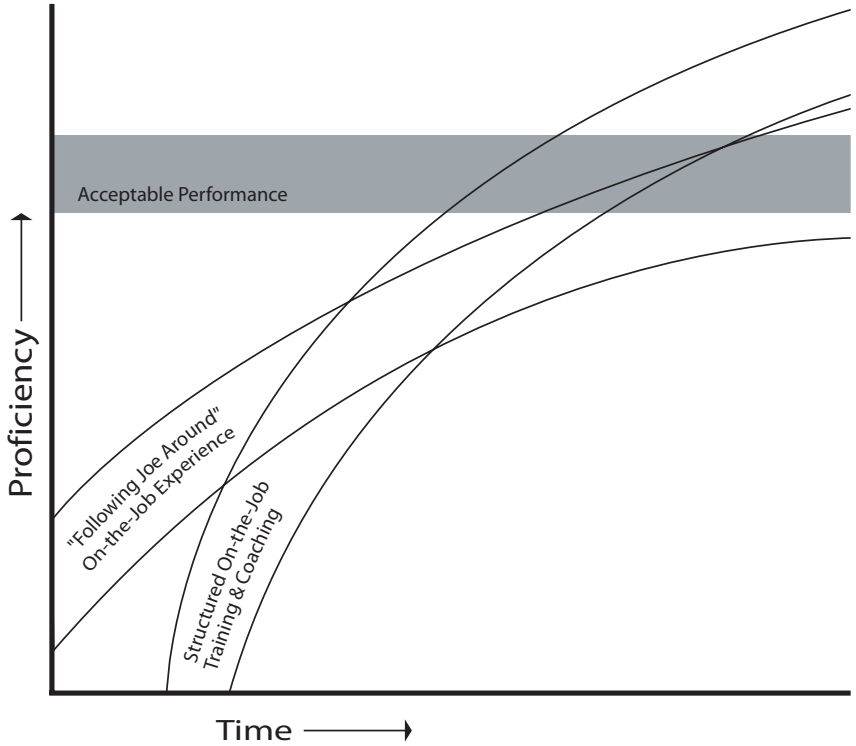

Figure 5. *While workers can learn basic skills by observation, most will reach acceptable performance sooner with a structured on-the-job training program. (Wiehagen et al. 2002)*

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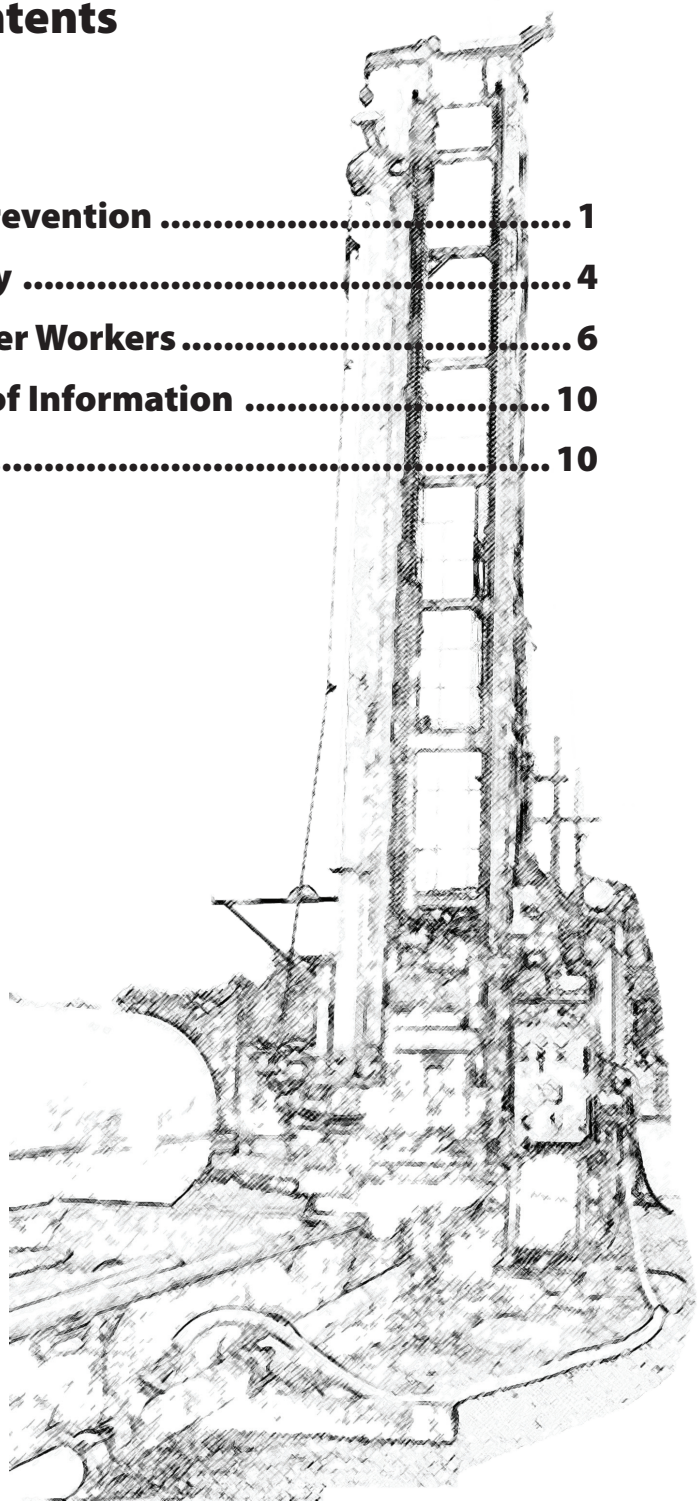

Hearing Loss Prevention

Water well drillers are exposed to high levels of noise while working. NIOSH researchers have found that water well drillers are exposed to levels above 85dB(A) while performing certain tasks during a typical drilling job. Noise levels consistently over 85dB(A) during an 8–hour work shift are hazardous and can lead to hearing loss in workers. Finding ways to reduce noise exposure is difficult because of many factors. The work environment is constantly changing due to the location of jobs and environmental factors. The types of drill rigs required for drilling are expensive. Equipment can range from new to used (10 to 30+ years old). Drillers and owners can work together to prevent noise–induced hearing loss, and measures can be taken to reduce exposure to hazardous noise.

> **Tip** In noisy areas around the rig, try using hand signals to convey simple messages (e.g., raise or lower the drilling rod).

Preventing hearing loss occurs through three stages. The first stage is removing noise from the source (i.e., drill rig). Various parts of a drill rig create noise besides the drilling rod. NIOSH researchers have examined noise levels of drill rigs. Some of the loudest parts of the drill rig include the compressor, engine, and cooling fan (Fig. 1). While removing the noise source from a worksite is ideal, the process would be expensive and difficult.

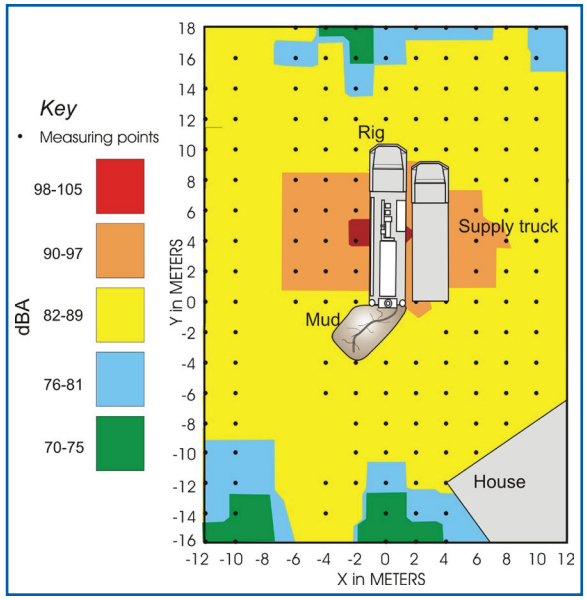

Figure 1. *The image above shows sound levels around a typical water well worksite. In this example, workers are exposed to sound levels above 90dB(A) within 6 meters of the rig, particularly near the compressor. All workers at a worksite should always wear hearing protection and avoid standing in these areas if not required to conduct a work task.*

Training Young Workers

The water well drilling industry has a workforce with many years of experience. Members of the "Baby Boomer" generation have filled drillers' ranks over the past 20 years. As these Boomers start to retire, company owners need to pass on these workers' experiences to inexperienced workers. While the industry trains new workers using an "apprentice model," today's young workers learn and think about their jobs differently than their parents or grandparents. To help train younger workers, companies need to know more about these workers and their preferred learning styles.

Generations X and Y

All workers can be grouped according to their approximate age and life experiences. A cohort is a group of individuals born at about the same time and who share common experiences as they pass through life's milestones. They start school, become teenagers, enter the workforce, and leave it at roughly the same time. The cohort name "Baby Boomers" describes people born after World War II who experienced the social, political, and economic events of the 1950s and 1960s (Salopek, 2000). New workers in the drilling industry are part of two cohorts. These cohorts grew up with a changing U.S. economy, a rise in the use of computers and technology, and more of a global outlook.

Figure 4. *A driller and helper bring different work experiences to the jobsite. Younger or less experienced workers can benefit from more structured training on how to work at a water well site. Checklists written for particular work tasks, such as adding casing, may help inexperienced workers learn how to perform the job safely and correctly in less time.*

to OSHA REG 29 CFR 1910.333 before commencing operations. Where it is difficult to see if the drill mast is clear of overhead objects, the driller should designate a person to observe the clearance and warn immediately if the mast approaches the limits of safety clearance [29 CFR 1926.550 9(a)(15)(iv)].

Table 1. *OSHA guidelines for operating heavy equipment near overhead power lines.*

Power line voltage phase to phase (kV)	Minimum safe clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35

DID YOU KNOW?

Lightning Strikes

In the United States an estimated 93 people die each year from being struck by lightning. Lightning strikes cause more deaths than most other natural disasters, such as hurricanes or tornadoes. Since water well drilling requires working outside in all conditions, workers need to pay attention to weather conditions for changes in wind velocity, rain and potential lightning. Most lightning strikes occur outdoors between May and September. One lightning strike can injure or kill one or more people. Thirty percent of people struck by lightning will usually die within one hour of injury. The following information about lightning should be part of monitoring weather conditions for workplace safety:

- Pay attention to weather forecasts during the thunderstorm season.
- Realize that lightning is present in all thunderstorms.
- Appreciate that lightning occurs before rain and can strike as far as 10 miles away from a thunderstorm.
- Seek shelter immediately when thunder is heard.
- Remain inside your vehicle.

The second stage of hearing loss prevention suggests moving the worker away from the noise source. Again, the set up of a drill rig requires the worker to operate close to the hole being drilled. The driller and helper can lower their exposure to hazardous noise levels by distancing themselves from these components. A helper is constantly moving equipment around the worksite. If workers are not required to be near the drill rod, compressor, cooling fan, or engine; they could lower their noise exposure by moving 6-12 feet away from these sources. The above actions may require the driller and helper to alter their communication with each other at the worksite.

While these two stages of hearing loss prevention may be difficult to complete because of worksite locations or equipment, the third stage can be performed by both drillers and helpers. Workers need to be protected from hazardous noise through the use of personal hearing protection devices (HPDs). Owners can help by providing hearing loss training and HPDs to workers in noisy environments. A noisy environment is one where workers must raise their voice to talk to someone who is an arm's length away (approximately 3-5 feet). In addition, if an employee notices a ringing sensation or a dull, flat sound after leaving the worksite, they most likely worked in hazardous noise environment and should consider wearing HPDs. There are many types of HPDs available, and the "best" protector is one that a worker will wear with the four 'C's" in mind:

Clean - Workers need to have clean hands and insert clean plugs into their ears; otherwise dirt, chemicals or other irritants can get into the ear canal.

Consistent - Workers must wear their HPDs consistently when noise levels are above 85 dB(A).

Comfortable - Ear canals are physically different for each person. If a worker has an HPD that is comfortable, they will be more likely to wear it. Owners should provide a variety of HPDs in different styles so workers can find the one that fits their ears comfortably.

Correct - Workers must insert HPDs correctly to get the most protection and noise reduction. NIOSH researchers use the Roll, Pull, Hold method of ear plug insertion to improve effectiveness.

Get the most from hearing protection using
the Roll, Pull, Hold Method

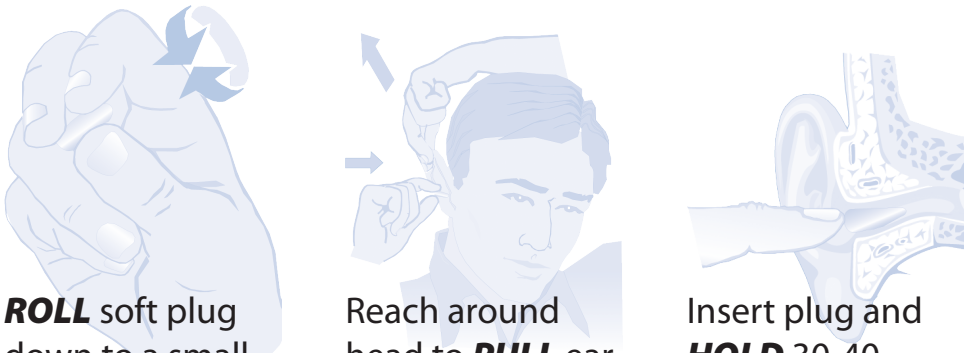

Figure 2. *For foam plugs, follow the manufacturer's instructions or try the NIOSH Roll, Pull, Hold method every time hearing protection is used. Consistently wearing hearing protection at a worksite on every job will help workers protect their hearing and prevent noise-induced hearing loss.*

Once the plug is inserted, check the fit. The plug should be within the ear canal (many plugs are soft, and if not held in place during expansion, will move out of ear canal). Cup hands tightly over ear. If sounds are much more muffled with hands over ears, the plug may not be inserted properly. If plugs are not effectively inserted, then remove plugs and re-insert again using the Roll, Pull, Hold method (Fig. 2).

HPDs take time to get used to, just like other forms of personal protective equipment (e.g., safety boots, glasses etc.). HPDs will lower the wearer's noise exposure to equipment, but WILL NOT eliminate it. Some hearing protectors may reduce certain frequencies more than others, thus changing the sound characteristics. Consistent use is important in preventing noise–induced hearing loss.

Electrical Safety at the Worksite

A water well drilling site is full of potential hazards. Most common among these hazards is electricity, which according to the Census of Fatal Occupational Injuries (CFOI) program was the cause for 21 fatalities among water well drillers between 1992 and 2000. Nineteen of those fatalities occurred while workers were drilling and/or servicing a water pump or when the rig contacted overhead power lines.

Owners and employees should work together to create jobsite and task–specific electrical safety guidelines. Drillers and helpers need to recognize electrical hazards as part of their job. The following electrical safety procedures should be part of any jobsite review:

1. **Call** your state's one call center to identify the location of underground public utility power lines.
2. **Verify** the location of all buried or embedded electrical circuits, including landowner and third–party lines at the worksite.
3. **Check** the condition of all equipment before drilling starts. Drillers and helpers should make sure the rig's electrical systems are working properly. Workers should check the integrity of the grounding system, internal safety mechanisms, operating voltage and the electrical wiring.
4. **Locate** power lines and take precautions to avoid them when erecting the mast. Accidents involving electrical cables often occur when a drill is being set up, moved, or broken down. OSHA guidelines for operating heavy equipment near overhead power lines [OSHA Standard B30.5-1994,5-.4.5] can serve as a *guideline for minimum clearance* when erecting drilling masts. Drilling industry guidelines recommend before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine the minimum horizontal distance from any point on the drill rig to the nearest power line when the mast is raised and/or being raised. If this horizontal distance is less than 100 ft. (30 m), first consult the local utility company and refer

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Figure 3. *If you don't know the contact information for your state's one call center, call the Dig Safely hotline and find out.*