

RECLAMATION

Managing Water in the West

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Office Safety Shouldn't be Forgotten

Chemical Grouting Summary, Steel Outlet Works Liner –
Shadow Mountain Dam, Grand Lake, Colorado



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This *Water Operation and Maintenance Bulletin* is published quarterly for the benefit of water supply system operators. Its principal purpose is to serve as a medium to exchange information for use by Bureau of Reclamation personnel and water user groups in operating and maintaining project facilities.

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Cover photographs – Two-part “Zipper” pump used to inject chemical grout.

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Office Safety Shouldn't be Forgotten

by Steven J. Melikean¹

Employees are usually surprised when I tell them that *office injury* frequency rates are higher than those in many industrial settings. More accidents occur in offices than in the construction, sawmill, industrial machinery, hospital, petroleum refining, forestry, and coal mining industries. The reason for this rate difference isn't exactly known. However, it has been suggested that office workers see their workplace as being benign, without obvious hazards. For example, a Bureau of Reclamation employee who is involved in operations and maintenance is constantly reminded of potential safety and health hazards when entering a powerplant. Usually, the first reminder is signage requiring that they wear hearing protection and a hard hat when entering the powerplant. At a weekly staff meeting, time is set aside for a "tool box" safety meeting in which safety and health issues are discussed. Or, perhaps, a potentially hazardous operation is planned, and supervisors and workers develop a Job Hazard Analysis. These scenarios, however, are not representative of the typical office worker.

So, what does the office worker need to be concerned about in his or her workplace? Changes have occurred in the American workplace as a result of new office technology and automation of office equipment. As with all new technology, these changes bring with it a set of health and safety concerns. In addition to more obvious hazards such as slippery floors or an open file drawer, a modern office may have hazards such as poor lighting, noise, poorly designed furniture, and equipment/machines that emit gases and vapors when not properly maintained. Even the nature of office work itself has produced a host of stress-related symptoms and musculoskeletal strains. For example, long hours at a poorly designed computer workstation can cause pains in the neck and back, shoulders, lower extremities, arms, wrists, hands, and eyes. Long hours can also result in a general feeling of tension and irritability.

The leading types of disabling accidents that occur within the office are the result of falls, strains and overexertion, falling objects/striking against objects, and being caught in or between objects.

Falls

Falls are the most common office accident, accounting for the greatest number of disabling injuries. The disabling injury rate of falls among office workers is 2 to

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2.5 times higher than the rate for non-office employees. A fall occurs when you lose your balance and footing. One of the most common causes of office falls is tripping over an open desk or file drawer. Bending while seated in an unstable chair and tripping over electrical cords or wires are other common hazards. Office falls are frequently caused by using a chair or a stack of boxes in place of a ladder and by slipping on wet floors. Loose carpeting, objects stored in halls or walkways, and inadequate lighting are other hazards that invite accidental falls. Fortunately, all of these fall hazards are preventable. The following checklist can help prevent a fall:

- Be sure the pathway is clear before you walk.
- Close drawers completely after every use.
- Avoid excessive bending, twisting, and leaning backward while seated.
- Secure electrical cords and wires away from walkways.
- Always use a stepladder for overhead reaching. Chairs should never be used as ladders.
- Clean up spills immediately.
- Pick up objects co-workers may have left on the floor.
- Report loose carpeting or damaged flooring.
- Never carry anything that obscures your vision.
- Wear stable shoes with non-slip soles.

If you find yourself heading for a fall, remember – **roll, don't reach**. By letting your body crumple and roll, you are more likely to absorb the impact and momentum of a fall without injury. Reaching an arm or leg out to break your fall may result in a broken limb.

Strains and Overexertion

Although a typical office job may not involve lifting large or especially heavy objects, it's important to follow the principles of safe lifting. Small, light loads (i.e., stacks of files, boxes of computer paper, books) can wreak havoc on your back, neck, and shoulders if you use your body incorrectly when you lift them. Backs are especially vulnerable; most back injuries result from improper lifting. Before you pick up a carton or load, ask yourself these questions:

- Is this too heavy for me to lift and carry alone?
- How high do I have to lift it?
- How far do I have to carry it?
- Am I trying to impress anyone by lifting this?

If you feel that the lift is beyond your ability, contact your supervisor or ask another employee to assist you.

Safe Lifting Steps

1. Take a balanced stance—feet placed shoulder-width apart. When lifting something from the floor, squat close to the load.
2. Keep your back in its neutral or straight position. Tuck in your chin so your head and neck continue the straight back line.
3. Grip the object with your whole hand rather than only with your fingers. Draw the object close to you, holding your elbows close to your body to keep the load and your body weight centered.
4. Lift by straightening your legs. Let your leg muscles, not your back muscles, do the work. Tighten your stomach muscles to help support your back. Maintain your neutral back position as you lift.
5. Never twist when lifting. When you must turn with a load, turn your whole body, feet first.
6. Never carry a load that blocks your vision.
7. To set something down, use the same body mechanics designed for lifting.

Lifting from a Seated Position

Bending from a seated position and coming back up places tremendous strain on your back. In addition, your chair could be unstable and slip out from under you. Instead of lifting from a seated position, stand and move your chair out of the way. Squat and stand whenever you have to retrieve something from the floor.

Solutions to Backbreaking Tasks

To avoid twisting while lifting, rearrange the space to provide ample room to lift without running into objects. People who have to twist under a load are more likely to suffer a back injury. Rotate through tasks so that periods of standing alternate with moving or sitting. Ask for stools or footrests for stationary jobs. Store materials at knee level whenever possible instead of on the floor. Make shelves shallower (12–18 inches) so you do not have to reach forward to lift an object. Break up loads so each weighs less. If you must carry a heavy object some distance, consider storing it closer, request a table to rest it on, or try to use a hand truck or cart to transport it.

Struck by or Striking Objects

Striking against objects is another cause of office injuries. Incidents of this type include:

- Bumping into doors, desks, file cabinets, and open drawers
- Bumping into other people while walking
- Striking open file drawers while bending down or straightening up
- Striking against sharp objects such as office machines, spindle files, staples, and pins

Pay attention to where you are walking at all times, properly store materials in your work area, and never carry objects that prevent you from seeing ahead of you.

Objects striking employees occur as a result of:

- Office supplies sliding from shelves or cabinet tops
- Overbalanced file cabinets in which two or more drawers were opened at the same time or in which the file drawer was pulled out too far
- Machines, such as typewriters, that were dropped on feet
- Doors that were opened suddenly from the other side

Proper material storage and use of storage devices can help avoid these accidents.

Caught In or Between Objects

The last category of leading, disabling accidents occurs as a result of office workers who get their fingers or articles of clothing caught in or between objects. Office workers may be injured when:

- Fingers are caught in a drawer, door, or window
- Fingers, hair, articles of clothing, or jewelry are caught in office machines
- Fingers are caught under the knife-edge of a paper cutter

While working on office equipment, concentrate on what you are doing.

Material Storage

Office materials that are improperly stored can lead to (1) objects falling on workers, (2) an obstructed view, and (3) fire hazards. A good housekeeping program will reduce or eliminate hazards associated with improper storage of materials. Examples of improper storage include:

- Disorderly piles of material
- Piling materials too high
- Obstructing doors, aisles, fire exits, and firefighting equipment

The following are good storage practices:

- Boxes, papers, and other materials should not be stored on top of lockers, flipper drawers, or file cabinets because they can cause landslide problems.
- Boxes and cartons should all be of uniform size in any pile or stack. Always stack material in such a way that it will not fall over.
- Always store heavy objects on lower shelves.
- Store heavy materials so that you do not have to reach across something to retrieve them.
- Try to store materials inside cabinets, files, and lockers.

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- Office equipment, such as typewriters, index files, lights, or calculators, should not be placed on the edges of a desk, filing cabinet, or table.
- Aisles, corners, and passageways must remain unobstructed – no stacks of materials should be in these areas. Storage areas should be designated and used solely for that purpose.
- Fire equipment, extinguishers, fire door exits, and sprinkler heads should remain unobstructed.
- Materials should be at least a minimum of 18 inches from sprinkler heads.

Other Office Safety and Health Issues

Ergonomics

Ergonomics involves fitting the workplace to the worker by modifying or re-designing the job, workstation, tool, or environment. Workstation design can have a big impact on an office worker's health and well-being. There are a multitude of discomforts that can result from ergonomically incorrect computer workstation setups. The most common complaints relate to the neck, shoulders, and back. Others concern the arms and hands and occasionally the eyes. For example, poor chairs and/or bad posture can cause lower back strain, and a chair that is too high can cause circulation loss in the legs and feet.

Indoor Air Quality

Indoor air quality is an increasingly important issue in the work environment. Indoor air quality and pollutant levels within office environments can be a complex problem. An inadequately ventilated office environment or a poorly designed ventilation system can lead to the buildup of a variety of indoor air pollutants. Air pollutants can originate within the building or be drawn in from the outdoors.

Examples of sources that originate outside a building include:

- Pollen, dust, and fungal spores
- General vehicle exhaust
- Odors from dumpsters
- Re-entrained exhaust from the building itself or neighboring buildings

Examples of sources that originate from within the building include:

- Building components and furnishings
- Smoking
- Maintenance or remodeling activities (e.g., painting)
- Housekeeping activities
- Unsanitary conditions (standing water from clogged drains or dry traps) and water damage
- Emissions from office equipment or special-use areas (print shops, laboratories, or food preparation areas)

Lighting

Lighting is one of the most important factors affecting personal comfort on the job. The best lighting system is one in which the light level is geared to the task, where brightness ratios are controlled (no intensely bright or dark areas in one field of vision) and where ceilings, walls, and floors are carefully chosen to minimize glare. Glare is defined as a harsh, uncomfortable bright light that shines directly in the eyes. Glare may be either direct, coming from lights or sunshine, or indirect, coming from a reflected surface.

Noise

Noise can be defined very simply as unwanted sound. Office workers are subjected to many noise sources: video display terminals, high-speed printers, telephones, fax machines, and human voices. Noise can produce tension and stress as well as damage to hearing at high levels. For noise levels in offices, the most common effects are interference with speech communication, annoyance, and distraction from mental activities. The annoying effect of noise can decrease performance or increase errors in some task situations. If the tasks require a great deal of mental concentration, noise can be detrimental to performance.

Electricity

Electricity is essential to the operation of a modern automated office as a source of power. Electrical equipment used in an office is potentially hazardous and can cause serious shock and burn injuries if improperly used or maintained. Electricity travels through electrical conductors that may be in the form of wires

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or parts of the human body. Most metals and moist skin offer very little resistance to the flow of an electrical current and can easily conduct electricity. Other substances such as dry wood, porcelain, or pottery offer a high resistance and can be used to prevent the flow of an electrical current. If a part of the body comes in contact with an electrical circuit, a shock will occur. The electrical current will enter the body at one point and leave at another. The passage of electricity through the body can cause great pain; burns; destruction of tissue, nerves, and muscles; and even death. Factors influencing the effects of electrical shock include the type of current, voltage, resistance, amperage, pathway through body, and the duration of contact. The longer the current flows through the body, the more serious the injury. Injuries are less severe when the current does not pass through or near nerve centers and vital organs. Electrical accidents usually occur as a result of faulty or defective equipment, unsafe installation, or misuse of equipment.

Smoke and Fire

One result of the recent trend toward open office environments is that smoke from office fires is not contained or isolated as effectively as in less open designs. Open office designs allow smoke to spread quickly, and the incorporation of many synthetic and other combustible materials in office fixtures (i.e., furniture, rugs, drapes, plastic wastebaskets, and vinyl covered walls) often makes “smoky” fires. In addition to being smoky, many synthetic materials can emit toxic materials during a fire. For example, cyanide can be emitted from urethane, which is commonly used in upholstery stuffing. Most burning materials can emit carbon monoxide. Inhalation of these toxic materials can severely hamper an office worker’s chances of getting out of a fire in time. It is imperative for office workers to recognize the signal to evacuate their work area and know how to exit in an expedient manner.

Chemical Grouting Summary, Steel Outlet Works Liner – Shadow Mountain Dam, Grand Lake, Colorado

Introduction

This article documents the work performed by Bureau of Reclamation personnel and employees of the Northern Water Conservancy District on the steel outlet works liner on Shadow Mountain Dam, Grand Lake, Colorado.

During a facilities inspection, cavitation damage and drummy voids were found behind the 36- by 48-inch-long stainless steel liner located in the gate shaft on the river outlet works. This was reported to have been grouted with cementitious grout in the late 1980s. A subsequent inspection for repair possibilities in March 2005 was performed by the Loveland Area Office and the Technical Service Center, Materials Engineering and Research Laboratory, (MERL). Epoxy bonded epoxy mortar repair of the damaged concrete areas and chemical grouting were determined to be viable means of repair for the cavitation damaged areas on the downstream edge and behind the steel liner.

During the first week in September 2005, members of the Northern Water Conservancy Districts maintenance team removed a portion of the 5-inch vent tube and installed an inflatable rubber packer to isolate the vent from chemical grout intrusion. They performed epoxy bonded epoxy mortar repairs on the downstream cavitation damaged areas on the crown and sides of the liner. They also installed access ladders and supplied a pump to assist in removing water flowing from behind the bulk heads into the work areas.

On September 8, 2005, MERL began chemical grouting operations on the 36-inch-square steel liner.

Chemical Grouting

Eighteen 3/8-inch-diameter holes were drilled through the steel liner and probed with awls and screwdrivers to determine the depth of the voids. Voids 2 to 5 inches deep were noted with many areas having 1.25- to 1.5-inch deep voids. The areas that had drummy voids were somewhat centrally located on the sides and crown and extended upstream and downstream in narrow bands. Plastic bang-in injection ports were installed. Injection holes and vent holes were placed to maximize grout travel and to provide positive venting and observation of grout

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travel. Holes were also drilled in the box section to observe any grout bypass around the packer. A packer was set in the bottom of the draft vent pipe to keep grout out. The first inflatable packer failed with a loud bang due to sharp edges on the weld near the bottom of the vent pipe. A second packer was wrapped with a rubber inner tube for protection and was installed successfully.

The “Zipper” pump was then used to grout all locations. The Zipper is a twin cylinder hand-operated pump with two intake tubes that are fitted with backflow check valves. This pump is designed to pump equal volumes of product from each side to provide a 1:1 mixing ratio. The product is pumped through a static mixing tube in the injection gun (F-assembly) where it thoroughly mixes the two components of the injection resin just prior to injection through the ports.

A two-part polyurethane and polyol resin consisting of Stratathane ST-538 and ST-539 from Strata-tech (Des Moines, Iowa) was injected. This material sets up in approximately 15 minutes, does not expand as it cures, and is very strong in compression. The following results were noted:

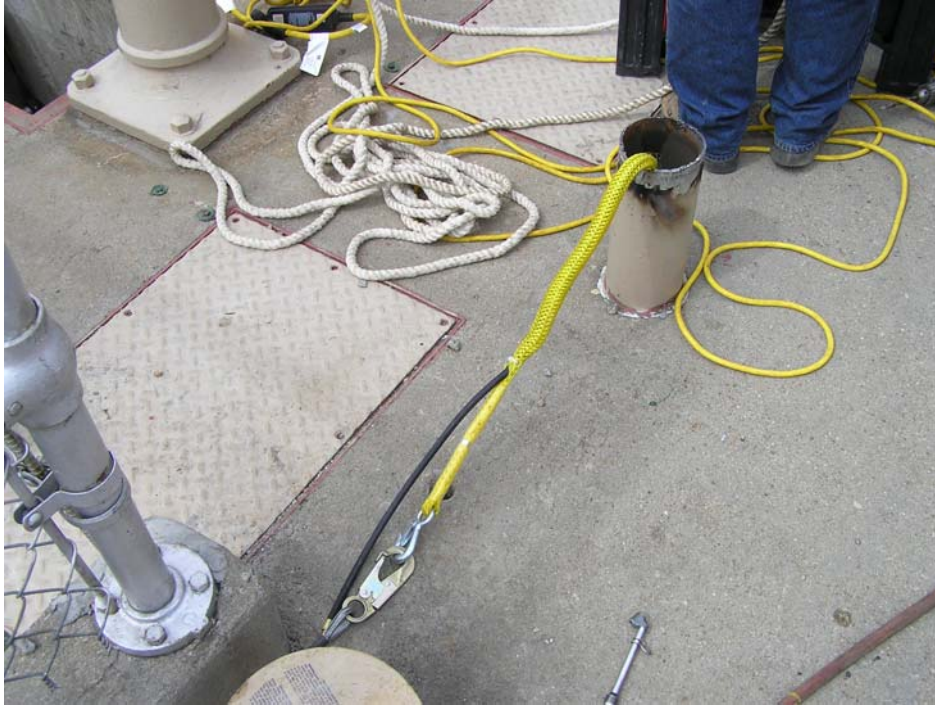
1. Approximately 11.5 gallons of mixed ST-538 and ST-539 were injected.
2. Approximately 0.75 gallon of Stratathane 504 was then injected to eliminate voids, which were still present near the upstream side of the liner. Stratathane 504 reacts with water and expands rapidly, enabling it to fill large voids more quickly. It was injected at a 1:1 ratio with water to complete the seal at the slide gate frame.
3. During grouting operations, water was displaced from around the steel liner to the downstream, upstream, and right sides around the circumference of the frame of the gate. Communication from the ports on the left side, across, and over the top to the right side occurred.
4. Grout did not bypass the vent tube packer into the steel box.



Concrete damage around steel liner (site visit).



Concrete damage around steel liner (site visit).



Vent tube into which inflatable packer was lowered on rope.



Access to outlet works liner.



Two-part "Zipper" pump used to inject chemical grout.



"F-assembly" injection gun.



Looking downstream into tight quarters in the outlet works.



Looking upstream into outlet shaft at pump operator.

Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.



The purpose of this bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends upon your help in obtaining and submitting new and useful operation and maintenance ideas.

Advertise your district's or project's resourcefulness by having an article published in the bulletin—let us hear from you soon!

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