Manual of Water Supply Practices

M3

# Safety Management for Utilities

Seventh Edition

American Water Works Association

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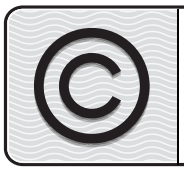



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# Preface

Protecting the professionals who produce adequate supplies of high-quality drinking water is of the utmost importance. Employees are a utility's most valuable resource, and their ability to work safely and in a safe environment is the main reason for workplace safety programs. Safeguarding the general public from construction sites and operations is another reason for the programs. To that end, the American Water Works Association has created a safety policy. The policy guides the discussion of safety practices presented in this manual. The most current statement can be found on the AWWA website, www.awwa.org/about-us.aspx.

Rather than editing the previous version of the manual, the Health, Safety, and Environment Committee chose to rewrite this manual and provide new information. This edition of M3 focuses on the development of a comprehensive Health, Safety, and Environment (HSE) program. It can be used as general guidance for water utility personnel that have been given the responsibility of developing their utilities' health and safety programs.

While providing a healthy and safe environment is a common goal among water utilities, regulations can be different depending on the country, state, or province in which your utility operates. Therefore, M3 avoids regulatory specifications (e.g., measurements, heights) that apply to a particular region and to the extent possible uses numbers that apply to all regions.

Along with the manual, readers will be provided with access to supplementary information and tools that can be used to aid in HSE program development. This includes sample checklists, site inspection forms, programs, and Job Safety Analyses. This supplemental material is delivered electronically to those who purchase this manual through the AWWA website, or can be obtained directly by going to www.awwa.org/M3.

The safety practices and management of safety programs in this manual represent general guidance. This manual cannot cover all situations and regulations. The audience for this manual is primarily utility management and other employees who have been assigned safety responsibilities, for example, a utility's safety manager or officer. Supervisors, who always have safety responsibilities to those they supervise, will also find this manual beneficial.

Because of its references to the US Occupational Safety and Health Administration (OSHA), this manual necessarily addresses US federal and state requirements, but Canada-specific guidance is included in the appendix.

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# Acknowledgments

The AWWA Management and Leadership Division and the Health, Safety, and Environment Committee gratefully acknowledges the contributions made by those volunteers who drafted, edited, and provided the significant and critical commentary essential to updating M3. The Editorial Review Board members dedicated countless hours in the final stages of preparation of this edition to ensure the overall technical quality, consistency, and accuracy of the manual.

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Chapter 1

# Establishing a Health, Safety, and Environment Program

*David C. Baird III, Peter S. Puglionesi*

Protecting the safety and health of employees is a key concern in any organization. The question of how best to accomplish the goal of sending everyone home safely at the end of each shift should always be at the forefront of any organization's planning efforts. Staff knowledge and management support alone have proved effective in some small organizations but ineffective in others. A formal Health, Safety, and Environment (HSE) program is a more reliable and effective means of consistently protecting workers from occupational injuries and illnesses. Formal written programs can address specific hazards and prevention measures (e.g., fall prevention) as well as specific regulatory mandates that require a written program (e.g., hazard communication, respiratory protection). Furthermore, there is widespread agreement that written management systems improve organizational performance, including performance in occupational health and safety.

This manual serves to establish the key components that should be included in a formal HSE program. Chapter 2 describes Job Safety Analysis (JSA) as a means to proactively examine and mitigate existing hazards on the worksite. Chapter 2 also introduces the hierarchy of controls, a methodology that is carried throughout the manual. A thorough

HSE program will also outline the procedures necessary should an incident occur; accident management is discussed in chapter 3. Recognizing that many hazards can be engineered out of a system, chapter 4 addresses key aspects of prevention though design. A meaningful program should also be effectively communicated with contractors. Chapter 5 describes contractor safety management and some of the special hazards that accompany the construction phase. Last, chapter 6 provides an index of common hazards. Many of these hazards should be considered in the development of any HSE program, and some can be evaluated depending on the type of system or its geographic location. In addition to planning for the hazards presented in chapter 6, extreme storm events should be considered in the development of an HSE program. More information on safety during emergencies can be found in AWWA Manual of Water Supply Practices M19, *Emergency Planning for Water Utilities*.

The rest of this introductory chapter presents research that demonstrates the need for formal HSE programs. This chapter then describes how to establish an effective program by delineating management steps and development activities that should be applied to each of the components offered throughout this manual.

Research conducted by the Lincoln Nebraska Safety Council in 1981 (Reese and Eidson 1999) surveyed more than 140 national construction-related companies. The council found that companies with formal safety plans and established procedures had fewer accidents than companies without plans and procedures. Table 1-1 summarizes those results.

**Table 1-1 Effectiveness of HSE programs**

| Safety plan component | Increase in accident rate % |
|---|---|
| Top management did not actively promote safety awareness | 470 |
| No written safety program | 130 |
| No document/review accident reports and reviewers did not have safety as part of their job responsibility | 122 |
| No established system to recognize safety accomplishments | 81 |
| No employee safety committees | 74 |
| No membership in professional safety organizations | 64 |
| No specific training for supervisors | 62 |
| No outside sources for safety training | 59 |
| No training for new hires | 52 |
| Safety programs not tailored to their company | 43 |
| No separate budget for safety | 43 |
| No safety inspections | 40 |
| Did not hold supervisor accountable for safety through merit salary reviews | 39 |

*Adapted from Reese and Eidson 1999.*

## Regulatory Requirements

The US Occupational Safety and Health (OSH) Act of 1970 did not grant the Department of Labor's Occupational Safety and Health Administration (OSHA) authority over federal, local, or state government-operated facilities. In developing its program to authorize states to enforce federal regulations, OSHA recognized the need to encourage states to regulate state and local government workplaces. The process of attaining state authority involves submitting an acceptable state plan to OSHA, in which states are required by OSHA to enact legislation and regulations that are equivalent to federal rules and also apply to the state and local government workplace.

As a result, many states have their own OSHA rules that apply to state and local government-operated water treatment plants (WTPs), in particular states with OSHA plans approved by federal OSHA (i.e., OSHA plan states). In addition, some states have enacted equivalent rules that apply only to state and local government employees.

The federal government's employees are covered under Section 19 of the OSH Act. This has been augmented by Executive Order 12196, dated February 26, 1980, which requires agency heads to furnish employees a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm.

As a result, federal- or state-equivalent OSHA rules are applicable and enforceable if the facility is

- a privately operated plant,
- operated by the federal government, or
- in one of the states operating OSHA Plans (Table 1-2).

For utilities in states listed as non-OSHA some governing body or legislation may be applicable, but no OSHA-equivalent safety and health standards exist. For example, in Texas public worker health and safety is managed by the Texas Department of Insurance, Workers Compensation Division, but there is no OSHA coverage of local municipal WTP workers. The Texas Workers' Compensation Act, section 411.101, states legislative policy of this division as "(1) promoting the adoption, application, and implementation of safety measures in industry and enterprise; (2) protecting workers against unsafe and hazardous working conditions; and (3) encouraging correction of any unsafe and hazardous working conditions in industry and enterprise." However, Texas and other non-plan states have no equivalent regulatory standards or enforcement, such as those provided by OSHA. So for those organizations in non-plan states, the drivers for compliance and even excellence are not the same, and what limited data are available indicate that having a plan with standards and enforcement does make a difference.

**Table 1-2 OSHA plan states**

| OSHA plan states | Non-OSHA plan states | OSHA plan states, governmental only* |
|---|---|---|
| Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, Wyoming | Alabama, Arkansas, Colorado, Delaware, Florida, Georgia, Idaho, Kansas, Louisiana, Maine, Massachusetts, Mississippi, Missouri, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Texas, West Virginia, Wisconsin | Connecticut, Illinois, New Jersey, New York, Virgin Islands |

*OSHA enforcement authority restricted to state and local government employment

The Department of Labor's Office of Inspector General published a report in February 2000 entitled *Evaluating the Status of Occupational Safety and Health Coverage of State and Local Government Workers in Federal OSHA States* (Report Number 05-00-0001-10-001). This report concluded that data from state plans suggest that local government workers are experiencing significantly higher occupational injury and illness rates compared to state workers, and initial evaluation reportedly confirms higher injury/illness rates among government employees and higher rates in non-plan states. However, these results have not been released because of the difficulty in confirming their statistical confidence intervals.

## Regulatory Requirements and Best Practices for HSE Programs

For those utilities that are regulated by OSHA's Process Safety Management (PSM) or the US Environmental Protection Agency (USEPA) Risk Management Program (RMP) regulations for control of hazardous chemicals, employee participation is a requirement that necessitates a written plan describing how employees are to be involved in implementation of those programs. This is critical for PSM and RMP because employees are working closest to the hazards and are in the best position to recognize and control those hazards. Likewise, employees such as operators and street crews can have the largest impact on injury prevention and safe work practices.

Injury and Illness Prevention Programs (IIPP) are written workplace safety management programs intended to improve workplace safety and health through good management practices and employee involvement. While some states, such as California, mandate that every employer implement an IIPP, there is no equivalent program requirement in the federal OSHA regulations, even though some specific regulations (e.g., confined space and lockout/tagout) call for written programs or plans. Regulations covering some industries or encouraging IIPP development exist in a total of 34 states. In recent years, OSHA has seriously contemplated such a requirement, and public comment on that proposal suggests that the regulation be based in part on one or both of two established industry consensus standards establishing best practices for IIPPs:

- ANSI/AIHA Z10-2005, Occupational Health and Safety Management Systems (American National Standards Institute/American Industrial Hygiene Association)
- OHSAS 18001-2007, Occupational Health and Safety Management Systems (Occupational Health and Safety Assessment Series Project Group)

While terms may vary between sources, the basic concepts of an HSE management program are management leadership and employee participation, planning, implementation, evaluation and corrective action, and management review, as illustrated in Figure 1-1.

Based on these activities, this chapter describes the typical process for developing a HSE program and key attributes of successful programs. The primary topics addressed are

- Developing a health, safety, and environment policy
- Management leadership and employee participation
- Program staffing and structure
- Roles and responsibilities
- Developing written programs
- Training and education
- Record keeping and recording
- Evaluation, corrective action, metrics, and continuous improvement

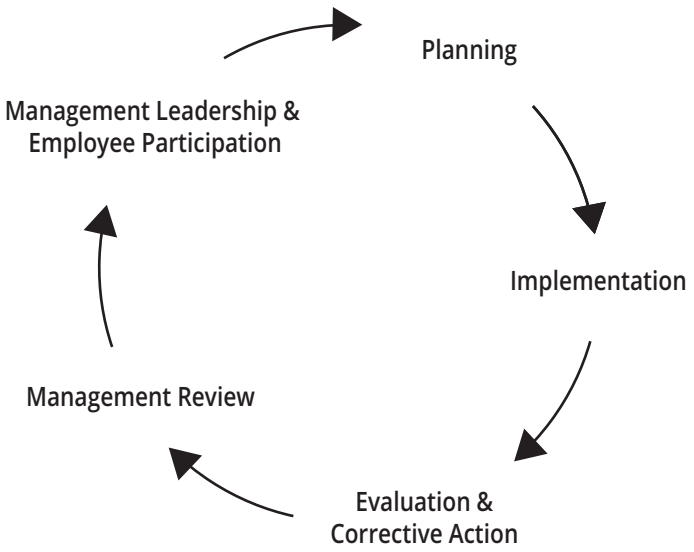


**Figure 1-1 Basic health and safety management program activities**

## DEVELOPING AN HSE POLICY

*The quality of a person's life is in direct proportion to their commitment to excellence, regardless of their chosen field of endeavor.*

—Vince Lombardi

With any endeavor, the quality of the outcome is in large part based on the level of commitment to that outcome. Management commitment is a key element that is universally understood as essential to safety excellence, but what is the actual expression of such commitment? Words? Resources? Presence? The short answer is "Yes" to all three, but it starts with words, initially presented through the HSE policy statement.

ANSI/AIHA standard Z10-2005 (Z10) states that a documented occupational health and safety policy is the foundation for any safety management system and that the policy must include the following four elements:

1. Protection and continual improvement of employee health and safety;
2. Effective employee participation;
3. Conformance with the organization's health and safety requirements; and
4. Compliance with applicable laws and regulations.

Z10 states the policy must be dated and signed or otherwise officially authorized and endorsed by top management and made available and communicated to employees. It is also helpful to share this information with other utility stakeholders and affected parties such as contractors, customers, and vendors.

A brief, written safety policy statement might be worded as follows:

*The* [Anytown Water Utility] *highly values the safety of its employees and the public. We are committed through the joint efforts of every employee (including the directors, managers, supervisors, and crews) to keep our workplace free of health and safety hazards and to prevent injuries and illnesses. We continually evaluate our safety performance and make improvements where necessary to maintain a safe workplace. Through routine and effective training and diligent implementation of our safety program, including all policies and procedures of* [Anytown Water Utility]*, we will maintain the safety of our employees and full compliance with all applicable environmental and safety laws and regulations.*

## MANAGEMENT LEADERSHIP AND EMPLOYEE PARTICIPATION

Management commitment is one of the most important requirements for success in any safety performance program. In order to overcome unsafe practices that have become status quo and to be heard above the noise of day-to-day activities and priorities, management commitment must be expressed in meaningful and ongoing ways. A written policy is generally not enough to achieve stated safety goals. Compliance requires the active engagement of all employees to develop a culture aligned with commitment to safety.

If a utility historically has not used written safety management programs or has had some limited level of safety management but desires to move to the next level, there may be some resistance to this effort. There may be a historic organizational culture that has not placed a priority on regulatory compliance. New managers and supervisors may have history or experience with different safety cultures, and may be implementing those cultures at their new workplace. While these individuals may want to do the right thing with regard to safety issues, their previous experience could have had inadequate safety staffing levels, a lackadaisical approach to safety, or other significant obstacles to a successful safety program. In that environment, these employees may have accepted and internalized historical organizational values that had assigned a lower priority to safety compliance, or they may doubt the organiztion will provide the necessary support (financial, manpower, training) needed to comply.

Human nature can make it difficult for employees to accept new approaches at face value when the new methods appear to conflict with years of experience. Employees may respond negatively to being given safety responsibilities unless there is clear communication that safety is a co-priority with meeting production, repair, construction, and financial objectives and there is sufficient technical safety support and oversight. Management must regularly reinforce the "our job is safety compliance" message and provide tangible evidence of its commitment through regular employee engagement and by providing the resources for achieving the safety objectives.

While policies and management plans are effective in setting the stage for a company commitment to safety, these plans and policies are best reinforced through management's active participation. Examples include:

1. Directors, managers and supervisors integrate regular and active involvement in safety compliance efforts into their day-to-day business (see Table 1-3).
2. Directors and managers discuss safety goals, their commitment, and employee accountability not only with their direct reports, but with other employees.
3. Safety objectives and accountability are integrated into performance evaluation goals for directors, managers, supervisors, and all employees.

**Table 1-3 Example activities for observable management involvement in safety**

| | Routinely | Weekly | Monthly | Quarterly |
|---|---|---|---|---|
| Director | Demonstrate leadership, show visible support<br>Participate in incident investigation process | Site safety visit: provide a visible presence in work area with a safety emphasis<br>Participate in weekly safety meetings | Review safety performance reports<br>Hold team members accountable for safety requirements | Conduct a safety observation<br>Participate in audits/ inspections<br>Lead safety toolbox meetings<br>Participate in reward/ recognition event |
| Managers | Demonstrate a personal commitment to safety at all times<br>Participate in incident investigation process | Lead weekly safety meetings | Conduct safety observations<br>Participate in audits/ inspections | |
| Supervisors | Continuously practice, educate and involve employees in hazard identification and use of safe work practices<br>Investigate all incidents and near misses<br>Recognize safety achievements<br>Consistently implement disciplinary program | Lead daily pre-job safety briefings that review activities, hazards, and controls<br>Lead weekly toolbox safety meetings | Participate in audits/ inspections | |

*Adapted from Clark 2008.*

4. Goals are set that measure poor performance by noncompliance rather than by the occurrence of an accident. An example of such a goal might be: "Comply with safety laws, regulations, and safety policies and procedures to the best of your ability consistent with job responsibilities. Actively work to help continuously improve safety performance and achieve safety excellence goals of no lost time or reportable injuries and no violations."
5. Corrective and disciplinary action is taken when managers, supervisors, or employees knowingly and repeatedly fail to meet their safety obligations. This is necessary to demonstrate that the organization is serious about meeting its compliance obligations.
6. All employees are held accountable for safety compliance and meeting their other safety goals, and employees who excel are recognized.
7. The safety budget process is openly defined and communicated and adequate funding is budgeted for safety staff, equipment, and supplies, including funds for unanticipated contingencies, such as addressing noncompliance issues quickly when they arise.

8. A mechanism is available to expedite funding, engineering, and/or procurement of critical safety needs.
9. Currently known critical safety needs are addressed as soon as possible.

Responding quickly to critical resource needs conveys management commitment to safety. Measures such as a priority approval process for safety critical needs and/or a contingency budget reserve are necessary to give management the ability to take actions that will bolster credibility and demonstrate management commitment. Table 1-3 provides additional specific criteria for management involvement that can be incorporated into performance requirements for each member of management and is observable by employees.

## Achieving a Culture of Excellence

Many organizations look at compliance as the goal for their safety programs, but remember that regulations are often *minimum* standards and just achieving compliance may not meet all safety goals for a given utility. Moving beyond compliance to safety excellence requires the active engagement of all employees to develop a culture aligned with the newly defined commitment. Culture can be one of the most difficult things to change. Culture change efforts in some larger organizations show that only a small fraction of management and employees will embrace new safety objectives and programs at their inception. The majority will adopt a wait-and-see attitude, and a small fraction will actively resist it. Success requires years of persistent communication, training, and—most important—showing this commitment in tangible ways.

It's never too late to start, and each utility at any time has the opportunity to establish and convey its safety priorities and establish a positive safety culture. Communication and employee participation as outlined in the following sections can improve the chances of success.

**Communication.** The following measures are suggested to actively, continually, and effectively communicate safety policy and programs to employees, supervisors, and managers.

1. Develop or improve existing model safety tools and plans to facilitate meeting basic safety compliance requirements.
2. Create a safety communication vehicle (newsletter or section in an existing utility communication) to regularly communicate to employees on safety policies, programs, new developments, performance, and positive examples.
3. Encourage active communication, cooperation, and coordination between individuals with corporate- or management-level safety functions and the supervisors and field staff with safety responsibilities through a safety coordination group that meets regularly.
4. Set up an intranet safety page with corporate policies, procedures, model programs, and links to outside resources (e.g., federal and state regulations).
5. Adopt incentive programs to promote active participation in safety compliance and excellence. While cost may be an issue, there will be financial returns in reduced injury and environmental costs. Measures should certainly include no-cost and low-cost measures such as featuring "Safety Employee of the Month/Year" in the safety publication and recognition at employee events. Consider low-cost awareness programs, such as caps or shirts for reaching milestones or performance goals as well as more sophisticated moderate-cost programs.

**Employee participation.** As important as management commitment and its impact on effective safety program implementation and performance is employee involvement.

The intent of employee participation is to encourage employees to

- have meaningful involvement in the structure, operation, and pursuit of the objectives of the safety program;
- identify tasks, hazards, and risks, and possible control measures; and
- participate in implementation of control measures.

In practical terms, employee participation in an effective safety program means providing a role for supervisors, hourly employees, and employee representatives in activities such as procedure development, training development, job safety analysis, incident investigations, health- and safety-related audits, and all aspects of the safety program planning and development process. Probably the most common mechanism for employee participation is participation in health and safety committees (adapted from ANSI/AIHA Z10-2005).

A safety committee is made up of both employee and management representatives. Typical duties include

- Workplace self-inspections
- Accident investigations
- Developing safe work practices
- Developing written safety programs
- Facilitating safety training

The committee also can help promote other activities that encourage employees to support the organization's safety program. Table 1-4 provides an example of defined employee participation for a few sample safety compliance areas.

**Table 1-4 Example employee participation plan**

| Safety Program Element | Employee Involvement | Designated Employee(s) |
|---|---|---|
| Safety training | Supervisors, operators, and field crews will participate in weekly safety talks about various safety topics. Selected staff may receive more intensive training on particular subjects related to their work situations. | All employees |
| Incident investigations | Involved personnel will cooperate with investigation team. Selected personnel may participate in the investigation as requested by the incident investigation team lead. | All employees |
| Emergency planning and response | All employees and contractors currently on-site will be provided emergency warning and evacuation training. | All employees and affected contractors |
| | Trained employees will be on emergency response team. Emergency response team members will assist in reviewing the emergency response plan. | Emergency response team members |
| Safety audits | Selected personnel may participate in audits and cooperate when interviewed by auditors. All employees will be provided emergency warning and evacuation training. | All employees |

## PROGRAM STAFFING AND STRUCTURE

Safety staffing demands are not solely based on an organization's employee count. There is a baseline of activity and expertise needed for the organization-wide and facility levels that is independent of number of facilities and a component of effort that is dependent on the number of employees/facilities. There are certain basic good practices and principles that can apply to any safety management system, including the following:

- Having a safety-accountable executive-level position makes it easier for organizations to achieve and maintain a high level of performance.
- All directors and facility managers must be accountable for safety compliance, support safety efforts for their operations, and regularly reinforce the importance of safety compliance to their employees.
- In large organizations, a central safety group can operate on a high level—providing policies and programs, assessing and auditing performance, encouraging coordination, and providing efficient shared services (e.g., reviewing and communicating emerging regulations).
- Safety compliance is more effective when experienced, trained safety staff provide close support to operations.
- Larger facilities or clusters of facilities may have a safety workload that justifies a designated safety specialist. If these positions report to operations, they should work closely with corporate safety groups (i.e., a "dotted-line" relationship) and follow corporate policies and programs.
- Safety staff at multiple levels within an organization must have clearly defined roles and responsibilities to achieve common safety goals and avoid duplication of effort, divergent programs, and potentially adversarial relationships.
- Everyone in the organization should have some responsibility for supporting the safety programs (integrated into their performance goals).

The staffing requirements often change and become more clearly defined as programs mature. A higher level of staffing may be necessary in the first few years of new safety program implementation because of time-intensive tasks such as program development and initial training. Once the programs are developed or revised and all initial training is completed, it is typical for a utility to reassess staffing levels based on a regular maintenance level of effort (e.g., refresher training and program support).

Figure 1-2 represents how the safety staff might be organized at a large utility with several facilities.

**Smaller utility staffing.** In smaller utilities the responsibility for managing safety may fall to a single safety manager who is supported by a training coordinator and/or administrative assistant. This can be challenging because, even though the department is smaller, many of the requirements and responsibilities are the same. A safety manager of a smaller utility is often required to not only develop the HSE program but also perform daily tasks such as inspections. Managers of small systems can find assistance from their workers' compensation insurance carrier's loss control department. OSHA also offers consulting services that small utilities can use as a source of expert advice.

**Staff qualifications.** Qualified staff is critical to safety success; therefore, when hiring and promoting safety staff, it is critical to select highly qualified individuals with the necessary training and education to fill as many safety needs as possible. If a small utility has short-term assignments or non-routine needs calling for skills and manpower in areas such as industrial hygiene and environmental management systems, outside resources can be contracted if necessary.

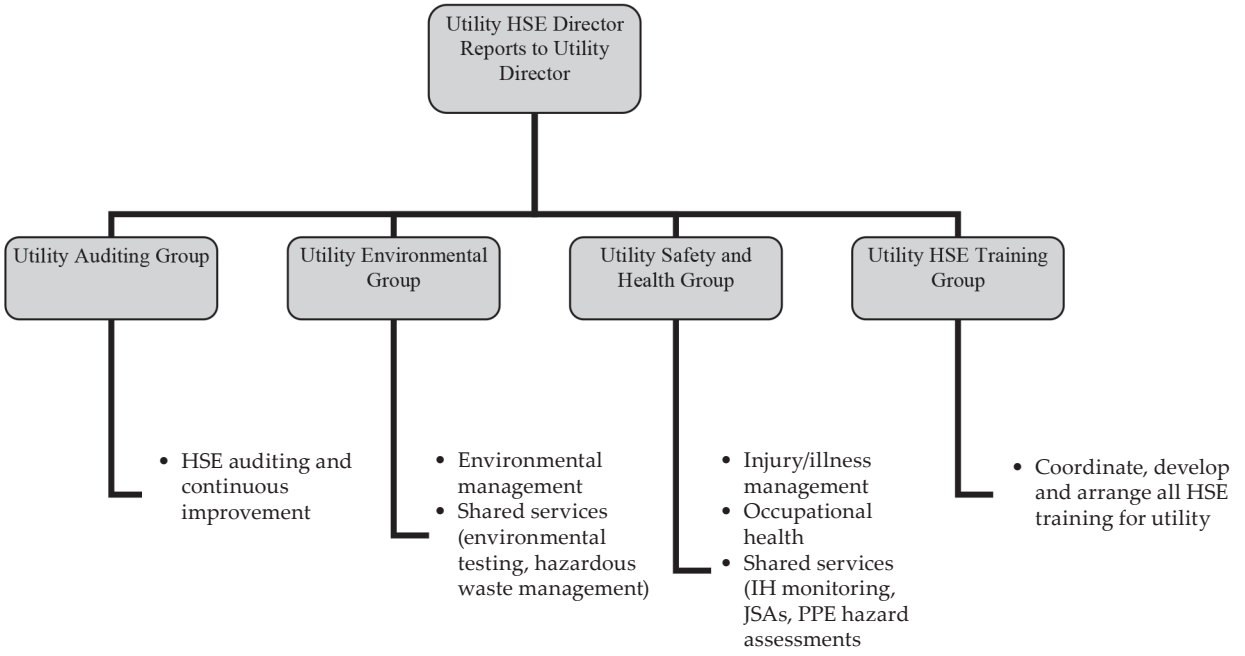


**Figure 1-2 Example of a large utility safety organization**

## ROLES AND RESPONSIBILITIES

Whether regulated by OSHA or not, some basic activities must be performed by any organization in order to provide a safe working environment for its employees, including job safety analysis, hazard prevention and control, and training. Beyond this, more detailed and administrative functions must be performed, such as:

- Injury/illness recordkeeping and reporting
- Workers compensation cases
- Injury case management
- Incident investigation
- Insurance inspections/requirements
- Employee health and safety concerns
- Union/labor safety meetings and issues

Often these responsibilities are spread across the organization (especially in smaller utilities) with no one person having overall responsibility for ensuring that these duties are completed. To ensure that all required and desired activities are being performed consistently and effectively, each utility should define the roles and responsibilities for HSE compliance. Table 1-5 provides a general distribution of HSE responsibilities that can be adapted to any organization, whether with dedicated safety staff or only production or administrative staff with dual responsibilities.

In smaller organizations with less staff, time must be spent on programs and tools that can quickly and efficiently be deployed to ensure that safety actions are completed and not continually put off in favor of seemingly more pressing production or financial demands. Regardless of the size of the organization, successful implementation of a safety program depends on each responsibility being formally assigned and effectively executed.

**Table 1-5 General utility HSE responsibilities**

| Corporate/Utility level | Regional/Divisional Level | Facility Level |
|---|---|---|
| Develop policies. | Implement policies. | Implement programs and procedures. |
| Coordinate development of utility-wide programs and procedures. | Participate in development of utility-wide programs and procedures and develop tailored procedures, if necessary. | Participate in regional/divisional HSE committees to identify needs and enhance facility HSE capabilities. |
| Track emerging laws and regulations that affect utility operations and communicate to the regions/facilities. | Implement HSE programs throughout the region/division by direct support, training, and oversight, as appropriate. | Regularly communicate HSE procedures and precautions to employees. |
| Provide shared services to the regions/facilities where it is more efficient to do so at the corporate level (e.g., training, specialty services). | Provide expert services to the facilities where it is more efficient to do so at the utility or regional level (e.g., industrial hygiene, hazmat). | Conduct regular reviews of potentially hazardous operations to verify that proper protections and procedures are used. |
| Conduct audits of regional/facility HSE compliance and assessments of program implementation efforts. | Conduct regular facility reviews to assess hazards, and identify the need for further compliance assistance. | Complete required inspections, training, and records. |

It is essential that the staff at every level make every effort to function as one team, and collaborate on procedure and program development and assist each other in implementation, training, audits, and other safety program elements.

## DEVELOPING WRITTEN PROGRAMS

The process of establishing a written health, safety, and environment program will help identify what has to be done in an organization to control hazards and promote greater health and safety awareness among employees, supervisors, and all key stakeholders including contractors, vendors, and customers. Developing a written program allows utilities to outline the policies and procedures that are necessary to achieve stated injury and illness prevention goals. Two levels of written documents will help define and guide a safety program:

1. Management programs/procedures (e.g., program improvement [audits], incident investigation, record keeping)
2. Compliance programs/procedures (e.g., lockout/tagout, hazard communication, confined-space entry)

**Management program development.** The purpose of a management program (MP) is to define the roles and responsibilities of individuals as well as the process mechanisms needed to implement and maintain an effective HSE program, resulting in a systematic, organized, and comprehensive approach to managing and achieving both regulatory compliance and excellence in health and safety performance. While the development of written programs begins within the planning activities, the written document itself needs to specifically address each of the basic elements of safety management: management leadership and employee participation, planning, implementation, evaluation, and corrective action. The following management program components are examples of the types of procedures used to plan, implement, and evaluate the safety and health program.

*HSE responsibilities.* Each organization is responsible for having in place clearly defined procedures to comply with health, safety, and environment regulations. Included within this procedure should be assigned roles and responsibilities for those individuals who are responsible for implementing and maintaining an effective health and safety program.

*Management program compliance.* The program compliance procedure can be used to ensure that all applicable regulatory requirements are encompassed in the utility's program documents by correlating the regulatory standards to the contents of the implementation programs.

*Employee participation/awareness.* This component includes methods for communicating with employees—in a manner readily understood by all affected employees—on matters relating to safety and health. This includes provisions designed to encourage employees to inform the employer of hazards or concerns at the worksite without fear of reprisal. It is also intended to ensure that employees are provided with full awareness of their rights and responsibilities under the utility programs.

*Employee training.* Training is one of the most important elements of any HSE program. It allows employees to learn their job properly, brings new ideas into the workplace, reinforces existing ideas and practices, and puts the program into action. Benefits from safety training include fewer work-related injuries and illnesses, minimizing risks to the environment, and reduced employee stress and worry caused by exposure to hazards. At a minimum, the safety training program should include all applicable regulatory mandated training for both supervisors and employees. This program may be merged with or implemented in conjunction with programs that manage and track other required training for water treatment operators.

*Injury/incident investigation and reporting.* This document contains the basic procedures and requirements for recording and reporting occupational illnesses and injuries as well as identifying the cause(s) of the accident or near-miss occurrence. In turn, this information can be used to implement corrective changes to preclude the recurrence of similar incidents.

*Program improvement (auditing).* An important part of any HSE program includes self-assessment and compliance measurements. By defining and identifying measurable performance marks and auditing against those marks, utilities are able to define specific goals and achieve continuous HSE program improvement resulting in fewer occupational injuries and illnesses.

These are some basic management procedures that should be part of any written HSE management program, and these can be expanded with additional procedures to address any topics that help those with safety responsibility understand and consistently plan, implement, and continuously improve performance. Management programs should be written in conjunction with compliance programs that ensure the observance of HSE standards.

**Compliance programs**. Compliance programs and procedures detail the procedures, practices, and instructions for the day-to-day implementation of the health and safety programs in accordance with regulatory requirements and your utility policy. These can be augmented by a safe work practices manual that serves as a quick pocket reference intended to supplement written procedures and training. The pocket manual provides guidance in the absence of any written procedure to assist employees and contractors in the safe performance of their duties. OSHA's general industry standards are broken down into several subject matter areas; some of these require written compliance programs, such as

- Bloodborne pathogens
- Confined space
- Control of hazardous energy
- Hazard communication
- Laboratory chemical hygiene

- Hearing conservation
- Respiratory protection

Other compliance areas do not require written programs but do require specific documentation. Developing formal written procedures for addressing these other issues is beneficial to ensure consistent compliance and implementation. One example of this is in personal protective equipment (PPE) where no written program is required but, under 29 CFR 1910.132 (2004), there must be a written and "certified" assessment of the workplace hazards.

**Procedure development.** People often learn, or are reminded, how to perform a task through procedures, and it is highly likely that most people will forget how to do tasks that are not repeated with frequency, hence the need for written procedures. Additionally, procedures often include checklists and forms that provide extra control and documentation to help ensure that work is performed properly and in accordance with established methods and safety precautions. Lack of procedures or a failure to follow procedures is a key root cause in many incidents and near misses both large and small.

Written procedures should not be too long or written as though only experts will be reading and using them. Here are some basic guidelines for writing effective safety procedures.

*Know your objectives.* Developing effective safety and health procedures requires a clear idea of what the procedure is to accomplish. Some objectives may be to provide a basis for discipline when safety rules are ignored, establish safe work practices for certain tasks, or to define how your organization will comply with safety regulations.

*Know your audience.* Very often safety procedures are written for safety professionals, supervisors, trainers, and other members of management who will interpret and enforce company regulations on safety and health (e.g., respiratory protection). Some procedures, however, will have an audience of employees or contractors who will follow the rules (e.g., excavation and trenching or emergency response). Understanding who will be using the procedures and in what environment can help determine what writing and layout style (e.g., significant white space and bold type for emergency situations) will best suit the audience.

*Use a consistent format.* The format used should make it easy to find a specific rule, procedure, checklist, or form when a safety or health question comes up. Consider using a standard 8 ½ in. by 11 in. page, hole-punched for insertion in a standard three-ring binder. This makes updating easy when procedures are revised. Additionally, on each procedure consider using the a consistent header, such as the one in Figure 1-3, that includes:

- Utility name or logo
- The manual name (if you have more than one manual)
- Section number (if more than one section)
- Procedure number and a brief procedure title
- Date of issue and revision number
- Page number (as "Page 1 of 3")
- Optional approval signatures/initials and dates

*Implementation matrix.* Even with concise and well-written programs and procedures, compliance is still a challenge and it can be difficult to keep up with all the requirements outlined in the procedures. Limited staffing in smaller organizations can mean that some individuals may be assigned safety compliance responsibilities in addition to other human resources, operations, or management duties. Regardless of the level of staffing, understanding all the required tasks for compliance can be overwhelming. Required actions

| **Anytown Utilities** | **SAFETY MANUAL** | |
|---|---|---|
| Number: **SP-1** | Subject: **Lockout/Tagout Program** | |
| **Page 1 of 30** | Current Issue: **Rev. 1** | Issue Date: **04 Dec 12** |
| Approved for use by: | ***I.M. Manager*** | |

**Figure 1-3 Example of a safety procedure header**

may include the one-time activities recommended to develop and implement complete safety programs as well as those recurring activities required to meet ongoing federal and state health and safety regulatory requirements.

One tool that can help manage these obligations is an HSE matrix or calendar of regular requirements that can be used by facility personnel with compliance responsibility to schedule and complete the implementation activities. This matrix should include the required initial and refresher training (see next section) and record-keeping requirements. The matrix should also include a column of key actions to achieve and maintain compliance. For recurring activities, a date can be added to track when those obligations are due.

## TRAINING AND EDUCATION

Many standards promulgated by OSHA explicitly require the employer to train employees in the safety and health aspects of their jobs. Other OSHA standards make it the employer's responsibility to limit certain job assignments to employees who are "certified," "competent," or "qualified"—meaning that they have had special previous training, in or out of the workplace. Designated personnel are selected or assigned by the employer or the employer's representative as being qualified to perform specific duties. These requirements reflect OSHA's belief that training is an essential part of every employer's HSE program for protecting workers from injuries and illnesses. Many researchers conclude that those who are new on the job have a higher rate of accidents and injuries than more experienced workers. Increasing knowledge of specific job hazards and proper work practices to lower injury rates is the primary goal of training employees. Training in the proper performance of a job is time and money well spent, and utilities should regard it as an investment rather than an expense. An effective program of health and safety training for workers can result in fewer injuries and illnesses, better morale, and lower insurance premiums, among other benefits. OSHA Publication 2254 (1998) provides the following key steps for developing an effective training program:

- Determine if training is needed
- Identify training needs
- Identify goals and objectives
- Develop learning activities
- Conduct the training
- Evaluate program effectiveness
- Improve the program

### Tracking Training

Each employee's training requirements will be commensurate with the hazards the individual may be exposed to in work assignments. The training modules should be developed and training should be assigned based on job assignments (e.g., confined space entrant for someone required to enter a tank) or workgroup (e.g., all operators or all emergency response team members). In any case a simple spreadsheet or matrix similar to that shown in Table 1-6 can be used to document required training.

### Training Documentation

All training needs to be documented. The best training records involve a package of information, including

- The date of the training
- The instructor or presenter
- The content of the training (include slides, handouts, or agenda)
- The training method (e.g., classroom, on the job, tailgate)
- A sign-in sheet of attendees with signature or initials required
- If applicable, the means used to verify the training was understood (e.g., test scores)

These records can provide evidence of good faith and compliance with OSHA standards and support audits of the program. It can also help answer one of the first questions an accident investigator will ask: "Was the injured employee trained to do the job?"

## RECORD KEEPING AND REPORTING

Accurate and consistent record keeping is a key factor in compliance and excellence. Therefore maintaining up-to-date documentation and records is critical for complying

**Table 1-6 Tracking of training**

| | | Personnel Required to Take Course | | |
|---|---|---|---|---|
| Course/Module | Frequency | Operations | Maintenance | Office/Admin |
| Lockout/tagout (LO/TO) | Initial | ✓ | ✓ | |
| LO/TO refresher | As required* | ✓ | ✓ | |
| Hot work | Initial | | ✓ | |
| Hazard communication | Annual | ✓ | ✓ | ✓ |

* OSHA regulations require retraining in certain situations (e.g., unsafe work practices or change in equipment).

with specific regulatory requirements, where required (e.g., OSHA 300 logs), but also for ensuring that the safety management program can be adequately understood, effectively evaluated, efficiently operated, and systematically improved. As part of the management system procedures discussed above, it is helpful to establish, implement, and maintain a procedure(s) for the identification, storage, protection, retrieval, retention, and disposal of records. This procedure can help ensure that all required records and reports of occupational illnesses and injuries are maintained in accordance with regulatory requirements (e.g., OSHA 29 CFR 1904). Another purpose of this procedure is to prevent recurrences of occupational injuries and illnesses by documenting and investigating major incidents, identifying root causes, and taking corrective actions. Incident investigation helps to identify hazardous areas and work assignments, systemic or repetitive patterns, and improvements that will reduce the overall injury and illness rate.

This procedure should include necessary and useful record-keeping forms or links to forms (OSHA and/or state equivalent forms), such as:

- Log of Work-Related Injuries and Illnesses (OSHA 300)
- Summary of Work-Related Injuries and Illnesses (OSHA 300A)
- Injury and Illness Incident Report (OSHA 301)
- Utility Incident Investigation Report (IIR) (unless a separate IIR procedure exists)
- Instructions for Recording and Reporting Injuries and Illnesses

Another helpful record-keeping tool is a summary of incident action items to aid in completing the correct records for specific incidents. Table 1-7 provides an example of a table that can be customized to meet specific utility policies as well as federal and state requirements for record keeping and reporting. This table includes some regulatory requirements, such as reporting to OSHA on fatalities, but it can be modified to meet individual expectations with regard to reporting.

Ultimately, the data you record need be uniform and accurate to assure the consistency and validity of the statistical data reported to OSHA. Accurate records are used for many purposes, including audits, performance measurement, program improvement, and resource allocation to critical operations. This information can also help utilities analyze their health, safety, and environment and make improvements where necessary.

## EVALUATION, CORRECTIVE ACTION, METRICS, AND CONTINUOUS IMPROVEMENT

One of the primary goals of any performance improvement program is to ensure that the organization is in full regulatory compliance with existing applicable federal, state, and local HSE regulations. A secondary objective is to use performance improvement processes, such as audits, as an opportunity to informally train personnel in compliance requirements and procedures and to raise awareness regarding utility HSE goals. Ultimately, a performance improvement program should be more broadly focused than just maintaining strict compliance; it should also include determining whether the established policies and procedures have been properly implemented and maintained, assessing measures to promote HSE excellence, identifying underlying root causes of HSE noncompliance incidents, and conducting evaluations of HSE management systems.

**Table 1-7 Example table of incident action items, record keeping, and reporting**

| Severity | Incident Threshold | OSHA 300 Report | Incident Investigation Report (IIR) | Internal Notification | Report to OSHA within 8 hours |
|---|---|---|---|---|---|
| **Major** | Fatality of an employee or third party on utility premises, in a utility vehicle, or on utility business | Yes | Yes | Yes | Yes |
| | Hospital admission of three or more employees | Yes | Yes | Yes | Yes |
| | Hospital admission >24 hours of any employee | Yes | Yes | Yes | No |
| **Moderate** | Days away from work (lost work day case) | Yes | No | Yes | No |
| | Medical treatment | Yes | No | Yes | No |
| **Minor** | First aid case | No | No | Yes | No |
| | Minor property damage/ downtime resulting in < $10,000 damages | No | No | Yes | No |
| | Near miss | No | No | Yes | No |

Measuring and monitoring are key elements of any safety program. Measuring and monitoring are used to determine whether the program is working as designed, any deficiencies are corrected, and opportunities for improvement are rolled back into the program.

Among other methods, ANSI Z10 lists the following methods to monitor, evaluate, and control hazards:

- Workplace inspections and testing
- Exposure assessment
- Injury, illness, and incident tracking
- Employee input
- Occupational health assessments

The organization can use these measures to identify and correct problems and identify opportunities for risk reduction before injuries or illnesses occur.

Other main components of the continuous improvement and feedback process are

- Incident investigation
- Audits

- Corrective and preventative action
- Feedback to the planning process

**Incident investigation.** Incidents and even near-misses can be indicators of potential problems and as such should be thoroughly investigated to determine root causes and identify corrective actions.

**Audits.** Audits of both the management system and regulatory compliance are valuable and a necessary part of the safety program. The system audit should determine if the management system procedures and their implementation are effective in managing the program. Compliance audits and inspections should outline appropriate corrective and preventive action activities as well as identify areas for feedback to the planning process for improving the management system. When possible, audits should be conducted by individuals independent of the activities being examined. This does not necessarily mean individuals external to the organization, but the auditors should be independent of the activities being evaluated.

**Corrective and preventive action.** As part of its safety management system, each utility should establish and implement procedures for identifying and investigating non-compliance issues, developing effective corrective and preventive actions, and tracking actions to closure. An effective procedure of this nature should include, at a minimum, the following elements:

- A method to address and investigate potential or actual non-compliance or safety issues
- A system to assign responsibility and provide resources to initiate and complete corrective or preventive actions
- A process to prioritize corrective or preventive actions based on the significance of risk and include deadlines for completion
- A process to track corrective actions to closure and communicate status to leadership and affected personnel
- A quality assurance process to confirm that corrective or preventive actions are adequate and appropriate to address the non-conformance
- A method to follow up on completed corrective actions to confirm that the intended results were achieved

**Feedback to planning.** As described in ANSI Z10, the findings and lessons arising from all the evaluation and corrective action activities must become part of the information that feeds back to the employee participation process, ongoing planning process, and management review. This information is used to help determine the underlying causes and other factors contributing to system or risk control failures, and hence is used to establish revised objectives and implementation plans. This feedback loop is an essential component of the continual improvement process.

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Chapter 2

# Job Safety Analysis

*Jerry Criscito*

Workers are injured or killed at workplaces across North America every day. Accidents can mean both human loss and financial loss to the employer and the employee. How can these losses be minimized? The best way to prevent losses caused by accidents and occupational illness is to develop a solid, working program for accident prevention. Systematically looking at workplace operations, establishing proper job procedures, and ensuring all employees are properly trained can help prevent workplace injuries and illnesses.

As a part of an effective Health, Safety, and Environment (HSE) program, a Job Safety Analysis (JSA) has proved to be an effective accident and occupational illness prevention tool in many industries. The JSA, also known as a Job Hazard Analysis (JHA), is a safety management tool in which the risks or hazards of a specific job in the workplace are identified and measures to eliminate or control those hazards are determined and implemented. Most safety programs are considered reactive, an action in response to an incident. A JSA is considered a proactive approach to workplace safety. A JSA is a process of systematically evaluating certain jobs, identifying the hazards or potential hazard associated with each step of the job, and finding effective control measures to eliminate or reduce the risk of hazards and make the workplace as safe as possible, before those hazards have a chance to become accidents.

The Occupational Safety and Health Administration (OSHA) defines a JSA as a means of "carefully studying and recording each step of a job, identifying existing or potential job hazards and determining the best way to perform the job to reduce or eliminate these hazards."

JSAs are a valuable tool for water utilities that have a commitment to reduce and prevent accidents and illnesses on the job. Developing and implementing safe job procedures, and training employees to work properly to prevent accidents, are actions that are likely to result in fewer worker injuries and illnesses, reduced workers' legal claims, more-effective work methods, and increased productivity.

JSAs play an important role in effectively managing HSE programs. This chapter provides a guideline for how JSAs can be used, prepared, and implemented. Key terms for understanding the function of a JSA are as follows:

A *hazard* is a potential for harm. If left uncontrolled, a hazard could result in injury or harm. A hazard can be a physical object, chemical, noise, radiation, extreme heat or cold, electrical energy, or anything else that has the potential to cause harm.

An *accident* is an unintended occurrence that may result in injury, loss, or damage. As soon as people are involved, a hazard may cause an accident. Someone slipping in an oil spill would be an accident.

An *injury* is the result of an accident. A sprained wrist or broken arm from a fall would be an injury.

A hammer balanced on a windowsill is a hazard. Knocking the hammer off the sill is an accident. The hammer striking someone and causing a cut or laceration is an injury.

## ADVANTAGES OF A JSA

The JSA is used to determine physical, procedural, and/or environmental hazards that do or could exist. JSAs also identify actions of personnel that could result in accidents or injuries and preventive measures that would eliminate or control hazards so a job can be performed safely.

The JSA not only helps supervisors and employees become aware of hazards on the job; it also has many other uses as well. A JSA may be used

- To determine specific training or skill development an employee should receive
- As a basis for inspection
- As an informational tool for accident investigations
- As part of a continuing communication program on employee health and safety awareness

A JSA is especially helpful as a training tool, because this tool provides an organized system for training both new and existing employees. Once a JSA has been prepared for a specific job, training new employees on that job will become more consistent. The entire job procedure does not have to be redeveloped every time an employee is to be trained or retrained. With a thorough JSA as a guide, all the steps of the process are identified and won't be overlooked during the training. The JSA also provides a basis for documentation of ongoing employee safety training. Training sessions with workers can be periodically conducted using the JSA to reinforce how to safely conduct a job.

A JSA can be of great value to the person investigating an accident. By reviewing the process and understanding the hazard, controls, job steps, and safe practices that have already been defined and implemented, accident investigators can gain valuable insight leading to a better accident investigation. The actions of the employee can be compared to the recommended job actions in the JSA to determine if the employee was performing the job properly. The investigator should also consider whether the JSA itself was correct and if any possible hazards are missing from the JSA that might have led to the accident in question.

JSAs may also help supervisors learn about the various jobs their workers perform. If the supervisors have not actually performed a specific job themselves, the JSA can guide them through process of that job. Because the JSA identifies what is involved in each job, step by step, the supervisor can learn in detail about each of the individual jobs they supervise.

## JSA DEVELOPMENT

All jobs in an organization have common elements. They all require people performing at their best level of productivity, producing goods and services in a safe and efficient manner. Helping do that is what the JSA is all about.

Often, employers, foremen, supervisors, and safety professionals conduct JSAs that are subsequently reviewed by workers who perform the job. At other times, workers may discover a task on the job site that does not have a written JSA, and may conduct their own JSA on the job site before beginning the task. This worker-produced JSA should be documented for review by the safety manager and the supervisor.

### Preparing for a JSA

- Review company accident history. Review with employees the worksite's history of accidents, losses that required repair or replacement, and any "near misses"—events in which an accident or loss did not occur, but could have. These events are indicators that the existing hazard controls (if any) may not be adequate and deserve more examination.
- Involve company employees. Involving employees in the initial job hazard ranking of all jobs that are being considered for having JSAs completed on them, and the development and review of JSAs, creates buy-in and provides the whole-picture view. The people who do a job have a unique understanding of the realities of the job, and this knowledge is invaluable for identifying hazards as well as effective and workable control measures. Involving employees helps minimize oversights, ensures a quality analysis, and gets workers to buy in to the solutions because they will share ownership in their HSE program.
- Conduct a preliminary job review. Discuss with employees the hazards they know exist in their current work and surroundings. Brainstorm with them for ideas to eliminate or control those hazards. If any hazards exist that pose an immediate danger to the workers' life or health, take immediate action to protect the workers.
- Any problems that can be corrected easily should be corrected as soon as possible. Do not wait to complete a JSA before correcting serious hazards. This will demonstrate a commitment to safety and health and clear the way for identifying all hazards that present unacceptable risks and evaluating types of hazard controls.

Development of a JSA is not a one-time activity, it's a process. JSAs need to be developed properly with solid input from those familiar with the job in question, identified control measures must be agreed upon and implemented effectively, and affected workers and supervisors must be trained on the information contain in the JSA.

Additionally, JSAs should be seen as living documents. Keeping JSAs up to date may sound like a lot of extra work, but changes are not needed frequently. A company's safety program should have a system for regularly reviewing and updating JSAs. If a situation, a job environment, or anything else changes, the change must be reflected on the JSA as quickly as possible. If the JSA is changed or revised, everyone concerned with the job should be informed of the changes and instructed in the new procedure.

When should supervisors review a JSA for possible updating? A JSA should be reviewed when an accident occurs on a job covered by the document. In this case, review the JSA to decide whether it needs revision. Check the JSA to see if the accident occurred because the JSA was not followed, or if the accident occurred because something was basically wrong with the job procedure or the analysis, or if a hazard existed that had not previously been recognized or eliminated.

When conditions change, such as job requirements, site conditions, manpower, or equipment operations, it is important to stop and reanalyze the job for potential new hazards created by these changes. New controlling measures should be put in place to eliminate or minimize the new hazard. If new controls cannot be implemented to reduce the hazard to an acceptable risk level, new engineering and administrative controls may need to be devised by job supervisors before work is resumed.

## Writing the JSA: Three Basic Steps

There are three basic steps in writing the JSA:

1. Each job is broken down into a sequence of steps. Each step describes the actions of the job as that job is performed.
2. Each step is examined to identify and define hazards, i.e., actions, conditions, possibilities, that could lead to an accident.
3. Recommended actions or procedures are determined for each hazard. The JSA becomes a guideline for what actions are necessary to eliminate or minimize the hazards that could lead to an accident or injury.

**Step 1: List job tasks.** Nearly every job can be broken down into job tasks or steps. Outline those sequential steps that it takes to carry out the job. Begin a job safety analysis by watching the employee perform the job and listing each step as it is performed (Figure 2-1). Be sure to record enough information to describe each action without getting overly detailed. Avoid breaking down the steps in such detail that it becomes unnecessarily long or so broad that it does not include basic steps. It may be valuable to get input from other workers who have performed the same job. Later, review the job steps with the employee to ensure everything significant is included.

**Figure 2-1 List job tasks**

Point out that the analysis is done to understand the sequence of steps that it takes to conduct the job and is not an evaluation of the employee's job performance. Include the employee in all phases of the analysis—from reviewing the job steps and procedures to discussing uncontrolled hazards and recommended solutions. Be sure to document the findings in order to create a written record of the JSA.

Sometimes it may be helpful to photograph or videotape the worker performing the job or to photograph the work equipment and work environment. These visual records can be handy references when doing a more detailed analysis of the work. Management and workers may also find it useful to assign a probability and severity ranking to each hazard in the job, noting how likely or probable it is that the hazard will occur, and the severity of the consequences should it occur.

**Step 2: Look for hazards.** Once the basic steps of the job have been recorded, the next step is to identify the potential hazards associated with each step. Consider talking with employees who have performed the job for several years, as they usually have a wealth of information and will be able to describe injuries or near misses they have had conducting the job, or injuries coworkers have experienced.

Don't just look for obvious hazards like a pallet leaning against the wall in an aisle. Look at the total environment. Some potential hazards are not obvious. Always consider the possibility of debris or other obstructions in aisles even if nothing is there at the time the JSA is developed. In order to consider the entire work environment, ask the following questions:

- What can go wrong?
- What are the consequences?
- How could the hazard arise?
- What are other contributing factors?
- How likely is it that the hazard will occur?

Document the answers to these questions in a consistent manner. Describing a hazard in this way helps ensure that efforts to eliminate the hazard and implement hazard controls target the most important contributors to the hazard. Probe for details regarding the job steps and the work involved in doing the job: How often does the job need to be done (e.g., daily, weekly, annually)? How often is each step of the job carried out (e.g., per shift, per hour)? How heavy is equipment that is lifted, pushed, or pulled?

Good hazard scenarios describe

- Where it is happening (environment)
- To whom or what it is happening (exposure)
- What precipitates the hazard (trigger)
- The outcome that would occur should it happen (consequence)
- Any other contributing factors

The purpose of the JSA is to identify *all* hazards—both those produced by the environment or workplace conditions and those connected with the job procedure. Examine each step carefully from both perspectives to find and identify hazards (Table 2-1).

Practical questions to ask that will help identify potential hazards include these:

- Can any body part get caught in or between two objects?
- Do tools, machines, or equipment present any hazards?
- Can the worker make harmful contact with moving objects?
- Can the worker slip, trip, or fall?

**Table 2-1 Types of hazards to consider when conducting a JSA**

| Chemical | Biological | Ergonomic | Physical |
|---|---|---|---|
| Inhalation | Bloodborne pathogens | Awkward positions | Caught in/on/ between; pinch points |
| Skin contact | Building-related illness | Contact stress | Electrical |
| Absorption | Legionnaires' disease | Forceful exertions | Fire or explosion |
| Injection | Mold | Repetition | Noise |
| Ingestion | Plant and insect poisons | Vibration | Radiation |
| | Tuberculosis (TB) | Work area design | Thermal stress |
| | Wastewater | | Slips and falls_ |
| | | | Striking against |
| | | | Struck by |

- Can the worker suffer strain from lifting, pushing, or pulling?
- Is the worker exposed to extreme heat or cold?
- Is excessive noise or vibration a problem?
- Is there a danger from falling objects?
- Is excessive brightness or poor visibility a problem?
- Can weather conditions affect safety?
- Is harmful radiation a possibility?
- Can contact be made with hot, toxic, or caustic substances?
- Are there dust particles, fumes, mists, or vapors in the air?
- Can the worker make plant, insect, or animal contact?
- Can any foreign object contact the eyes?

A material safety data sheet (MSDS) is a good resource for assessing chemical hazards. An MSDS is a written document that outlines information and procedures for handling and working with chemicals. MSDS documents contain physical and chemical property information, potential hazard information, emergency procedures, and manufacturer contact information.

Recent changes to the OSHA Hazard Communication Standard require that MSDS transition to safety data sheets (SDS). The difference is that an SDS is constructed and formatted to conform to the globally harmonized system (GHS), which mandates all SDSs have 16 standardized sections arranged in a strict order. Manufacturers are required to produce the MSDS/SDS and, along with distributors, are required to provide them to purchasers of their products.

**Step 3: Recommended controls and actions.** Once the basic steps of the job and potential hazards associated with each step have been recorded, the final step in conducting the JSA is to determine ways to eliminate or control the identified hazards. A control measure is anything that will help to control the hazard by either preventing it from occurring or minimizing its impact if it does occur. If a hazard cannot be eliminated, steps should be taken so the consequences of the hazard are as low as reasonably practical in order to protect workers and the public.

When evaluating options for corrective measures, consider the hierarchy of controls:

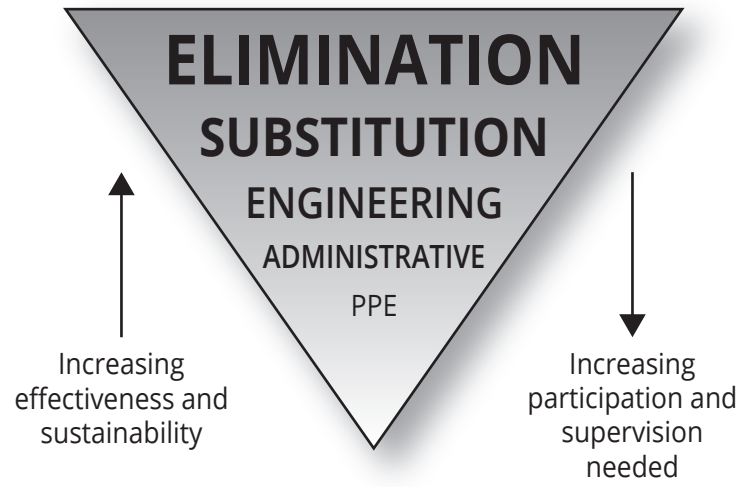
- Elimination
- Substitution
- Engineering
- Administrative
- Personal protective equipment

As shown in Figure 2-2, progressing down the hierarchy results in reduced effectiveness. According to the Centers for Disease Control and Prevention, which developed the hierarchy, "The idea behind this hierarchy is that the control methods at the top of the list are potentially more effective and protective than those at the bottom. Following the hierarchy normally leads to the implementation of inherently safer systems, ones where the risk of illness or injury has been substantially reduced" (CDC 2010).

Elimination of the hazard altogether is the most effective control measure to reduce risk. By adopting the Planning through Design (PtD) methodology described in chapter 4, many hazards can be eliminated or designed out of a system. For example, human interaction with potentially hazardous machinery or equipment can be reduced by automating certain processes. Similarly, the design team or operations and maintenance (O&M) staff can opt for an appropriate material or process substitution that is less hazardous. It's important to equally assess the substituted material or process for any risks it may pose.

Where elimination or substitution controls are not practical, the next strategy is to control the hazard at its source. Engineered controls do this, unlike controls that generally focus on the employee exposure to the hazard. The basic concept behind engineered controls is that, to the extent feasible, the work environment and the job itself are designed to eliminate hazards or reduce exposure to hazards. Engineered controls can be simple in some cases. They are based on the following principles:

- If feasible, design the facility, equipment, or process to remove the hazard or substitute something that is not hazardous.




*Centers for Disease Control and Prevention.*

**Figure 2-2 Hierarchy of controls. Apply the highest level of control commensurate with the risk level.**

- If removal is not feasible, enclose the hazard to prevent exposure during normal operations.
- Where an enclosure is not feasible, establish barriers or local ventilation to reduce exposure to the hazard during normal operations.

If engineered controls are not feasible, administrative controls should be considered. Administrative controls include safe work practices, such as the utility's general workplace rules, standard operating procedures, or other operation-specific regulations. For example, even when a hazard is enclosed, exposure can occur during maintenance of the enclosed equipment. Through established safe work practices that incorporate additional protective measures when conducting maintenance operations, employee exposure to hazards can be further reduced. Administrative control measures also include additional relief workers, exercise breaks, and rotation of workers. These types of control are normally used in conjunction with other controls that more directly prevent or control exposure to the hazard.

When exposure to hazards cannot be engineered out of normal operations or maintenance work, and when safer work practices and other forms of administrative controls cannot provide sufficient additional protection, a supplementary method of control is the use of protective clothing or equipment. This is collectively called personal protective equipment (PPE).

While PPE (Figure 2-3) seems to be the most common form of protection and in some cases is mandated by law, it should be considered a last line of protection and always used in conjunction with engineered and administrative controls. PPE may also be appropriate for controlling hazards while engineered and work practice controls are being installed.

Note that one of the major weaknesses of PPE is the inconsistency of its effectiveness. This is primarily due to improper fit and application, both of which can be hard to monitor on a routine basis.

As with Steps 1 and 2, document all the specific steps that need be done to correct or mitigate the identified hazards. Specify exactly what is to be done to correct the hazard, then take action to make those corrections. Using the JSA as a roadmap, follow through regularly to ensure that precautions are in place and new procedures are being followed. If new techniques for doing a job are required, provide training to affected employees.

**Figure 2-3 Personal protective equipment**

The JSA can also be an effective means of uncovering health hazards in a job operation. The job could be contributing to a medical problem that otherwise might not become known for a long time. Examples are things like deterioration of the lower back, loss of hearing or loss of sight, chemical overexposure, or some other occupational disease.

These health problems are not visible or as dramatic as accidents because they usually don't happen all of a sudden. Nevertheless, they are extremely costly to the company and are a serious detriment to employee health. Many health hazards have to be assessed through measurements conducted by an industrial hygienist or other qualified individual. If a potential health hazard exists, it's important to determine the actual situation so appropriate steps can be taken to eliminate or control the hazard.

## Challenges

Significant pitfalls are possible in developing JSAs that could result in a safety program being less effective than it might otherwise be. Common pitfalls include

- Not listing all hazards
- Listing hazards but taking no action
- Listing nonspecific action and recommendations
- Failing to involve all levels of staff
- Failing to update JSAs when changes occur
- Failing to train and retrain staff on JSAs

It may be impractical to develop JSAs for the hundreds or thousands of maintenance jobs that may exist in any given plant or field operations. At a minimum, JSAs should be done for

- Repetitive maintenance jobs such as changing a crane cable
- Basic tool and equipment usage jobs such as using a cutting torch
- Infrequently performed maintenance jobs that are extremely hazardous or have a history of accidents

## The JSA: An Important Safety Factor

If adopted effectively, JSAs can be valuable tools to help to reduce accidents and occupational illnesses and to increase operational efficiency. They often result in cost reductions, may lead staff to find a better way to do a job, and serve to document employee training. They are an important tool in the overall safety program.

Measurement of past incidents, successes, and failures happens after the fact and is considered a "lagging" indicator. Measurement of future performance or commitment to tangible goals is considered a "leading indicator." Performing a JSA can help workers and management identify potential hazards before they occur, and implement corrections to minimize the risks. Setting tangible goals to perform safety analyses of all jobs, or to correct hazards so that they reach a specific minimal level of risk, are examples of using leading indicators to drive a safety program, as opposed to lagging indicators, which measure past performance.

These items can be found in the electronic resources that are offered as part of this manual available at www.awwa.org/M3:

- Instructions for completing a Job Safety Analysis form
- Example of a completed Job Safety Analysis
- Job Safety Analysis – blank form
- Example of a job description and physical requirements for a conservation coordinator

- Example of a job description and physical requirements for waterworks operator field crew
- Hazard action list – blank form

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Chapter 3

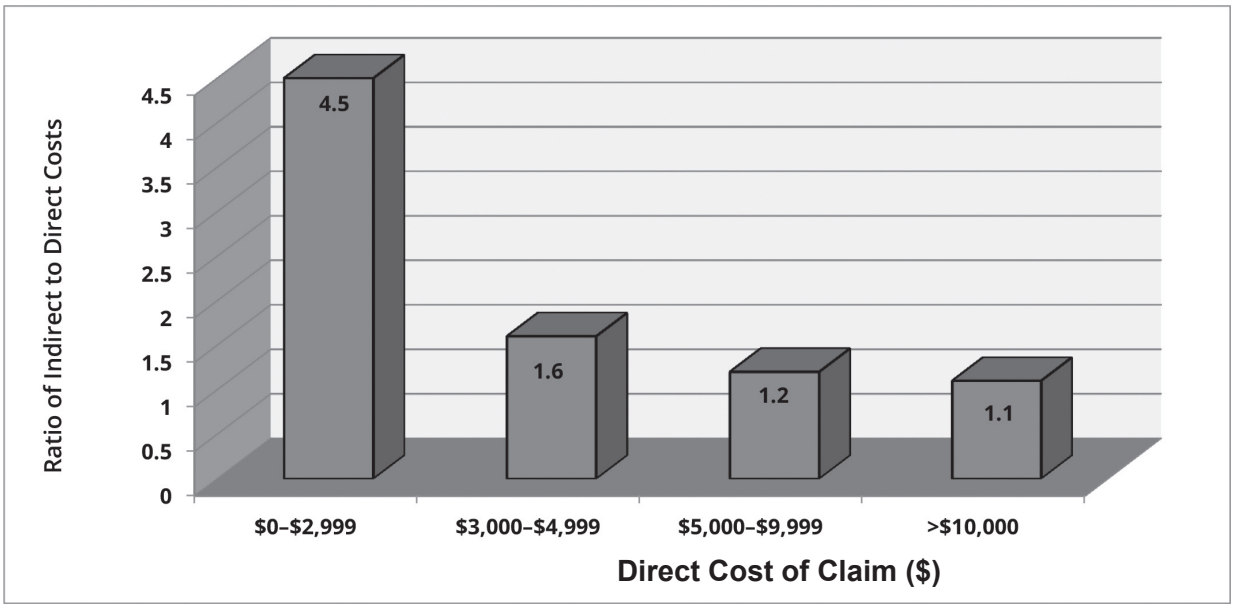
# Accident Management

*Mike Jacobs*

Even after the most thorough Job Safety Analysis (JSA), accidents can still happen. The repercussions of any accident can affect a utility's financial stability. According to the Occupational Safety and Health Administration (OSHA), US employers pay an estimated $1 billion per week in direct workers' compensation costs alone. This does not include the sometimes immeasurable indirect costs of accidents. These indirect costs include lost productivity, training replacement employees, accident investigation, and low employee morale, to name a few. As shown in Figure 3-1, OSHA has historically used the results of a 1981 Stanford University study that found the indirect costs of accidents on the job can range from 1.1 (for the most severe injuries) to 4.5 (for the least severe injuries) times the direct costs, which include medical expenses and insurance premiums for workers' compensation benefits, liability, and property losses. According to OSHA, "the lower the direct costs of an accident, the higher the ratio of indirect to direct costs" (US Department of Labor 2013).

## ACCIDENT MANAGEMENT PROGRAMS

In addition to JSAs, formal accident management programs are invaluable components of any comprehensive health, safety, and environment (HSE) program. Accident management serves to reduce costs of future accidents by analyzing and improving upon utility processes. A Water Research Foundation (WRF) project, *Water Utility Safety and Health: Review of Best Practices* (Borowski and Adams 2010), found that "one of the most significant




*Source: Business Roundtable 1982.*

**Figure 3-1 Ratio of indirect to direct costs of on-the-job accidents**

opportunities [in the water industry] for improving safety and health performance is to conduct thorough accident investigations and to manage the return to work process for the injured workers." From initial emergency response and reporting to effective return-to-work (RTW) programs and record keeping, this chapter will outline practices that will help develop an efficient injury and illness management process.

## Accident Response

**Initial medical attention.** A utility must be prepared to respond quickly and efficiently to any injury. The first priority at the scene of an accident is to ensure that the area is safe for the injured employee and the responders, and that the injured employee receives adequate medical attention. Employees should be assisted with obtaining, or instructed to seek or provide, medical attention as needed before doing anything else.

To facilitate a quick response, a utility should have readily available first aid kits and facilities that are appropriate to the employees' potential exposure to injury in any given area of the facility (e.g., eye wash in the laboratory). Employees who may need to provide immediate care (e.g., distribution or plant operators) should be trained in first aid/cardiopulmonary resuscitation (CPR) and safe handling of bloodborne pathogens. In some cases this training is required (e.g., a confined-space attendant) and a utility should check local regulations. A review of completed Job Safety Analyses can help determine which employees should be trained in first aid/CPR; the number of employees per shift or per work area that are to be trained should also be outlined in the HSE program. All employees should be trained in how to contact emergency medical services. If emergency services cannot respond in a reasonable amount of time, a utility may need to establish an in-house emergency response team with specialized training in immediate medical care.

For injuries that do not need immediate care but do require medical attention, utilities should consider contracting with an occupational health provider (OHP). This will

ensure that employees are seen in a timely manner by an occupational health doctor who is specially trained to deal with occupational injuries and illnesses. By establishing a relationship with an OHP, a utility also ensures that the treating physicians are familiar with the types of work being performed at the utility, as well as the utility's workers' compensation insurer's requirements and return-to-work program.

## Accident Reporting

All accidents should be reported as soon as possible so each accident can be investigated thoroughly—before evidence is altered or destroyed—and causes corrected. Initial reports also provide documentation for accidents that were initially thought to require on-the-scene first aid only, but later require medical attention and reporting under workers' compensation requirements and/or must be logged for OSHA or another regulatory agency. Once an injury or illness is reported, the response will help determine the ongoing well-being of the employee and the ultimate cost of the claim.

Supervisors are typically responsible for investigating accidents and should be trained in post-accident response, even if the utility rarely has work-related injuries. An infrequent claim history makes it more likely that employees and supervisors will not know what to do in the event of an injury. They may inadvertently make a decision that could adversely impact the well-being of the employee and the length or cost of the claim. It is the responsibility of utility management to establish an accident-response program that clearly defines the roles and responsibilities of employees, supervisors, and any other staff that may be involved in the reporting and investigation process. A strong accident reporting and response program identifies, probes, and documents all aspects of an accident scene and the events that led to the accident.

After the appropriate medical attention is provided, accidents should be reported to the employee's immediate supervisor. The supervisor should then complete an injury report form that documents the initial findings. The form used for initially reporting an injury should be simple but informative. The form should include the who, what, when, and where, and how (i.e., it is not only important to know if personal protective equipment was being used, but also *how* was it being used) of the incident. A complete injury report will include the answers to the following questions:

1. What exact job was the injured employee doing? (e.g., Employee was loading water pump onto truck.)
2. What tools, materials, or equipment were being used to accomplish the work assignment?
3. What specific action caused the accident? (e.g., Employee slipped and water pump hit his side.)
4. What action did the employee do or not do that caused the injury? (e.g., Employee was not using hand crane to load the pump.)
5. What safety protection devices were provided? Were they being used?
6. What, if any, unsafe conditions or defects in equipment, materials, or tools were there at the job site where the accident occurred?
7. What, if anything, was wrong with work methods employed or other acts that caused the accident? (e.g., The hand crane is provided to load and unload heavy items from the truck. Employee was in a hurry and did not use the crane.)
8. What safeguards were being used (or not) and what safeguards should have been used?

9. What steps will be taken to prevent similar injuries? (e.g., Accident was discussed with crew at weekly safety tailgate meeting.)
10. What else should be done to prevent recurrence? (e.g., Foreman or helper should check loading and unloading of equipment to ensure that safe procedures are followed.)
11. Were there any witnesses to the accident or the events leading up to it?

Some utilities may have other staff, such as a safety, risk, or human resource specialist, who can assist with the gathering of information and completion of the accident report.

If the accident results in a serious injury that requires medical attention, a report will typically need to be filed with the utility's workers' compensation insurer. Regulatory agencies (e.g., OSHA) also have reporting requirements.

## Investigation and Documentation

A thorough investigation following an accident provides an excellent opportunity for the utility to demonstrate that it values its employees' well-being and is interested in preventing future injuries. Findings from the investigation should be used to reinforce good safety practices, develop control methods, eliminate hazards, and develop training. A properly implemented accident investigation process will promote continuous improvement and can reduce the recurrence of injuries and cost of claims.

As stated above, the investigation should begin immediately after an accident occurs. The injured employee's supervisor is typically the most familiar with the work being done and the work area; the supervisor should initiate the investigation and ensure that important evidence is not moved, lost, taken, or destroyed. The site investigation should establish how the accident was work-related and document information that cannot be preserved but will be needed to complete a formal accident report. The investigation should also include photographing the work area and equipment involved as well as interviewing witnesses.

If the injury is minor (i.e., first aid only) and the cause is clear, the supervisor may be able to complete the investigation and report the findings quickly, with no need to contact outside authorities. If the injury is serious (i.e., requires medical attention) and/or the cause is unclear, a more thorough investigation will be needed. This investigation may involve employees, safety committee members, management staff, engineers, safety professionals, and insurance representatives. The site investigation should establish surface causes of the accident. Guidelines for conducting this investigation include the following:

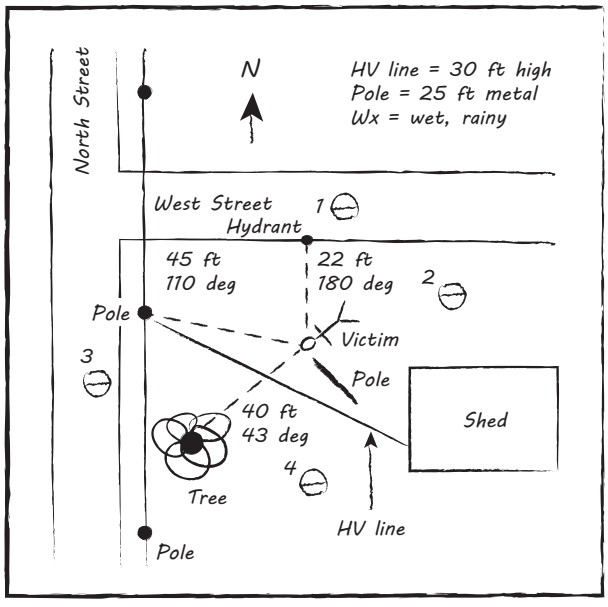
- Record the time of day, location, and type of work being done at the scene.
- Use all of your senses and take note of your initial observations:
    - What is the condition of the equipment, tools, and other materials involved in the accident?
    - Are there skid marks, spills, stains?
    - Is there anything that seems irregular or out of place?
    - What are the weather conditions?
    - Is there excessive noise, light, or other distractions?
    - Who is on scene?
- Take photos. Some important points to remember:
    - Take photos at different angles.
    - Be sure to capture the entire scene and all equipment and witnesses.

- Take notes on each photo. Identify the type of photo, date, time, location, subject, weather conditions, measurements, etc.
- Place an item of known dimensions in the photo if hard-to-measure subjects are being photographed.
- Identify the person taking the photos.

- If possible, videotape the scene. Video recordings can provide detail that photos may not be able to capture.
- Take statements from witnesses and ask them to explain how the accident happened. Also, have them describe anything that was moved or otherwise disturbed before the investigation began.

Measure distances and positions of anything and everything you believe to be of any value to the investigation and make a diagram of the accident scene. Be precise when making diagram and make sure measurements are tied to permanent points. Other information that should be included on the diagram includes direction (N, S, E, W) and where people were located when the accident occurred.

The diagram in Figure 3-2 illustrates the triangulation method, which makes it possible to later pinpoint the exact location of an object. In this accident, the victim contacted a high-voltage line with a metal tree-trimming pole. The position of the victim's head is measured from three points. Notice the small circles with horizontal lines through them. These circles indicate where photos were taken. Also, directional north is indicated and all major objects are identified.




*Adapted from Oregon OSHA Online Course 1110. Used with permission.*

**Figure 3-2 Triangulation method**

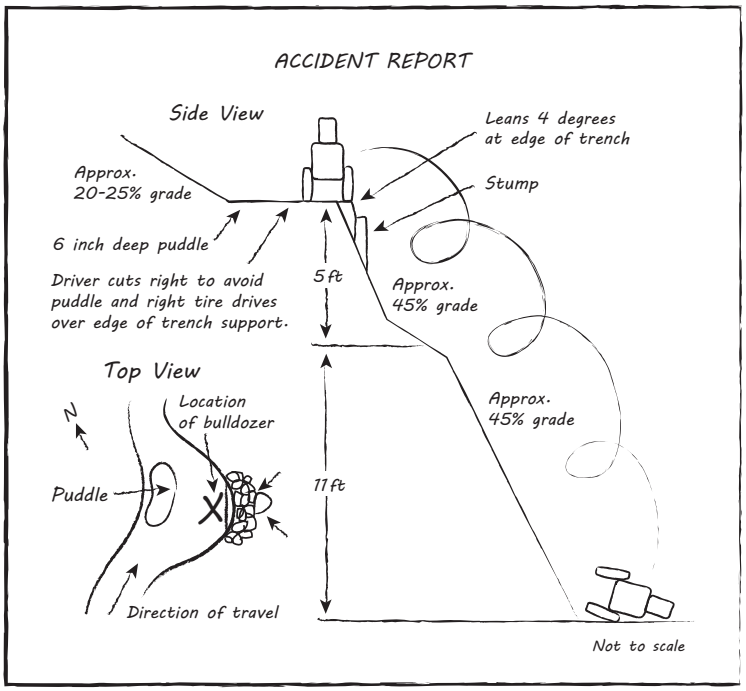
Figure 3-3 is another diagram that demonstrates a major advantage of illustrating an accident scene. It shows motion through time by diagraming how a bulldozer rolled down the side of a hill.

## Root Cause Analysis

The initial and site investigations identify surface causes of the accident such as technical defects or employee error, but the investigation must not stop there. If it does, the opportunity to prevent similar accidents may be lost. Oregon OSHA fatality investigator Mike Riffe says it best: "Too often, finger pointing is used in accident investigations. If the employer's goal is to find out who did it, they will never get to prevention. They need to ask, 'What went wrong?' and then look carefully for weaknesses or holes in their safety program and fix them to prevent future incidents" (Mesaros 2012).

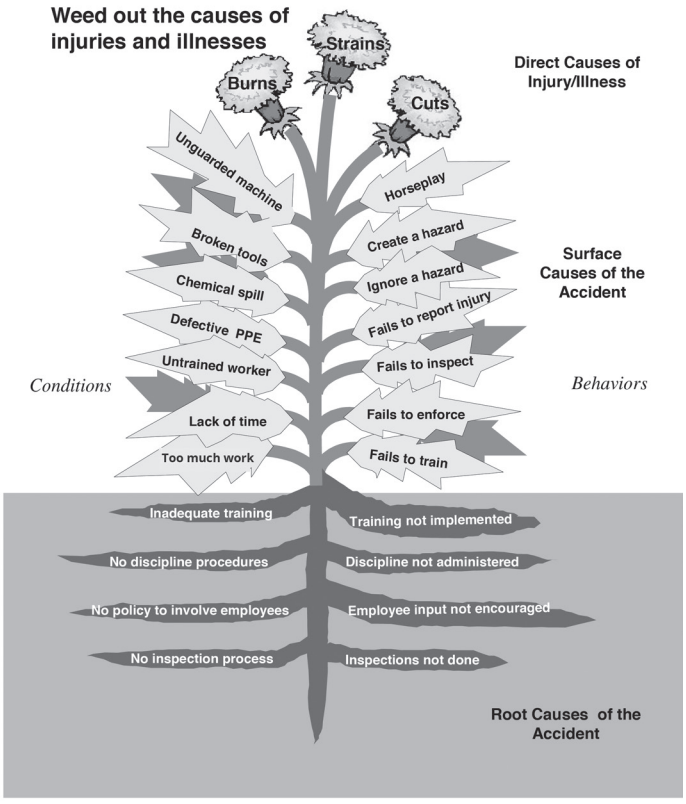
When technical defects and employee error contribute to an accident, they are often linked to underlying safety system conditions that have created a hazardous situation and unsafe behaviors that are manifested in the surface causes of accidents. These underlying conditions are typically the root cause of the accident. The "accident weed" shown in Figure 3-4 is often used to illustrate the relationship between surface and root causes, and common examples of each are shown.

Many techniques are used to evaluate the root causes of accidents, but one of the most useful is the "5-Why" technique, which is relatively easy to use and requires no advanced statistical analysis or data collection. The technique follows a structured question-and-answer sequence that contains a feedback loop to the previous question. By asking enough times why an event happened, the technique is supposed to "peel away




*Adapted from Oregon OSHA Online Course 1110. Used with permission.*

**Figure 3-3 Sketching motion through time**




*Oregon OSHA.*

**Figure 3-4 Accident weed and root cause analysis**

the layers of symptoms" associated with a problem. The process continues until another answer cannot be justified and the root cause is narrowed to the last question or answer set. An example of a question-and-answer sequence using this technique is as follows:

The vehicle will not start. (The problem)

1. *Why?* The battery is dead. (First why)
2. *Why?* The alternator is not functioning. (Second why)
3. *Why?* The alternator belt has broken. (Third why)
4. *Why?* The alternator belt was well beyond its useful service life and not replaced. (Fourth why)
5. *Why?* The vehicle was not maintained according to the recommended service schedule. (Fifth why, a root cause)

While asking five whys will usually lead to a root cause, it is okay to ask six or seven whys if needed. When using this technique, remember that the focus is on identifying a broken or absent process, not a human or equipment failure. In the example above, an investigator could jump to the conclusion that not maintaining the vehicle to the recommended service schedule is operator negligence; however, the operator may not have the training or parts to maintain the vehicle. In this case, a sixth why may be necessary in order to get to the true root cause of an accident.

## Corrective Action

As a result of the accident investigation, the utility should be able to define corrective measures that need be taken to prevent the recurrence of similar injuries. As in developing the Job Safety Analyses, the hierarchy of controls should be considered when evaluating options for corrective measures. The accident investigation may alert O&M or HSE staff to risks that could be eliminated or substituted through site modifications. The accident investigation may also indicate that an employee was not wearing appropriate personal protective equipment (PPE). Although use of PPE should be enforced, especially while additional controls are being implemented, remember that PPE is only a temporary solution and should be used in conjunction with other controls.

When recommending corrective actions, consider the decision maker's perspective and come prepared with the appropriate information. In preparing recommendations the following information should be provided:

- What is the hazard?
- What is the accident and incident history associated with the hazard?
- What is the recommended corrective action?

Be prepared to provide a simple cost–benefit analysis. To provide this information, research the direct cost (discussed in the Introduction to this chapter) associated with this accident and/or similar accidents, and the potential indirect costs. Compare these costs to the projected cost of the corrective action.

Once corrective action has been approved, the responsibility to take those actions by an assigned date should be given to a specific employee, and the actions' implementation, activation, and completion should be tracked.

The finding from the accident investigation along with corrective measures to be taken should be shared with all employees and management (note that before sharing this information the name of the injured employee should be removed). Typically this information can be shared through the safety committee.

A final future step is to evaluate whether the corrective action has been effective at reducing that type of incident, or effective in promoting employee awareness or learning, or other actions.

## Return-to-Work Programs

A return-to-work (RTW) program is a formal process to return injured employees to work with restrictions while they continue their recovery. According to the WRF project *Water Utility Safety and Health: Review of Best Practices (*Borowski and Adams 2010*),* "Water utilities often offer employee benefits that include liberal leave policies. These policies compromise employers' ability to effectively manage injury cases." The study also found that many utilities are unwilling to offer light-duty and RTW programs. This may be because utility management is not fully aware of the benefits that a RTW program can offer.

In fact, studies have shown that injured workers who are off work longer than six months have only a 50 percent chance of returning to their jobs. If time lost exceeds one year, chances are 90 percent that they will never return to work (Chandler 2003). Returning an employee to light duty is much cheaper than losing an employee completely to an injury.

Workers' compensation carriers can be a great resource when developing a RTW program. Carriers can provide sample programs and program review. Also, some states or workers' compensation carriers may provide incentives for returning an employee to work; for example, Oregon will pay 50 percent of a worker's wages while that employee is

on light duty (up to 66 days) and pay for work-site modifications that may be needed so the employee can go back to work safely.

The following are key aspects of an effective return-to-work program.

**Management support.** The only way a return-to-work program can work is if it is supported by upper management. A utility should have a written RTW program that is agreed upon by its entire management team. The program should demonstrate the utility's commitment to returning employees to work after an injury, as well as define both the utility's and the employee's responsibilities. This will ensure that, regardless of varying circumstances, the process will be followed.

**Knowledge of physical requirements.** In order to determine whether an employee will be able to return to work after an accident, the physical requirements of that employee's job must be understood. As with a JSA, each position should be evaluated and the essential functions of the job, including the job's physical requirements, should be documented. Most positions can be evaluated by the immediate supervisor or manager. However, positions with extreme physical requirements may need to be evaluated by a safety professional or physical therapist.

For positions with extreme physical requirements, the JSA should be used to develop a physical capacity test (PCT) that measures an employee's ability to perform simulated or real job activities. Employees should be required to pass a PCT along with a pre-placement physical to ensure that they are capable of performing the physical requirements of the job. The PCT can also be used to evaluate an employee's ability to return to work.

**Identification of light duty.** After job descriptions have been developed, duties within the job should be identified that are physically less strenuous. This will help when an employee with restrictions is trying to return to work. Although it is usually more beneficial to return employees to light duty within their positions, sometimes their restrictions do not allow it. It may be necessary to have them work with another department.

**Occupational health provider.** The treating physician is, of course, primarily responsible for applying the most appropriate clinical care to treat the injury or illness. However, the physician is often the key to minimizing the time away from work as well. Depending on local laws, employees may be able to see a physician of their choice. Regardless, a medical facility that understands occupational medicine should be available. Select a nearby occupational health facility so injured employees can receive quick attention. For traumatic or after-hours injuries, the local emergency room may be more appropriate.

Using the same medical facility to conduct routine services, such as pre-placement physicals and physical capacity testing, can be beneficial. For these routine services, medical staff with a good picture of utility operations will be more in tune with the physical requirements expected of employees. It may be appropriate to invite staff from the facility to see some of the more specialized tasks.

**Claims management.** Returning an employee to work should be the responsibility of one person, a claims manager, within the utility. While many will be involved in the process, possibly including a professional claims manager or third-party administrator, having one person in the utility responsible will ensure that the process is effective and consistent.

The claims manager should have a thorough understanding of the RTW process and any applicable laws. To maintain an effective RTW program the claims manager should

- Maintain the written RTW program, and ensure that everyone has the appropriate training.
- Communicate with the injured employee on a regular basis, ensuring that he or she understands and is comfortable with the process.

- Interact with the treating physician and provide the doctor with details of the utility's RTW program, including available light duty. Also ensure the physician receives the injured employee's on-the-job physical requirements.
- Ensure that the physician provides detailed restrictions and that those restrictions are followed when the injured employee returns to work.
- Keep the employee's supervisor and manager informed of the injured employee's status.
- Interact with the utility's insurance company to ensure all of the required information is provided in a timely manner.
- Maintain a file of all claims-related records.

## Record Keeping

Maintaining records of work-related injuries and illnesses is not only a good idea, it is required by OSHA and state and provincial agencies. In the case of OSHA, records of injuries and illness that are work-related must be kept on OSHA's Form 300, Log of Work-Related Injuries and Illnesses. OSHA inspectors will typically request these records when performing an inspection.

In most cases only records of significant injuries and illness (those requiring medical attention from a physician) are required to be kept. However, maintaining records of less significant injuries and even near misses can be beneficial. These records can be used in a proactive way by the utility to

- Manage company safety and health programs
- Locate workplace hazards
- Raise employee awareness regarding safety and health issues
- Establish the need for additional employee training
- Identify injury and illness trends

The following electronic resources are available at www.awwa.org/M3.

- Accident Investigation Program Example
- Accident/Incident Analysis – Blank Form
- Early Return to Work Program Example
- Physician Release-to-Work – Blank Form
- Temporary Modified Duty Job Description Example and Form
- Example of a job description and physical requirements for a conservation coordinator
- Preplacement Physical Capacities Test for Construction Crew – Blank Form
- Example of a job description and physical requirements for waterworks operator field crew
- Passing Criteria for Maintenance, Valve, Construction Crew Fitness Example
- Physical Capacity Requirements – Blank Form

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Chapter 4

# Prevention Through Design

*Carolyn Jones*

Investigations conducted through accident management programs may lead to the implementation of new processes or even the renovation of existing structures, creating a safer work environment. Alternatively, construction of a new facility also promulgates consideration of hazards, utility processes, and practices. Both new construction and extensive renovations benefit from addressing safety factors early on in the design phase, and more specifically, from Prevention through Design (PtD). This chapter outlines how health, safety, and environment (HSE); engineering; and operations and maintenance (O&M) teams can collaborate to effectively reduce risk in the workplace by designing out hazards.

## WHAT IS PREVENTION THROUGH DESIGN?

Prevention through Design is a US initiative from the National Institute for Occupational Safety and Health (NIOSH) to promote minimizing and eliminating workplace hazards and risks when projects are in the design phase. PtD was preceded by similar voluntary efforts in other organizations and formal regulations in some countries (e.g., United Kingdom). The NIOSH mission for the PtD initiative is "to prevent or reduce occupational injuries, illnesses, and fatalities through the inclusion

of prevention considerations in all designs that impact workers. The mission can be achieved by:

- Eliminating hazards and controlling risks to workers to an acceptable level 'at the source' or as early as possible in the life cycle of items or workplaces.
- Including design, redesign and retrofit of new and existing work premises, structures, tools, facilities, equipment, machinery, products, substances, work processes and the organization of work.
- Enhancing the work environment through the inclusion of prevention methods in all designs that impact workers and others on the premises." (NIOSH 2013)

By identifying hazards early in the project, facility, or process design and then incorporating design changes and controls, projects can be built without those hazards, or with hazard reduction measures included. PtD is a proactive process that brings together knowledgeable HSE, engineering, and operations and maintenance staff in the conceptual and early design phases. Through a risk-identification process and subsequent application of the hierarchy of controls, water utility facilities can be designed from the ground up with fewer hazards and with control measures already included.

The goal of PtD is to eliminate or reduce hazards at the source, thereby reducing the risk of injuries and the need for complicated, expensive procedures and/or personal protective equipment (PPE). Hazard elimination is most cost-effectively completed in the early scoping and conceptual design stages (e.g., alternative chemistry or inherently safer chemicals). Later reviews may identify additional hazard reduction options, and as such, PtD can be an effective methodology for not only new design, but for renovations, additions, and site modifications as well. For example, if a potential permit-required confined space can be modified through improved access, lighting, ventilation, and/or other hazard-reduction methods, work in that space may no longer be classified as a permit-required confined-space entry. Monitoring, rescue, ventilation, PPE, and so on, will only be required based on the job or task hazards. The safety features included at the design stage will benefit the workers for years to come when that facility goes on line. The PtD concept is to look beyond designing just for minimum regulatory compliance. Instead, all safety hazards that can be designed *out*, or practicable safety controls that can be designed *in*, are identified and included by the design team.

## PtD IMPLEMENTATION IN THE WATER INDUSTRY

Water transmission, treatment, and distribution facilities and systems present many opportunities for PtD, such as

- Moving a valve actuator above-grade, out of a valve vault, to eliminate the need for operators to enter a permit-required confined space to operate the valve.
- Providing a platform with appropriate access and railings, so that workers are at the proper ergonomic height while operating a valve or performing maintenance and repair, and workers do not need to work from a ladder.
- Specifying the purchase of quieter equipment so that employees can work in the area without the requirement for hearing protection use.
- Providing equipment to lift and feed treatment chemicals automatically, eliminating the need for workers to handle heavy bags of chemicals.

## Roles and Responsibilities

Effective application of PtD requires a team approach, including representation from HSE, engineering, and O&M professionals. The best design incorporates input from all team members providing their different perspectives, technical knowledge, standards and criteria knowledge, and knowledge of actual work practices in the field. Field knowledge from employees who work or have worked hands-on with the equipment or processes is essential. Cost estimators may also be part of the PtD team to provide financial analyses of options, returns on investment, and other costs.

When identifying PtD roles and responsibilities, consider how and why a particular safety concern is under discussion. For design of a new project or process, the design team, led by engineering, will likely perform alternatives analyses and prepare conceptual engineering reports, and consequently will need to initiate PtD review for design alternatives. However, if a safety concern is identified by HSE professionals as part of an injury analysis, that team will likely lead the initial PtD effort in the event that safety concerns necessitate major renovations or site modifications.

Typical responsibilities for each sector include:

**Health, safety, and environment**

- Identify hazards of existing facility designs or processes that could be reduced or eliminated through the PtD process.
- Conduct hazard analyses (using various methodologies such as Job Safety Analysis) to identify risks and prioritize them.
- Identify hazard controls and/or reduction strategies.
- Participate in reviews to identify and rank PtD design alternatives.
- Conduct design review of projects to identify hazards, controls, and opportunities to implement risk-reduction measures, and communicate information to design team.
- Coordinate with O&M staff to reach consensus on best PtD measures.
- Participate on post-project lessons-learned reviews for effectiveness of PtD measures.

**Engineering and project management**

- Communicate and coordinate with other PtD stakeholders (construction manager, security, environmental, purchasing, public relations, finance, IT) early in any new project or process design, or during upgrade of existing operations.
- Provide HSE and O&M with sufficient technical information on process/project alternatives to enable hazard evaluation.
- Implement standard PtD design criteria as determined by the agency.
- When PtD design challenges arise, coordinate discussion with PtD team members to resolve issues.
- Include PtD considerations in conducting alternatives analyses and ranking alternatives.
- Provide outside designers with PtD criteria when projects are not designed by in-house teams.
- Provide regular design review opportunities for stakeholders, including O&M and HSE, and incorporate PtD feedback.
- Hold lessons-learned sessions at project closeout to gather information on the success of PtD solutions or the need to make changes in the future.

**Operations and maintenance**

- Identify hazards of existing facilities and processes, including ideas for improvements on an ongoing basis.
- Participate in formal and informal hazard analysis processes, providing key input from the user perspective.
- Participate in review of design alternatives that incorporate PtD measures, providing input from the user perspective.
- Participate in the design review process, identifying health and safety hazards and PtD opportunities to the design team.
- Participate in post-project lessons-learned reviews of PtD measures' effectiveness.

## PtD Methodology

**Hierarchy of controls.** When implementing PtD, the hierarchy of controls provides a systematic structure to rank the preferred safety approach(es) and determine the best approach, given the project-specific parameters. Consider the five levels of the hierarchy of controls described in chapter 2:

1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. Personal protective equipment (PPE)

The PtD focus is to achieve workplace safety by levels 1–3, thereby avoiding reliance on levels 4–6. While the optimal approach is complete elimination of a hazard, there may be limitations because water industry facilities have some inherent hazards that cannot be completely designed out. Therefore the PtD goal is to use the hierarchy of controls to modify the design within practicable limits, reducing the hazards as low as is reasonably possible.

**Hazard identification and evaluation methods and tools.** The process of identifying hazards/risks can range from informal, empirical methods to extensive, formal hazard evaluations such as a JSA. Water industry staff should consider the scale and scope of the project under consideration when selecting the appropriate hazard evaluation method. Specific hazard evaluation methods are covered in detail in ANSI/ASSE Z590.3 – 2011. In general, methods may include:

- Job Safety Analysis (JSA)
- Design checklists
- Process hazard analysis (e.g., what-if analysis, checklist analysis, hazard and operability study, failure mode and effects analysis)
- Risk ranking
- Operability and maintainability reviews
- Code compliance reviews
- Process safety management type reviews

Chapter 6 identifies common water industry hazards and control measures that can be considered when conducting a hazard analysis as a part of the PtD methodology. Additionally, several important steps to take during a PtD analysis are:

- Include HSE, O&M, and engineering staff to get a broad perspective on concerns.
- Review historical injury and incident data for common injury causes.
- Review government-mandated programs, such as permit-required confined-space entry or lockout/tagout, that require significant safety resources (staffing, special equipment and training, respirator and other PPE use) to meet the requirements.
- Look at existing facilities and processes and ask, "How could this facility or process be improved for safety?"
- Visit similar facilities at other water agencies and talk with them about their best safety management practices.
- If other agencies have already built or implemented a new technology, talk to them about what is working or not working for worker safety for that technology.
- Hazard identification should also be considered during the construction phase of a project.

**Thinking through user and maintenance needs.** Effective PtD must consider how workers will need to operate *and* maintain the equipment or process. Because the design engineer may not have operations experience, clear communication with O&M staff is necessary. O&M staff should clearly express their needs, including equipment access, space requirements to reach components for maintenance or dismantling, how equipment controls are to be calibrated, where workers will need to tie off, and other routine or common tasks. These needs concerning worker interaction with the process and equipment must be part of the data-gathering process early in the design phase, because each interaction has potential worker safety consequences. The design engineer must ask questions that go beyond "What does the equipment or process need to do?" to determine "What does the worker need to do with, on, under, or on top of the equipment/process?"

**Equipment specifications.** The specifying and purchasing of equipment that meets safety and health goals is a PtD area with significant potential for success. Some examples include:

- The Buy-Quiet approach adopted by the National Aeronautics and Space Administration (NASA) to specify noise emissions criteria along with other technical and performance criteria, to reduce equipment noise hazards (NASA 2014)
- Specifying purchase of ergonomically adjustable chairs and workstations for control rooms with multiple users
- Specifying standard fall-arrest and retrieval equipment for an organization so that equipment and controls are consistent between facilities

**Internal agency design standards.** Developing internal agency design standards that both integrate lessons learned and provide a standard approach across the organization can simplify the process and yield consistent, successful results. These standards must meet at least minimum applicable regulatory standards, but then can include organization-specific criteria above and beyond the minimum requirements. Some examples include:

- Standard manhole designs incorporating both regulatory requirements and best practices (e.g., ladder restraint or confined-space entry enhancements)
- Standard vault designs incorporating stairs, ventilation, and lighting to facilitate entry
- Standard tank roof designs for regular access (i.e., ladder/stair and railing) or emergency service access (tie-off anchor points)

- Standard chemical unloading pad and storage tank containment and detection systems

**Design process and proactive design safety review.** Robust design review is another essential requirement for effective PtD methodologies. PtD considerations will begin with the alternatives analysis and conceptual engineering phases. At this early stage, only broad PtD assessments can be made, such as evaluations of different chemical processes, or the identification of hazard categories that will need to be addressed further on in the design. In addition, any applicable, project-specific, internal design standards should be identified as part of the overall design criteria.

When the design is under way, project design review that includes safety concerns is critical at early-, mid-, and near-final design stages. The review should focus on

- Whether or not the applicable safe design criteria have been incorporated in the design
- Resolving safe design issues that were identified as important, but that couldn't be fully specified until more detailed design decisions were made
- Identification of unanticipated concerns

Engineering teams generally implement regular design review. For PtD review, the team must include individuals with health and safety expertise, as well as operations and maintenance expertise. Design review can be challenging if reviewers are not familiar with reading engineering drawings, if reviewers have trouble visualizing three-dimensional (3D) facilities from two-dimensional drawings, or if the design has many pages of drawings for a large, complex facility. Suggestions include having overview presentations from the design team, skills training on how to read engineering drawings, the use of design review checklists, and if feasible, the use of software programs that provide a 3D view of the facility. The final important step in safe design review is to have a good process to capture and respond to design review comments.

**Constructability.** The construction phase of a project may also provide opportunities for implementing PtD strategies that will keep construction laborers safe. Examples include the construction or assembly of modular roof or building units on the ground, then lifting the completed units into place, or the installation of fall-arrest system anchor points on structural elements before those elements are installed, so construction workers are able to use them during construction. PtD application during construction requires good knowledge of construction means and methods, which may necessitate input from construction management experts. Full implementation of PtD should include the construction phase.

**Lessons learned.** Every project is an opportunity to apply PtD concepts to eliminating, reducing, or controlling safety hazards. Every project is also an opportunity to identify additional safe measures and/or lessons learned, although some of those lessons may not be understood until workers have worked in the facility for a while. However, it is important for an organization to not only make necessary safety corrections, but to have a system in place to capture those lessons learned so that the information can be shared and considered during future project design.

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Chapter 5

# Contractor Safety Management

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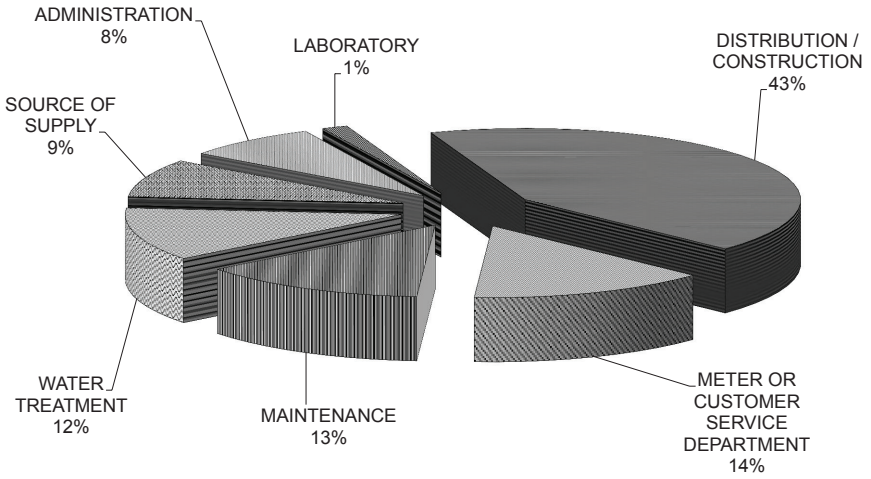
The water industry's construction and distribution system operations have the largest share of injuries of all water system operations (Figures 5-1, 5-2 and 5-3). Whether contractors are used only for major construction or for distribution system rehabilitation and repair, contractors have historically been responsible for, and the victims of, many major incidents. Incidents often include collapse of excavations, falls, being struck by vehicles and heavy equipment, being caught in rotating equipment, and release of hazardous energy.

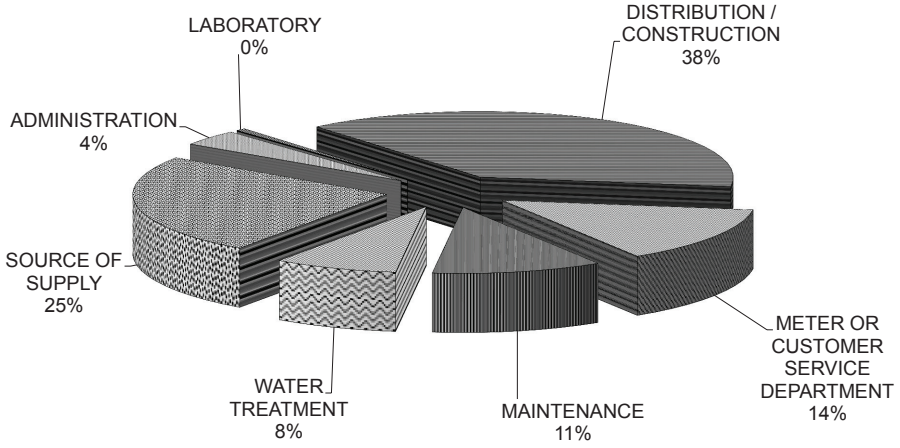
Historically, many considered safety solely the contractor's responsibility, and some even believed that liability increases when the owner improves contractor safety oversight. Beyond the human toll, water systems pay for contractor incidents in higher contractor overhead costs, distribution system and plant damages, service interruptions, and in many cases, damage to the organization's reputation. Robust contractor safety management programs have proven their value in reducing incidents, property damage, costs, and liability.

This chapter reviews established health, safety, and envrionment (HSE) practices that can be applied during contracting and construction to prevent injury to contractors, employees, and the public and prevent damage to property and operability.



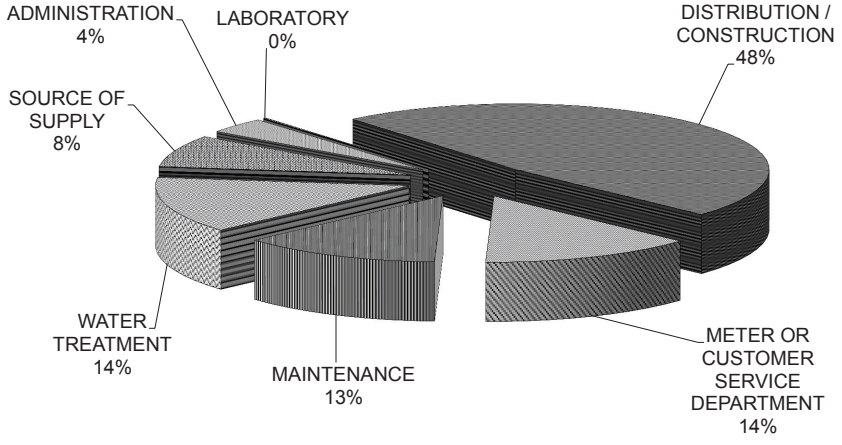

*Puglionesi 2003.*

**Figure 5-1 Percent recordable cases with no lost workdays by type of operation (1999)**




*Puglionesi 2003.*

**Figure 5-2 Percent recordable cases with lost workdays by type of operation (1999)**




*Puglionesi 2003.*

**Figure 5-3 Percent of lost workdays by type of operation (1999)**

## MAKING SAFETY PART OF THE CONTRACT

Organizations around the world have learned that they can improve contractor safety performance by comprehensively communicating and applying safety management requirements at all phases of the work, from before contractor selection through project completion.

Contractors will do what is necessary to win and hold a utility's business. In order to make safety performance and practices important to them, make it clear that it is important enough that contractors with poor safety records will be rejected, and insist on good contractor safety programs and practices that include identifying and correcting safety problems on an ongoing basis.

Successfully completing any project without an accident or safety violation depends upon both a comprehensive contractor safety management program and knowledgeable, engaged employees involved in contracts, purchasing, project management, and safety oversight.

### Regulatory Requirements for Owners

While there are no generally applicable requirements for owners to have contractor safety management programs or for contractors to have comprehensive HSE programs, there are several relevant regulatory requirements and standards. Facilities that use chlorine, ammonia, or aqueous ammonia may be regulated under OSHA Process Safety Management (PSM) or US Environmental Protection Agency (USEPA) Risk Management Program (RMP) regulations (29 CFR 1910.119 and 40 CFR 68). These regulations were modeled after best practices developed for PSM in the petrochemical industry. Both regulations require contractor safety management for PSM.

OSHA Standard 1910 "applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services."

The standard requires the owner or operator, when selecting a contractor, to evaluate the contract owner or operator's safety performance and programs and periodically evaluate the contractor's performance during the course of the job.

In addition, the owner/operator of a facility is required to develop and implement safe work practices to control the entrance, presence, and exit of the contract owner or operator and contract employees in process areas and to notify the contractor of all known potential fire, explosion, or toxic release hazards related to the contractor's work and the process.

In turn, the contractor must ensure that each of his or her employees is trained in safe work practices for performing the job at hand and that the employees are instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.

Documentation that each contract employee has received and understood the training is also required under the OSHA standard. The records must contain the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.

The standard also has notification requirements should any unique hazards occur because of the contract owner or operator's work, or of any hazards are found by the contract owner or operator's work.

## Regulatory Requirements and Best Practices for Contractors

OSHA regulations do not require written comprehensive HSE programs for the construction industry, although some specific regulations call for written programs or plans. For example, hazardous waste cleanup and emergency response operations regulations (29 CFR 1910.120) require the development of both a company program and a site-specific health and safety plan (HASP). The HASP addresses hazards that are specific to the conditions at the site and the work being done.

California construction safety regulations (Title 8 CCR 1509 and 3203) specifically require developing and implementing an effective construction Injury and Illness Prevention Program (IIPP). This mandatory approach is also taken in Washington, Hawaii, Australia, and much of the European Union. Regulations covering some industries or encouraging IIPP development exist in a total of 34 states. For example, California regulations require:

1. Every employer to establish, implement and maintain an effective Injury and Illness Prevention Program.
2. Every employer to adopt a written Code of Safe Practices that relates to the employer's operations.
3. The Code of Safe Practices to be posted at a conspicuous location at each job site office or provided to each supervisory employee who shall have it readily available.
4. Periodic meetings of supervisory employees under the direction of management for the discussion of safety problems and accidents that have occurred.
5. Supervisory employees to conduct regular safety meetings with their crews at least every 10 working days.

The detailed IIPP regulations in Section 3203 are lengthy, but generally include

- Identifying the persons with authority and responsibility for implementing the program
- Training and instruction initially for changes in hazards, including supervisor training
- A compliance assurance system, including employee recognition and disciplinary action
- Active two-way communication (meetings, posting, written communications, a means of anonymous employee hazard notification, and labor/management HSE committees)
- Periodic inspection to identify/evaluate hazards, unsafe conditions, and work practices
- Procedures to investigate occupational injury or occupational illness
- Procedures for timely corrective action

There are two well-established industry consensus standards establishing best practices for IIPPs:

- ANSI/AIHA Z10–2005 Occupational Safety and Health Management Systems (American National Standards Institute/American Industrial Hygiene Association)
- OHSAS 18001–2007 Occupational Health and Safety Management Systems (Occupational Health and Safety Assessment Series Project Group)

### Contract Requirements

The legal foundation for enforcing an organization's program resides in the construction contract and construction specifications. As a program evolves, make sure that standard contract language supports the actions that may be necessary under a specific program. If not supported by the contract and specifications, contractors may request additional compensation for compliance and even legally challenge actions taken by the utility or its representatives. Depending upon the program, critical provisions of the contract and the specifications may include

- Safety/environmental performance and/or program submittals required for either pre-qualification or selection
- Safety and environmental selection/exclusion criteria
- Safety program/project-specific plan submittals (e.g., health and safety plan, emergency/fire protection plan, job hazard analysis, hazardous material MSDSs)
- Pre-job orientation and planning meetings
- Site safety orientation for all contractor/subcontractor personnel
- License/qualification/training requirements
- Contractor safety representative staffing/qualifications
- Contractor safety field inspection, self-assessment and reporting
- Reporting/investigation of incidents and violations of laws or regulations
- Corrective action
- Contractor warning and suspension for failure to comply with safety requirements and grounds for termination
- Contractor evaluation and its use in future contractor selection

## CONTRACTOR PREQUALIFICATION AND SELECTION

Selecting only contractors with an adequate safety record and safety program improves safety performance by

- Eliminating the worst-performing contractors, often those with whom staff would prefer not to work.
- Encouraging all current and prospective contractors to improve safety performance; they know it matters to the utility and they may lose the business if they don't perform well.

Organizations that prefer to work with a few, prequalified contractors administer a routine annual safety information request. If practices or laws restrict the ability to prequalify, the safety information request can be made after the presumed lowest-qualified bid is identified. The submittal is then evaluated against the contractor selection criteria to determine whether to prequalify or select the contractor.

Prequalification and selection can range from a simple review of performance data to a comprehensive review of both performance and safety programs. The simplest approach is to request the company's workers' compensation Experience Modification Rating (EMR) issued by the company's insurer for the last 3 to 5 years. An EMR of 1.0 is the average for the industry; 0.5 is half the industry average, and 2.0 is twice the industry average. More extensive safety information submittals may include any of the examples outlined in Table 5-1.

**Table 5-1 Examples of prequalification and selection information to be collected from the contractor**

| Type of Information | Examples |
|---|---|
| Safety performance | Experience Modification Rating (EMR) |
| | Recordable injury/illness information (e.g., OSHA 300A summaries) |
| | Number of hours worked; number of OSHA-recordable injuries/illnesses; number of fatalities; number of lost workday (LWD) cases |
| | Recordable or LWD incidence rates (no. recordable or LWD cases × 200,000/ employee hours worked) |
| | List of OSHA notices of violation and fines |
| | Safety/health-related judgments, claims, contract terminations, or pending/ outstanding lawsuits |
| HSE programs | Certification that contractor follows all applicable regulatory requirements |
| | Description of the contractor's HSE programs |
| | Copy of the HSE program |
| | Description of the contractor's HSE training (e.g., course listing, frequency, syllabus) |
| Environmental performance | List of environmental citations |
| | List of reportable petroleum or chemical releases |
| Licenses/certifications | Copy of licenses, certifications, training or experience documentation (e.g., crane, OSHA 10/30 training) |
| Experience/references | Projects and references for similar scopes of work |

Some programs go beyond these practices to include specific safety practice questions, such as the following:

- Does the firm have a written safety and health policy or mission statement?
- Does the firm have a written safety and health training program?
- Does the company training program include

  Company HSE policies/programs
  New employee orientation training
  Emergency action plan
  Fire prevention plan
  Confined-space entry
  Excavation safety
  Fall protection
  Personal protective equipment
  Respiratory protection
  Lockout/tagout
  Hot work
  Electrical safety
  Bloodborne pathogens
  Scaffold
  Hazard communication
  Hearing conservation
  Injury/illness record keeping

- Is all HSE training documented? Is understanding/proficiency documented?
- What additional HSE training do supervisory personnel receive (foremen, crew supervisors, etc.)? What are the site safety representative's qualifications?

- Does the company have a new employee orientation and HSE training program?
- Are safety meetings regularly conducted?
  - How often?
  - Is there an established agenda?
  - Who ensures these meetings are conducted?
  - Are all employees required to attend?
- Does the company have a written disciplinary action policy on safety violations?
- To what extent does the firm use professional HSE staff?
- Are HSE inspections/audits conducted and documented?
- How are identified conditions brought to closure? Are corrected conditions documented?
- Is a Job Safety Analysis conducted? If so, when and for what activities?
- Is there a behavioral safety program? Behavior-based safety is a concept that accidents are a result of human error. Behavior-based programs address the cause of the errors (e.g., attitude, environment)
- Is there a "stop-work" program for serious safety conditions? (Stop-work programs require work to be stopped when a serious hazard is not addressed.)
- Is incident investigation conducted for all injuries? For near misses?
- Is safety a criteria in evaluating the performance of foreman, supervisors, management?

## Contractor Acceptance Criteria

Some organizations are uncomfortable with disqualifying bidders based on their safety record, but this is now a common practice in industry and government. Selection criteria range from a simple numerical EMR or incidence limits, to qualitative evaluations, to complex numerical scoring assigned to both performance and answers, to a series of questions. Some examples of simple contractor acceptance criteria are provided in Table 5-2.

Many organizations are initially worried that adopting definitive numerical criteria will exclude trusted contractors. A preliminary survey usually allays these fears because the vast majority of contractors have EMRs below 1.5. The EMR criteria can be used as a tool to gradually improve contractor safety performance, beginning at higher EMR thresholds and gradually reducing them as the program matures and contractor performance improves. Some organizations have achieved a reduction in contractor EMRs to an average well below 0.5 over decades of applying a rigorous contractor safety management program.

There is no correct set of criteria for evaluating a contractor's safety record or program. Each organization should select the approach that best suits the organization and adjust the criteria with experience and to further encourage safety performance improvements among their contractors. Some organizations may want to avoid a hard exclusion criterion and always give its health and safety organization the ability to determine whether extenuating circumstances allow for acceptance under a corrective action program (e.g., a small company's rate may be greatly affected by such things as injuries due to a vehicle accident in transit to a work site).

Many organizations avoid an evaluation of the contractor's safety program because they believe that this is not their role, it is resource-intensive, and they might incur some liability for approving the contractor's program. To address this concern while still

**Table 5-2 Examples of prequalification and selection criteria to be used by the owner/utility**

| | Acceptable | Corrective Action Required | Unacceptable |
|---|---|---|---|
| Experience Modification Rating (EMR) | | | |
| New | < 1.25 | 1.25–1.5 | > 1.5 |
| Improved | < 1.0 | 1.0–1.25 | > 1.25 |
| Mature | < 0.75 | 0.75–1.0 | > 1.0 |
| Advanced | < 0.5 | 0.5–1.0 | > 1.0 |
| Prequalification and Selection Criteria | | | |
| | No pattern of violations, fatalities, or serious injuries | Some history of violations, fatalities, or serious injuries | Pattern of serious violations, fatalities, or serious injuries |
| | Fully understands HSE program and training requirements (based on job and submitted information) | Some HSE program and training deficiencies or gaps (based on job and submitted information) | No or seriously deficient HSE program and training |
| | Has excellent qualifications and relevant experience | Has limited qualifications and relevant experience | No relevant qualifications and experience |
| | Has necessary licenses and certifications | Has some but not all necessary licenses and certifications | Does not have necessary licenses and certifications |

identifying weak contractor programs, water systems may decide to review contractor HASPs to identify deficiencies or gaps. Project engineering/management, purchasing, and perhaps even the legal department should be involved in this decision making.

Requirements generally flow down to subcontractors for such things as insurance and compliance, but practices vary regarding flow down of safety performance selection criteria. An organization may decide to flowdown all requirements to all subcontractors, apply them only to major subcontractors over a designated dollar threshold, identify a limited set of subcontractor criteria to all subcontractors (e.g., EMR), or apply none at all. Regardless, contractor and subcontractor safety requirements, along with any applicable flow-down clauses, should be explicitly written into the contract documents.

## PRE-JOB CONTRACTOR ORIENTATION AND PLANNING

Prior to the commencement of work, a good practice is to hold an orientation meeting for the contractor's site manager/supervisor and safety representative to ensure the contractor is fully prepared to comply with the safety requirements of the contract. The meeting will generally

- Review the work, including key mobilization steps, heavy equipment, and projected effects on facility operations
- Review major facility petroleum/chemical hazards and the hazardous substances that will be brought on site to complete the work
- Confirm that the contractor understands its obligations to provide a site safety representative responsible for construction safety whenever work is conducted
- Share key facility emergency information, contractor work rules, and facility HSE programs (e.g., lockout/tagout, hot work/safe work permits) that must be communicated to all contractor and subcontractor personnel before they begin work

- Confirm that the contractor understands its obligations to provide site safety orientation for all site workers (unless the facility conducts the orientation itself) and any other safety and skill training required for the safe completion of the work
- Review key contract safety requirements (e.g., safety meetings, inspection, reporting, corrective action, discipline, and work suspension/termination provisions)

A contractor orientation checklist may be used to guide the pre-job orientation. A checklist also serves to document the transmittal of critical information and can include a contractor's acknowledgment that they understand the safety requirements.

Some facilities prefer to provide a safety orientation to each and every contractor and subcontractor employee as a condition of gaining access to the facility to ensure that the orientation is rigorous and to ensure that there is documentation of the orientation and that each person understood the content. If safety orientation is a contractor responsibility, the program should include an acknowledgment by the contractor that appropriate site safety training will be provided to all contractor employees and subcontractor employees before work begins on the premises as well as the transmittal of documentation that the orientations were conducted and understood.

## CONTRACTOR WORK RULES AND GUIDANCE

The owner and contractors each have their own HSE programs. The owner should define when a contractor may operate solely under its own program and when it must also meet the owner's requirements. Generally, the owner's requirements are also applied when work is within the boundary limits of an existing facility or operation where the contractor may affect the safety of facility personnel and where an incident can damage property or the ability to operate. Good practice includes preparing and communicating the following to contractors:

- A brief list of contractor safety rules. This can also be used as a handout for the contractor's employees and subcontractors.
- Key aspects of the facility emergency action plan (or other emergency plan), at minimum covering the facility's major hazards, emergency alarm system, evacuation routes, and assembly areas.
- The water system's own HSE programs, when the contractor is working on an existing operation where the owner's employees or facility could be affected by the work (e.g., lockout/tagout program, hot work/safe work permit).

Large organizations sometimes develop procedures, guidelines, and model plans specifically for contractor use on their projects.

## CONTRACTOR PROGRAMS, PLANS, AND TRAINING

As discussed previously, OSHA regulations do not require written comprehensive HSE programs for the construction industry, although some specific regulations call for written programs or plans and some states and countries require an IIPP.

While studies have shown that an IIPP requirement significantly reduces injury and illness rates (OSHA 2012), an organization may not feel it is appropriate to require all contractors to develop an IIPP in order to qualify to perform work. A safe construction environment can be maintained by some combination of company health and safety programs and the development and application of site-specific HASP requirements. Site-specific plans may include

- Contractor's HSE policy and signed commitment
- Clearly assigned responsibility and accountability for site HSE
- Emergency or contingency plan, including contacts and evacuation procedures
- Fire prevention plan addressing hazardous material storage and use
- Qualifications and training of site safety representatives
- Description of major activities that affect hazards and safety programs that apply
- Licenses, certifications, and specialized training required based on the planned activities and equipment
- Communication of hazards and hazardous substances
- Periodic inspection to identify and evaluate hazards, unsafe conditions, and work practices
- Employee recognition and disciplinary action programs
- Immediate reporting of occupational injuries and illnesses
- Injury/illness/near miss investigation procedure
- Procedures for timely corrective action
- Health and safety programs and/or JSA that address the anticipated activities and hazards and identify needed precautions and protective equipment
- Health and safety site orientation
- Training, tailgate meetings, safety meetings
- Record keeping and submittals during the work

If the HASP approach is used, it should be flexibly administered to allow contractors with mature, effective health and safety programs to rely on and use their existing programs.

## INJURY/ILLNESS/INCIDENT REPORTING AND INVESTIGATION

Many have learned in their own operations that immediate and accurate reporting of injuries and illnesses is essential for proper care, reporting, and case management and that the use of an occupational health provider (OHP) to rapidly assess and care for injuries is an effective tool for minimizing unnecessary hospital visits and vague or inaccurate diagnoses (see chapter 3). Prompt incident investigation and corrective action are essential to preventing recurrences. Late and inaccurate reporting of injuries and illnesses can be costly and complicated.

Many contractors, particularly small companies, are less experienced and less equipped to effectively manage injuries and are more likely to mismanage such cases. Because the utility staff could potentially be involved in cases of serious injury and since the cost is ultimately built into the contractor's overhead, it is essential that contractors are required to promptly report and investigate injuries and illnesses. At a minimum, contractors should immediately report incidents and provide a copy of the investigation report. Some owners also participate in the investigation or conduct their own independent review. Organizations with aggressive contractor safety programs have even required immediate consultation with their own OHP.

Owners at OSHA PSM-regulated facilities are required to maintain a log of contractor injuries and illnesses. This can be a log that they maintain or a copy of the contractors'

logs. Beyond the requirements, consider copying the contractors' performance data logs to measure the effectiveness of the contractor safety management program.

## CONTRACTOR EVALUATION

Evaluating contractor safety and health performance provides important feedback to the contractor and helps determine their consideration for future work. Monitoring and evaluating performance can be done in a variety of ways. For small projects, informal site supervisor and operator monitoring may be the most efficient and effective choice to assure safety compliance. For larger projects, approaches vary from integrating this responsibility with the construction/project manager's other duties, to using health and safety staff, to using outside resources (consultants or insurance company representatives).

An evaluation form can facilitate consistent review practices and documentation. If the organization decides to perform active, frequent auditing of safety performance during the project, a detailed checklist of common construction safety requirements/issues is helpful. This checklist is usually different from an overall safety performance evaluation, which is used to support future contractor selection decisions. Detailed auditing may identify hazard and noncompliance issues, and documentation should include corrective actions taken by the contractor.

For OSHA PSM facilities, formal evaluation of the contractor's performance in meeting their obligations is required at least once during the work. This can be performed by the person who is assigned to manage the contractor or to provide safety oversight. The scope and frequency of the evaluation is discretionary.

## SPECIAL HAZARDS OF CONSTRUCTION

Health and safety issues and hazards applicable to construction are similar to those encountered during water system operations, but certain hazards and issues have greater significance and require greater emphasis. These include

- Cranes, hoists, and rigging—dropping, toppling, collapse
- Excavation—underground lines, adjacent heavy equipment, danger of collapse
- Confined space—physical, chemical, oxygen, hot work
- Fall protection—falls from leading-edge work, inadequately guarded edges, worker interaction with lifts
- Hot work—fire, inadvertent work on active or inadequately cleared equipment
- Lockout/tagout—inadequate lockout/individual protection, inadvertent work on active or inadequately cleared equipment
- Contractor work in or around high hazard chemicals or processes
- Traffic—struck by vehicle, inadequate warning and transition zones
- Security—vulnerabilities due to inadequate identification requirements and access control at construction entrances
- Emergencies—inadequate personnel accounting and emergency access

### Pre-Start-Up Safety Review

Chapter 4, Prevention Through Design, addressed techniques for improving safety both during construction and during the operating life of the facility. Another key element of

safety management is reviewing the completed facility during the commissioning phase to ensure that the new or modified facility is ready to safely start up and operate. Pre-start-up safety review generally includes

- Inspection for hazards and compliance with standards, often using a checklist
- Verification that construction and equipment is in accordance with design specifications
- Verification that adequate safety, operating, maintenance, and emergency procedures are in place
- Verification that prior design/construction review recommendations have been resolved or implemented
- Completion of operator training on new or improved equipment, processes, and materials
- Establishment of maintenance schedules and replacement part requirements

## FOSTERING PARTNERSHIPS

Partnerships can be an effective means of encouraging participation and success in improving safety performance. Partnerships can be sought with frequently used contractors, with regional contractor associations, and with a regional industry consortium. The regional labor/industry consortium approach has been successfully used to promote training and basic understanding of minimum safety requirements and practices. The Delaware Valley Petroleum Refiners Association partnership with regional nonprofit and union organizations provides process safety management curriculum for employees working in refineries, and serves as a good model for other industries. The program is an eight-hour training session followed by a written test (IUOE 2008).

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Chapter 6

# Common Hazards and Safety Programs

This chapter provides a brief introduction to hazards that are commonly faced in the water industry. While not all-inclusive, this chapter does cover many of the hazards that managers, engineers, HSE staff, and operators will face and may want to consider when implementing Prevention Through Design (PtD) practices, developing Job Safety Analyses (JSAs), or selecting contractors. This information was assembled by experienced water industry safety professionals based on their knowledge of each hazard, and it serves as a great tool to evaluate whether or not a particular hazard applies to a particular utility.

The hazards addressed in this chapter are organized categorically as follows:

**Physical Hazards**

Arc flash
Permit-required confined space entry
Excavation and Trenches
Hazardous energy control (electrical Safety
Hot work
Materials handling
Noise exposure
Pressure vessels
Tractor operation
Traffic and the work zone
Driving hazards: weather and car accidents' alcohol and car accidents; eating, drinking, and car accidents
Hot and cold weather conditions

**Biological hazards**

Aniimals and insects
Bloodborne pathogens

**Chemical Hazards**

Chemical exposure and highly hazardous chemicals
Compressed gases
Asbestos, lead, and mercury
Hazardous waste
Pesticides

**Personal (or Health) Hazards**

Drug and alcohol abuse in the workplace
Ergonomic hazards
First aid and access to medical assistance
Lone worker
Respiratory hazards
Sanitation and isease prevention
Violence in the workplace

# PHYSICAL HAZARDS

## Arc Flash

**Description of hazard.** Water plant operators and associated maintenance staff are frequently asked to work on electrical switchboards, panel boards, and motor control panels that are energized. In order to perform such work, an arc flash analysis must be done to determine the arc flash boundary and level of personal protective equipment (PPE) required to protect workers from potential exposure to an arc flash.

**Common controls.** Electrical safety training for these workers is usually included in most basic safety training. Based on new standards, additional training is needed on the following topics:

- Arc flash hazards (AFH) and how to avoid them
- Required PPE for AFH
- Basic arc flash analysis of the electrical system
- Understanding the arc flash warning label
- Risk hazard categories
- Safe work practices and troubleshooting procedures

Equipment control panels must be field marked to warn of potential arc flash hazards; specific details on the flash boundary and appropriate PPE are required on the warning labels for qualified persons who may work on or near the hazard. Warning signs that meets the ANSI Z535 Standard can be ordered from a variety of sources. PPE for arc flash protection is required and depends on the incident energy at every point where a worker may work on energized equipment. PPE could include shoes, gloves, flame-resistant clothing, and safety glasses/shields. The selection of the proper PPE and training procedures depends on an accurate arc flash assessment being done on the electrical system. Professional services are available in most locations and should be used to ensure that all arc flash regulations are followed.

### *Regulatory information and other resources*

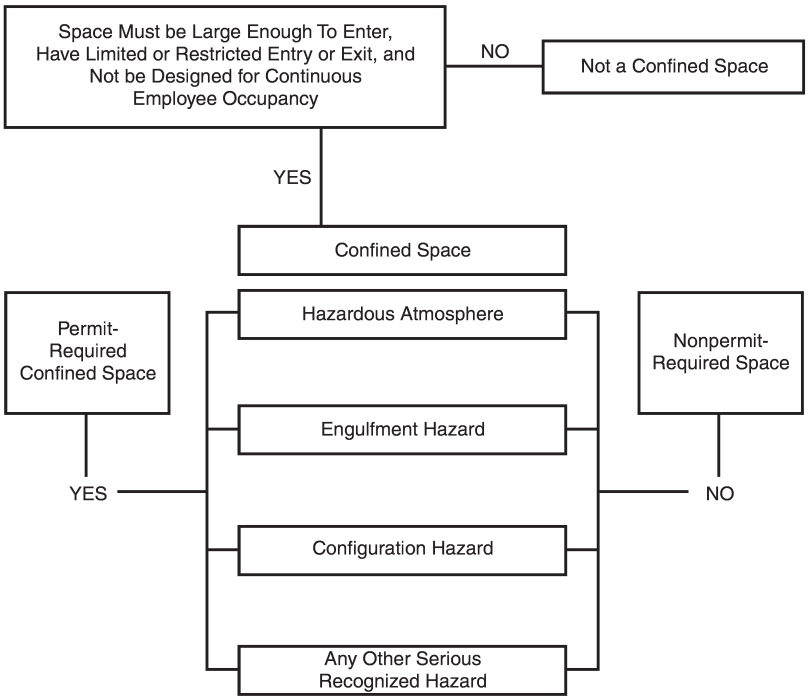
OSHA regulations 1910.302–308 and 1910.331–335 require that all "non-dwelling" facilities have an arc flash hazard analysis done to determine the presence of a flash hazard, the arc flash boundary, and the level of PPE required.

The National Fire Protection Agency (NFPA) 70E regulations provide a roadmap to meeting the latest workplace arc flash protection requirements and meeting the OSHA standards.

## Permit-Required Confined-Space Entry

**Description of hazard.** Water plant operators and associated maintenance staff are exposed to possible death or injury when entering what is considered a confined space. Examples of confined spaces in the water industry are storage tanks, tunnels, vaults, meter pits, excavations, and process basins. These spaces are large enough for a worker to enter, have restricted means of entry or exit, and may present hazards related to atmospheric conditions, engulfment, configuration, or any other recognized serious safety hazard.

**Common controls.** Atmospheric testing with direct-reading instruments is required before a confined space is entered. Also before an entry is allowed, a written entry permit must be completed and posted at the confined space location. In many situations, power ventilation equipment may be used to ensure adequate oxygen levels are maintained and toxic contaminants are not above permissible exposure levels. Figure 6-1 outlines a decision-making process for determining if a space is a permit-required confined space.




*Courtesy of Melinda Raimann, Cleveland (Ohio) Division of Water.*

**Figure 6-1 Confined space decision tree**

Rescue procedures must also be planned prior to the entry, and a minimum of one trained attendant must always remain outside the confined space to monitor the worker who has entered the confined space. Workers must be trained properly and equipped with the required safety equipment before the work is conducted.

Physical hazards from mechanical equipment must also be locked out to ensure worker safety. Valve pits or manholes that may be flooded with water or other fluids must also be rendered safe prior to entry. If work is performed on an elevated storage tank, additional fall-protection procedures need to be followed. When workers are exposed to air contaminants such as sandblasting materials, welding fumes, or paint solvents, additional air monitoring and explosive hazards controls need to be taken.

#### *Regulatory information and other resources*

OSHA regulations (1910.146).

## Excavations and Trenches

**Description of hazard.** Water distribution workers and associated inspection staff are frequently required to work in or around excavations and trenches. Hazards related to excavation and trenching operations include entrapment, suffocation, gas explosion, electrocution, and being struck by heavy equipment.

**Common controls.** *A competent person* must be trained to identify all existing and predictable hazards associated with the excavation or trench, including identification of soil types, and be authorized to take corrective action to eliminate hazards.

A written excavation safety plan needs to be developed to ensure compliance with existing safety standards. Components of the plan should include the following:

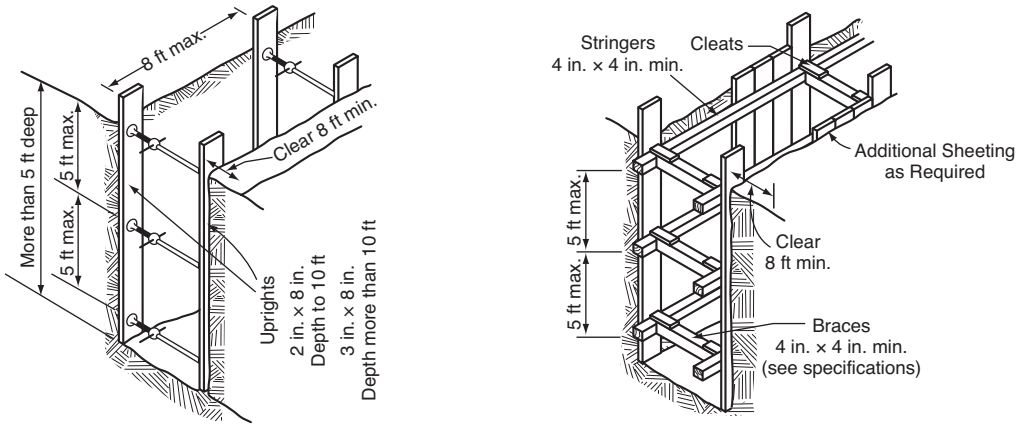
- Notification of the local "one-call" system for locating underground utilities
- Location of underground utilities
- Consideration of confined-space atmosphere potential
- Selection of proper soil protective systems and personal protective equipment and clothing
- Determination of soil composition and classification
- Assessment of surface and subsurface water problems
- Determination of depth of excavation and duration of work
- Training and supervision of all workers

The competent person must be onsite and ensure the plan is followed. Daily and periodic inspection of the excavation and trench site must be conducted and documented. Conduct an inspection before every shift, rain event, or any other event that increases hazards.

Soil testing must be done on freshly excavated samples from the work site; the testing determines the soil type and type of soil protective system that should be used. The three basic protective systems are sloping and benching, shoring, and shield (trench boxes) (Figure 6-2).

Sloping and benching systems for excavations 5 ft to 20 ft deep must be constructed under the instruction of the competent person. A registered professional engineer must design and stamp excavations greater than 20 ft deep to ensure safety. Other general hazard controls include

- Storing spoil piles a minimum of 4 ft from the side of excavation.
- Removing or support all overhead hazards (e.g., utility lines).
- Erecting signs and barricades to protect workers from vehicular traffic.
- Testing for a hazardous atmosphere daily if the excavation or trench is 4 ft or deeper and potential for such a hazard exists.




*Source: AWWA Water Operator Field Guide.*

**Figure 6-2 Hard, compact ground (left) can be braced at intervals, while saturated, filled, or unstable ground (right) needs additional sheeting or shielding to hold back loose soil.**

- Providing a means of egress from the excavation or trench with a ladder, ramp, or stairs so lateral travel distance does not exceed 25 ft.
- Requiring workers to wear rescue harnesses with a lifeline attached.
- Alerting rescue teams to the location of the excavation or trench when possible.

#### *Regulatory information and other resources*

OSHA regulation 1926.650, Safety and Health Regulations for Construction – Excavation

NIOSH training materials are available at www.cdc.gov/niosh.

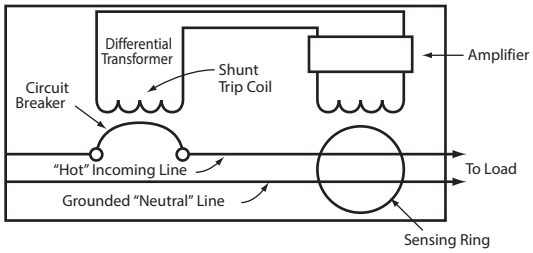
## Hazardous Energy Control (Electrical Safety)

**Description of hazard.** Water plant operators and associated maintenance staff are frequently exposed to many electrical hazards that can cause burns, arc blasts, fires, explosions, shocks, and electrocution (death). Overhead wires at various voltages are present on most water treatment facilities and throughout all service areas. The presence of water in the workplace compounds the hazard from electricity because water is a good electrical conductor. Electrical energy is the primary power source for all pumping and control equipment, and good lockout/tagout programs are essential to avoid exposure to live circuits.

**Common controls.** General electrical safety practices that are essential to a safe working environment include

- Maintaining all electrical equipment according to prescribed practices and manufacturers' instructions
- Inspecting all electrical equipment on a regular basis and making repairs only if authorized to do so; reporting all electrical failures and repair needs to appropriate power suppliers
- Ensuring all safety features are used as designed
- Protecting electrical cables and cords from damage
- Using extension cords only when necessary, but never as a substitute for permanent fixed wiring
- Avoiding wearing metal objects (rings, watches, etc.) when working with electrical systems
- Maintaining a minimum 10-ft (3-m) clearance from overhead wires that contain 50 kilovolts or less (higher voltages require a greater clearance distance)
- When working in damp locations, inspecting electrical cords and equipment carefully to avoid shocks and always making use of the ground-fault circuit interrupter (Figure 6-3)
- Avoiding use of electrical tools and lighting in wet and/or explosive environments, and using explosion-proof equipment and wiring instead in such conditions
- Ensuring that all electrical power tools are properly grounded or double insulated for protection from shock hazards
- Keeping doors on electrical panels in place and closed, correctly labeling circuits breakers and switches and plugging empty breaker slots
- Using voltage-rated rubber gloves or jumpers when removing the water meter or repairing a water service within an excavation

Electrical protective devices, including fuses, circuit breakers, and ground-fault circuit interrupters are critically important to electrical safety. Ensure all such devices are




The differential transformer continuously measures the current flow in the "hot" and "neutral" lines. Under normal conditions, the current is equal in each line. If there is a difference of as little as 5 mA (0.005 A) the amplifier energizes the shunt trip coil which causes the circuit breaker to trip in 1/40th of a second or less.

EXAMPLE: A hand drill has a defective motor winding allowing a portion of the current to flow to the metal case and thus through your body causing a shock and possible electrocution.

Always use a ground fault interrupter when using electrical equipment outdoors and in damp, wet locations. Always make sure your electrical tools are in good shape.

*Source: AWWA Water Operator Field Guide.*

**Figure 6-3 Ground fault interrupter**

installed and maintained properly. Arc blast (arc flash) occurs when high-amperage currents jump from one conductor to another through air, generally when servicing equipment. See the arc flash hazard section for more information.

### *Regulatory information and other resources*

OSHA regulations 1910.301–1910.399 govern electrical work and 1910.332 covers training in safe work practices when working with electrical equipment.

NIOSH training materials are available at www.cdc.gov/niosh.

## Hot Work

**Description of hazard.** Hot work is one the largest causes of facility fires. Hot work is a temporary operation involving open flames or producing heat and/or sparks. The sparks, welding slag, open flames, and hot surfaces can ignite nearby combustibles, starting what could become a raging, uncontrollable fire. A fire in a hidden area can often go unnoticed until it is well established, spreading and causing needless destruction to nearby equipment and materials.

**Common controls.** A formal permit to authorize hot work should be in place for all operations such as cutting, welding, brazing, grinding, soldering, or any other activity that produces an ignition source. A written corporate policy statement should specify who has the authority to issue hot work permits on all shifts. The permit should require that trained fire watchers maintain constant fire watch of the work area during the hot work and for one hour after work is completed, as well as monitoring of the area for an additional three hours.

Additional hot work precautions include the following:

- As much as possible, remove all potential fire hazards from hot work area.
- Use guards to confine the heat, sparks, and slag, and to protect the immovable fire hazards.

- Welders and other hot work personnel must wear PPE, including eye protection, helmets and/or hand shields, and other protective clothing.
- Keep appropriately rated fire extinguishing equipment in the area, in a state of readiness for instant use.
- Vent all hollow spaces, cavities, or containers to allow air or gases to escape before preheating, cutting, or welding.
- Place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.
- Never conduct hot work in the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air), or on a metal partition, wall, ceiling, or roof with a combustible cover.

Insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process. Before issuing a permit authorizing hot work, consider whether the work can possibly be avoided, or if there is another, safer, way to complete the work.

A sample hot work permit is available in the online resources at www.awwa.org/M3. The permit should be only valid for the single job and should expire at the end of the shift or on completion of the fire watch.

#### *Regulatory information and other resources*

OSHA Regulation 1910.252, Welding, Cutting, and Brazing, addresses safety precautions for hot work.

Iowa State University Department of Environmental Health and Safety Hot Work Permit Program details a hot work program. www.ehs.iastate.edu/publications/manuals/hotwork.pdf.

NFPA 51B: Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, provides guidance for people who manage, supervise, and perform hot work. www.nfpa.org.

## Materials Handling

**Description of hazard.** Water plant operations and maintenance tasks include various materials-handling activities. These work activities include manual lifting and the operation of cranes and hoists and powered industrial trucks, and other tasks related to water treatment and distribution. Workers can be at risk of collisions with moving parts and equipment, strain or injury from exertion or improper techniques, and other injuries.

**Common controls.** Workers must be properly trained to operate various types of materials-handling equipment. When cranes or hoists are used, a trained operator must be at the controls and all aspects of equipment inspection, maintenance, and operation procedures must be followed to ensure safety. Proper rigging for lifting is also required to prevent the load from shifting during the lift. When planning the lift, the operator must understand the characteristics of the load, including weight, dimensions, center of gravity, and the hazardous/toxic nature of material in the load.

Operators must also review the rigging to ensure slings and other devices are sufficient to support the load and attach it to the hook. During the lift, safe clearances must be maintained and workers must stay clear of the loads. Periodic inspections of all operating mechanisms, hydraulic lines, hooks, ropes, chains, and related electrical apparatus must be carefully documented. Any damaged or defective equipment must be immediately tagged and removed from service. All repairs and adjustments to this equipment must be performed by well-trained and certified workers.

Powered industrial trucks (forklifts) are common in many large water utility plants. All operators must be trained in the safe operation of the specific type of truck being used. Some basic rules for forklifts include the following:

- If the driver can't see past a load in front, then the forklift should travel backwards, carefully.
- Know the capacity and load limits for a vehicle, and never attempt to lift beyond them.
- Maintenance and repairs need to be conducted by authorized and trained personnel; call on trained mechanics when needed.
- When leaving a vehicle, lower the forks, put controls in neutral, set the brake, shut off the power, and remove ignition key or connector plug.
- Never park in front of fire equipment, doors, exits, or in high-traffic areas.

Manual lifting techniques that avoid causing back injuries are essential (Figure 6-4). The following guidelines will help avoid back problems:

- Wear back braces if required to lift and carry heavy loads.
- Avoid twisting and turning movements.
- Use legs to position and move the torso.
- Avoid leaning or bending over for extended periods.
- Stretch and exercise the back before starting work each day.
- Inspect the work area for slip, trip, and fall hazards.
- Inspect steps and stairs before climbing; use a handrail whenever possible.
- Lift with the legs; position the body so the load is centered and supported by the body before lifting and carrying.
- Avoid sudden jerks and pulls on a load, which could cause muscle sprain or injure discs.

**Figure 6-4 Proper lifting technique helps avoid back injuries.**

### *Regulatory information and other resources*

OSHA regulations 1910.176 –1910.184 govern materials handling.

NIOSH training materials are available at www.cdc.gov/niosh/topics.

## Noise Exposure

**Description of hazard.** Water plant operators and associated maintenance staff are frequently exposed to noise levels that can be harmful to hearing. Noise sources include pumping and process equipment, alarms, generators, compressors, and ventilation equipment. Excessive noise exposure can cause temporary or permanent hearing loss, stress, and other physical problems.

Generally, noise levels above the 85-decibel level (dBA), expressed as an 8-hour time-weighted average, trigger the requirement for a hearing conservation program. Certain impact or impulse noise levels may also be present and mandate the use of hearing protection.

**Common controls.** Noise can be controlled in the work environment by isolation or enclosure of the source of the noise. Control rooms can be constructed in treatment plants to provide a low-noise environment for operators. If operators must enter high-noise areas they can be required to use personal hearing protection to protect against high noise levels.

Hearing conservation programs are mandatory when workers' noise exposure levels equal or exceed a prescribed regulatory dose (time-weighted average based on 8-hour time interval). A hearing conservation program includes noise level monitoring, initial and annual audiometric testing of workers, mandatory use of hearing protection that is properly fitted and maintained, and annual training on the harmful effect of noise. Hearing protection must be made available to workers who are exposed above the action level and required when the levels of noise exceed the noise levels standards. Earplugs and earmuffs are commonly used for hearing protection and usually reduce noise exposure levels by 15–20 decibels.

### *Regulatory information and other resources*

OSHA regulation 1910.95

NIOSH training materials are available at www.cdc.gov/niosh/topics.

## Pressure Vessels

**Description of hazard.** A pressure vessel is a cylindrical or spherical metal container capable of withstanding pressures exerted by the contained material. Many liquids and gases must be stored under high pressure in such vessels. Safety codes have been developed that specify the container design for specified conditions, with special emphasis on the strength of the vessel to prevent rupture and subsequent explosions. All shells, test chambers, tanks, and model parts designed for internal pressures greater than 15 pounds per square inch (psi) are considered pressure vessels.

Pressure vessels include compressed-gas storage tanks (e.g., air, oxygen, nitrogen tanks), anhydrous ammonia tanks, autoclaves, chemical reactors, hot water storage tanks, hydro pneumatic tanks, and refrigerant vessels, designed for a pressure greater than 15 psi and a volume greater than 5 cubic feet in volume or one and one-half cubic feet in volume with a pressure greater than 600 psi.

When pressure vessels fail, the result is usually catastrophic: a ruptured vessel releases vast stores of energy and contents. The results may produce a shock wave of the vessel contents, and high-speed projectiles. Such failure poses a safety risk to personnel,

jeopardizes other critical equipment and material, and may result in the release of hazardous or toxic contents, environmental pollution, and loss of production.

**Common controls.** Pressure vessels that contain only low pressures are constructed of tubes and sheets rolled to form cylinders. The walls of pressure vessels whose contents are under high pressure, however, must be thick enough to provide adequate strength to avoid rupture. Hydraulic and pneumatic cylinders are machined components that are types of pressure vessels.

To ensure that pressure vessels are operating and maintained safely, periodic inspections must be conducted by qualified and authorized personnel every two years (every five years for hydro pneumatic tanks). Internal inspections are conducted if deemed necessary by the inspector of record. There are three types of board-certified pressure vessel inspectors:

- Boiler and Pressure Vessel Inspector: an employee of the local boiler safety regulatory agency who is authorized to inspect any boiler or pressure vessel subject to the ASME Boiler and Pressure Vessel Code (BPVC)
- Special Inspector: an insurance company employee who is only authorized to inspect what the inspector's company insures
- Owner–User Inspector: an employee of the organization that operates the boilers or pressure vessels who is trained under the company's authorized inspection program and supervised by one or more engineers with qualifications satisfactory to and approved by the boiler safety agency having jurisdiction for that facility.

To be authorized to perform repairs, a repair company must hold an "R" stamp issued by the National Board of Boiler and Pressure Vessel Inspectors. In all cases, the owner and the repair company must consult an inspector before a repair is begun. The completed repair is subject to the inspector's acceptance.

If an accident does occur, a detailed report of the accident must be submitted immediately to the regulatory agency. If someone is injured or the tank explodes, neither the vessel, nor any parts are to be removed or disturbed before the chief inspector grants permission, except for the purpose of saving human life and limiting consequential damage.

#### *Regulatory information and other resources*

Pressure vessels must be designed in compliance with the latest edition of the ASME BPVC, Section VIII or Section III.

Pressure-vessel welding must be in compliance with the BPVC Section IX for welding qualifications and Section V for welding inspection.

OSHA regulations 1910.101 through 1910.111 address pressure vessels used for compressed gases.

## Tractor Operation

**Description of hazard.** Tractors are versatile tools that can be used for many different tasks. Unfortunately, when used improperly, tractors can and do cause many severe injuries and fatalities. Many accidents are similar, such as rollovers, flip-overs, and back-overs. Most tractor incidents are caused directly or indirectly by operator error—bad judgment, unnecessary haste, or carelessness. In many cases, tractor operators work independently without much supervision, so operators must understand and buy into the importance of safety. To promote this safety culture, management must stress safety on a regular basis.

Common hazards and accidents in tractor operation of are:

- Rollovers
- Flip-overs

- Caught in or between pinch points
- Power takeoff (PTO) hazards
- Fueling
- Back-overs/struck by
- Front-end-loader incidents
- Incidents with attachments
- Falls from the equipment
- Hydraulics
- Shear and cutting points
- Thrown objects
- Highway incidents
- Hot surfaces
- Noise

Tractor rollovers happen when the center of gravity moves past a baseline of stability, either to the side or rear of the machine. Many rollovers happen at speeds less than 8 mph and on slopes less than 5 degrees. A tractor can flip in less than one second, so once it reaches the point of no return, it is too late.

Contributing factors to rollovers include the various dimensions and weights of implements, operating speed, type of terrain, and moisture in soil.

Common causes for rearward rollovers:

- Tractor is stuck in mud or soft soil, which prevents the rear wheels from rotating
- Climbing a hill that is too steep
- Releasing the clutch too quickly with the transmission in a low gear and engine at a high speed

Side rollovers can be caused by

- Driving on a hillside that is too steep
- Driving too close to the edge of a roadside ditch or embankment
- A front-end loader that is elevated too high on a hillside or in a turn taken at excessive speed

**Common controls.** Tractor safety has improved greatly over the years. Rollover protective structures, seat belts, improved guarding, enclosed cabs, electronic controls, stability sensors, and climate control have all contributed to making tractor operations safer and more comfortable.

Prior to operating a tractor, employees should assess the work area for obstacles, holes, slopes, ditches, curbs, wire, glass, and bees. Conduct tractor pre-operation checks, and notify a supervisor if defects are found. Employees should wear PPE and always maintain and use the tractor's safety features (e.g., rollover protective structures [ROPS], seat belts, and PTO shields). Operate the tractor and implements safely and according to the manufacturer's instructions. Although tractors are versatile machines, other machines may be better suited to specific tasks and should be used instead. Know the equipment's blind spots, and never carry passengers.

ROPS work by limiting a rollover to 90 degrees and preventing the operator from being crushed under the weight of the tractor. ROPS work only if a seat belt keeps the operator in the cab as the tractor is rolling.

Proper training should include classroom and practical lessons and should be documented in writing. This training should include

- Tractor and implement hazards
- Review of operator's manuals
- The importance of not operating defective equipment
- Location of guards, shields, and other safety devices
- Identification of safety hazards at the work site
- Hands-on supervised instruction
- Competency test on equipment and implements
- Instruction on attaching implements

Tractors generate deadly carbon monoxide so they should not be used in buildings. If operation in buildings is required, be sure there is enough ventilation to eliminate the possibility of carbon monoxide buildup.

Safety equipment that should be on all tractors:

- Seat belt
- Rearview mirrors
- Head/tail/turn lights
- Backup alarm
- Slow-vehicle warning triangle
- Fire extinguisher (5 lb multipurpose—ABC class)
- High-intensity warning lights

Prevention of side rollovers:

- Slow down when cornering (centrifugal force pivots a tractor on the outside wheels).
- Avoid working on steep slopes if possible.
- Stay at least one tractor width away from the edge of a bank.
- Follow operator manual instructions when operating equipment on slopes.
- Make wide slow turns.
- Know the terrain: small holes, depressions, large rocks, or stumps can cause tip-over.
- Go down slopes in low gear.
- Back up a slope if transporting a heavy implement.
- Follow the tractor operator's manual and instructions on side mount implement placement (up or down hill).

Prevention of flip-overs:

- Release the clutch only when rear wheels can rotate forward.
- Do not climb steep hills in a forward direction. Instead, back the tractor up the hill.
- Use only enough engine speed to start tractor moving while engaging the clutch smoothly.

- Change speed gradually by applying power smoothly.
- Ballast (counterbalance) the tractor properly for the job.
- Hitch loads properly to a drawbar; don't attempt to pull logs or other objects that may catch on an obstruction in the ground and pull the front end off the ground. Use the drawbar at the height recommended in the operator's manual. Don't alter or raise the height of the drawbar.
- Use reverse gear to break tractor tires free from frozen conditions.
- Use another machine to pull a tractor out of the mud.

When traveling on the road in a tractor:

- Attach a slow-moving-vehicle emblem.
- Use headlights and high-intensity flashing lights.
- Use an escort vehicle when feasible.
- Secure attachments in the transport position. Never operate attachments in transit.
- Take it slow and pull over when needed to let normal traffic pass.
- Take special care at intersections, turns, and curves.
- Always leave room to stop safely.
- Carry a charged cell phone.

#### *Regulatory information and other resources*

OSHA regulations 1926.1001 and 1926.1002 describe the requirements for installation of ROPS on heavy equipment used in construction.

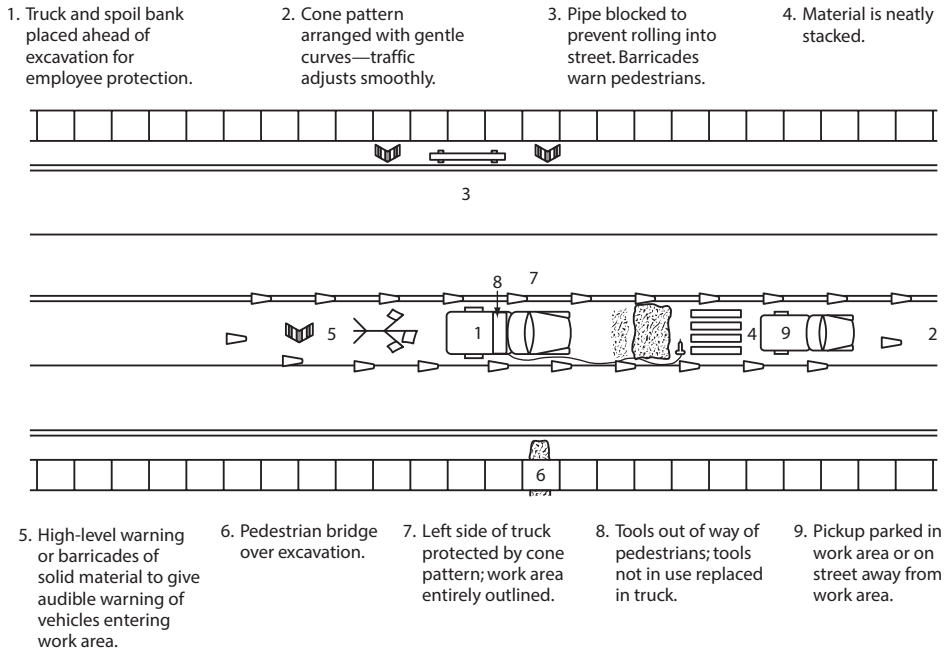
Recommendations Specific to Hazards Associated with Heavy Equipment and Powered Industrial Truck Use. www.osha.gov/SLTC/etools/hurricane/heavy-equip.html

## Traffic and the Work Zone

**Description of hazard.** According to the Bureau of Labor Statistics, transportation incidents and workers struck by vehicles or mobile equipment account for the highest number of fatal work injuries. In a work zone, workers are susceptible to the careless driving of oncoming traffic as well as to the actions of work vehicles and equipment.

**Common controls.** Effective temporary traffic controls must provide for the safety of workers, road users, and pedestrians, while providing for the efficient completion of the work activity (Figure 6-5). Construction area warning signs must be visible at all times when work is being performed and removed or covered promptly when the work is complete. Hazards associated with working on the roadway cannot be completely eliminated because of the constant shifting and changing nature of work zone activity, but they can be greatly reduced by implementing the following controls:

- Train all employees on work zone traffic safety.
- Evaluate the work space in advance to ensure work area protection and minimize possible disruptions to pedestrians and vehicular traffic.
- When exposed to vehicular traffic, employees should wear high-visibility safety apparel.
- Design and implement a traffic control plan (TCP) according to the characteristics of each location, such as speed, volume, direction of traffic, time of day, type of work, and duration of work.




*Source: AWWA Water Operator Field Guide.*

**Figure 6-5 Proper placement of cones, vehicles, pipes, and equipment help keep a field operation safe for workers, pedestrians, and public traffic.**

- Set up advance warning signs to alert oncoming drivers to the work area. Signs must convey a simple, easily understood message.
- Use channeling devices (cones, barricades, etc.) in the transition zone for smoothing vehicular traffic flow and to separate vehicular traffic from the work space.
- Monitor traffic flow on a continuous basis. Be aware of changing conditions of the work area or traffic, and make adjustments accordingly.
- When feasible, place reserve trucks and other work vehicles in the work zone in a manner to provide additional protection to the work area.
- Keep equipment and material inside the work zone to prevent employees from entering an unprotected area adjacent to the work zone to access the equipment.
- Promote awareness of the dangers of working around vehicles and moving equipment in both the work area and outside the protected activity zone.

In addition to a TCP for outside of the work zone, an *internal* traffic control plan (ITCP) should be created for the work zone itself. ITCPs are used to safely coordinate and control the interaction between workers, construction vehicles and operating equipment within the workspace.

### *Regulatory information and other resources*

OSHA regulations 1926 Subpart G—Signs, Signals, and Barricades

Federal Highway Administration's *Manual on Uniform Traffic Control Devices for Street and Highways,* which dictates traffic control signs or devices used for protection of con struction workers and sets minimum standards, provides guidance, and ensures uniformity of traffic control devices to promote highway safety and efficiency.

ANSI/ISEA 107-2004 American National Standard for High-Visibility Safety Apparel and Headwear Class 2 or 3 requirements

## Driving Hazards

**Description of hazard.** *Alcohol and car accidents.* Almost 11,000 people die every year in accidents related to drunk driving. Of those, more than three youths die every day. The average for a drunk driving–related death is one person every 50 minutes. These deaths make up about one third of all traffic deaths. In terms of distance, a drunken person needs an estimated 4 extra feet of breaking distance compared to a driver who hasn't had anything to drink.

*Cell phones.* Cell phones have changed the world in so many ways. They connect people across the county and even the world. They allow immediate contact with emergency services, no matter where an accident occurs, which can save lives. Unfortunately, using cell phones while driving is a main reason why people need to call for help in the first place. According to autoinsurance.org, cell phones are responsible for 24,000 injuries per year and 995 deaths.

Twenty-one percent of drivers admit to texting while driving, and 46 percent of teens admit to texting while driving. Texting while driving increase chances of crashing by a factor of eight, which is twice as bad as getting behind the wheel while drunk. A texting driver needs 70 extra feet of braking distance to stop a car, compared to an attentive driver.

*Weather and car accidents.* The weather is also a powerful foe. Icy or wet weather creates slippery, unsafe roads and the risk of hydroplaning. Snow-packed and slushy roads are difficult to navigate. Precipitation, fog, and dust storms impede vision. Wind can push light or high-profile vehicles off course. Add speed that is excessive for the conditions and an accident is bound to happen. More than 1.5 million weather-related accidents occur every year in the United States, resulting in 673,000 injuries and 7,400 deaths.

*Eating, drinking, and car accidents.* Splitting attention between the road and food or a beverage can also be dangerous. Studies show that eating or drinking can increase the chance of an accident by 80 percent. Seventy percent of people admit to eating while driving, and 80 percent acknowledge drinking while driving.

**Common controls.** No one can control another driver. Alertness and attention to the road, other drivers, and surrounding conditions are key to safe navigation of the roads and avoiding the hazardous behaviors of other drivers and the weather. Avoid texting, talking on the phone, and eating or drinking while driving. Don't consume alcohol or drugs and then get behind the wheel. Alter driving habits according to the weather, and leave extra time to arrive at a destination. Turn lights on during hazardous weather and at dawn and dusk.

Employ these defensive driving techniques:

- Scan the roadway and adapt to conditions.
- Anticipate the actions of other drivers.
- Use a turn signal so other drivers know what to expect.
- Know a vehicle's stopping distance and use the two-second rule for following distances. (Remain at least 2 seconds per 5 mph from the vehicle in front to provide a distance of one car length stopping distance.)
- Respect other users of the roadway, and share the road with all travelers, including bicyclists.
- Pass only when allowed and when there is no oncoming traffic.

- Yield the right of way.
- Be alert and avoid distractions.

#### *Regulatory information and other resources*

National Highway Traffic Safety Administration: www.nhtsa.gov/Driving+Safety

Official US government website for distracted driving: distraction.gov

Insurance guidelines for safe driving: autoinsurance/driving-hazards

## Hot and Cold Weather Conditions

**Description of hazards.** Working in extreme weather or conditions—hot or cold—can be dangerous. People who work outdoors must be aware of the dangers, the signs of injury, and the way weather hazards can be controlled.

**Hot-weather hazards.**

High temperatures + high humidity + physical work = Heat illness.

When the body is unable to cool itself through sweating, serious heat illnesses may occur. Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees. The most severe heat-induced illnesses are heat exhaustion and heatstroke.

*Heat exhaustion* should not be dismissed lightly. Fainting from heat exhaustion can be dangerous, not only because the victim is obviously ill, but also because the victim may be operating machinery or controlling an operation that should not be left unattended or that could pose an additional danger to the victim. The symptoms of heat exhaustion include headache, nausea, vertigo, weakness, and thirst.

*Heatstroke* occurs when the body temperature rises to critical levels, causing a medical emergency. If the body temperature is too high, death can occur. The symptoms of heatstroke include dry pale skin with no sweating, hot red skin that appears sunburned, rapid heartbeat, shallow breathing, mood changes such as irritability, and confusion.

**Common controls.** A victim of heat illness should be moved to a shady or air-conditioned area and outer clothing removed. If heatstroke is suspected, call 911. Wet the person's skin with cool water by applying damp towels or spraying the victim. If the victim is able, have him or her drink cool water or other nonalcoholic beverage without caffeine.

Do not allow the person to leave the site or be left unattended unless authorized by a medical professional. The medical outcome of an episode of heatstroke depends on the victim's fitness and the timing and effectiveness of first aid treatment.

Controlling heat on the job is the first step in preventing overheating. Common controls include

- Ventilation, air cooling, fans shielding, and insulation in hot work environments
- Frequent rest breaks in a cooler environment
- Drinking small amounts of cool (50–60 °F/10–15.5 °C) water or nonalcoholic and non-caffeinated liquid frequently—one cup every 20 minutes
- Additional breaks for anyone showing signs of heat-related strain or fatigue, particularly new employees or workers just back from vacation or illness who are not yet used to the heat environment
- Doing heavy work during the coolest part of the day
- Time to acclimate workers to heavy, hot work

- Dedicated first-aid training on heat disorders in every hot work area or for every work crew
- A buddy system for workers in chemical protective clothing to observe each other for any medical problem

**Cold-weather hazards.** When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, including permanent tissue damage and possibly death. Prolonged exposure to freezing or cold temperatures or cold-water immersion may cause trench foot, frostbite, and hypothermia.

*Hypothermia* occurs when the core body temperature drops below 95 °F (35 °C). Symptoms of hypothermia include uncontrolled shivering, slurred speech, clumsy movements, fatigue, confused behavior, weak pulse, and slow, shallow breathing. If any of these signs are observed, call for emergency help.

*Frostbite* occurs when deep layers of skin freeze, becoming hard and numb, and usually affects the extremities—fingers, hands, toes, feet, ears, and nose. Symptoms of frostbite include hard, pale, and cold skin; pins and needles feeling, followed by numbness; and aching or throbbing of the affected area.

*Trench foot* occurs when the feet become swollen and itchy, then very painful, and leg cramps may occur. The skin may blister and die. It may involve the tip of the nose and ear as well. Workers are at increased risk of cold exposure when they have certain health conditions, such as cardiovascular disease, diabetes, and hypertension; they take certain medications; they are in poor physical condition; or they are older.

**Common controls.** Seek medical attention immediately for hypothermia, and quickly for cases of frostbite and trench foot. If medical help isn't immediately available for hypothermia,

- Move the victim to a warm, dry location if possible; if not, shield him or her from the cold and wind as much as possible, including insulating the body from cold ground.
- Limit movements to only those that are necessary. Do not massage or rub the person. Vigorous or jarring movements may trigger cardiac arrest or further damage affected skin.
- Remove wet clothing; cut it away if necessary to avoid excessive movement.
- Cover the victim with layers of dry blankets or coats, including the head, leaving only the face exposed.
- Share body heat by lying unclothed under the covers next to the victim, making skin-to-skin contact.
- Monitor breathing. If the victim's breathing has stopped or appears dangerously low or shallow, begin cardiopulmonary resuscitation (CPR) immediately.
- Provide warm beverages if the affected person is alert and able to swallow.
- Apply warm compresses only to the victim's neck, chest wall, or groin but *not* to the arms or legs, which forces cold blood back toward the heart, lungs, and brain, causing the core body temperature to drop.

First aid for frostbite or trench foot includes the following:

- Soak the affected area in warm water (102 to 110 °F [39 to 43 °C]) or repeatedly apply warm cloths to affected ears, nose, or cheeks.
- Wrap the frostbitten areas with dry, sterile dressings; wrap between frostbitten fingers or toes to keep them separated.

If protection from refreezing cannot be guaranteed, delay the initial rewarming process until a warm, safe location is reached to prevent thawing and refreezing, which may cause more damage.

Controlling cold conditions on the job is the first step in preventing frostbite and other cold-induced conditions. Ways to keep warm and safe include these:

- Wear proper clothing, particularly insulated, layered clothing, gloves, and hats.
- Train workers about cold-induced injuries and illnesses and appropriate first-aid techniques.
- Take frequent short breaks in warm dry shelters.
- Avoid exhaustion or fatigue; energy is needed to keep muscles warm.
- Use the buddy system to recognize danger signs, especially when the temperature is 10 °F (–12 °C) or below and when working near water.
- Drink warm beverages but avoid caffeine and alcohol.
- Eat warm, high-calorie foods.
- Provide heated trailers, shelters, or other warm areas for workers.
- Schedule outdoor work during the warmest part of the day, and plan a work/rest schedule that avoids prolonged exposure to the cold.
- Take more breaks when the temperature is low or the wind speed is high.
- Shield the work area from wind and draft.
- Allow workers to become acclimated to the cold before working full time in a cold environment.
- Keep an extra supply of clothing in the vehicle for workers who must travel for extended periods in the cold weather.
- Replace fluids regularly, particularly with warm liquids, because working in cold dry air can cause more water loss than usual.
- Review cold and heat stress policies annually.

#### *Other resources*

Mayo Clinic, Patient Care & Health Info, Diseases and Conditions. www.mayoclinic.org/diseases-conditions

National Institutes of Health, U.S. National Library of Medicine. www.nlm.nih.gov/medlineplus/ency

## BIOLOGICAL HAZARDS

### Animals and Insects

**Description of hazard.** Water plant operators and associated maintenance staff are frequently exposed to vector-borne diseases from the bites of infected ticks and mosquitoes. One of the most common tick-borne diseases in the United States is Lyme disease. Ticks are found in wooded areas, high grass, or leaf matter. West Nile virus, which affects about one in five people who are infected, is carried by mosquitoes that can be found near standing water or in weedy or wooded areas.

Rodents and other wild animals can also carry disease. Both live and dead animals can carry rabies and rat bite fever. Hantavirus has also been found in rodent droppings, and infection can lead to hantavirus pulmonary syndrome (HPS), which can be fatal.

Symptoms of vector-borne diseases often occur one to five weeks after exposure and can include fever, headaches, fatigue, body and muscle aches, vomiting and diarrhea, joint pain, rash, stiff neck and, paralysis.

Stinging insects that fly (e.g., bees, wasps, and hornets) can cause reactions that range from mild discomfort to severe allergic reactions requiring immediate first aid or medical care. Fire ants can bite and sting, injecting venom that causes a burning sensation and red bumps at the sting site, which develop into white fluid-filled pustules in one to two days. Poisonous snakes and spiders, such as the black widow and brown recluse, are frequently encountered by meter readers and installers and other distribution system workers.

**Common controls.** If a worker is bitten or stung by an insect or rodent and symptoms of severe illness are apparent, or is bitten by a poisonous snake, seek immediate medical attention. Otherwise, monitor the victim over time to determine if symptoms of illness occur.

Numerous steps can be taken to avoid vector-borne diseases and poisonous critters.

- Wear light-colored clothing, hat, long-sleeved shirt, and long pants tucked into boots to cover as much of the body as possible.
- Use insect repellents containing 20 percent to 50 percent DEET or Picaridin on exposed skin and clothing.
- Check skin and clothing for ticks daily, especially hair, underarms, and groin.
- Avoid working outdoors during dawn and dusk hours when mosquitoes are usually most active.
- Do not disturb ant mounds, and check over an area for ants before starting to work.
- Workers with a history of severe allergic reactions to insect bites or stings should carry an epi-pen (auto-injector) and advise coworkers of this condition.
- Avoid direct contact with rodents, and wear protective clothing—including respiratory protection and gloves—when removing dead animal remains or droppings.
- Wear boots that are at least 10 inches high, and watch for snakes sunning on fallen trees, limbs, or other debris.
- Use flashlights to scan work area for spiders before entering meter pits or vaults and wear long-sleeved shirt and long pants.

### *Other resources*

Local college or university extension programs typically have information about pest control specific to an area and the prevalence of specific vector-borne diseases.

Centers for Disease Control and Prevention. www.cdc.gov

## Bloodborne Pathogens

**Description of hazard.** Bloodborne pathogens are infectious microorganisms present in blood that can cause disease in humans. Workers who are exposed to these pathogens are at risk for hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV), and other diseases. Water system workers trained in first aid who can reasonably be anticipated to come into contact with blood as a result of doing their job duties are covered

by the OSHA Bloodborne Pathogens Standard. Laboratory staff may also become exposed when working with sharp implements or beakers that may break and cut a worker.

**Common controls.** Employers must identify job positions that may result in contact with bloodborne pathogens, along with a list of tasks and procedures performed in these positions that may result in worker exposure. A Job Safety Analysis, discussed in chapter 2, would serve in identifying these roles as well as engineering controls, such as properly labeled disposal containers for sharp objects and infectious waste, including the bloodborne-pathogen hazard.

First-aid kits should include appropriate PPE, such as gloves and eye protection, to prevent exposure to blood and other potentially infectious materials. Other steps to protect against worker infection by bloodborne pathogens include

- Establishing a written exposure control plan and updating it annually
- Making vaccinations for hepatitis B available to all workers with occupational exposure
- Making post-exposure evaluation and follow-up available to exposed workers
- Providing information and training to workers and maintaining worker medical and training records

#### *Regulatory information and other resources*

OSHA regulation 1910.1030

OSHA fact sheets and training information are available at www.osha.gov.

## CHEMICAL HAZARDS

### Chemical Exposure and Highly Hazardous Chemicals

**Description of hazard.** Water plant operators and associated maintenance staff are often required to work with chlorine gas, ammonia, acids, bases, and other highly hazardous chemicals. Accidental releases of these chemicals have been reported by water treatment facilities across the United States and Canada. Such releases pose a significant threat to water operators and emergency responders.

**Common controls.** To prevent against unexpected releases, water suppliers must establish a comprehensive process management program. A key provision of process safety management (PSM) is the process hazard analysis, a careful review of what could go wrong and what safeguards must be implemented to prevent a release of hazardous chemicals.

Training and written materials for these hazardous chemicals must be available to workers. Water systems must develop and implement a formal hazard communication program. This program details how the employer will meet the requirements for labeling, and will provide safety data sheets (SDS) and training for each water system worker. An example SDS and description of the required information that must be provided is among the electronic resources for this manual, available at www.awwa.org/M3.

#### *Regulatory information and other resources*

OSHA regulation 1910.1200 for Hazard Communication

OSHA regulation 1910.119 for Process Safety Management and Appendix (list of highly hazardous chemicals) and Appendix C (compliance guidelines and recommendations that can be used to meet the PSM standard requirements)

PSM Covered Chemical Facilities National Emphasis Program (CPL 03-00-014, Nov. 29, 2011)

*Environmental Compliance Guidebook: Beyond US Water Quality Regulations,* by Christine Herndon and Shelly Hemming, provides handling and disposal guidelines, as well as regulatory information, for hazardous chemicals and waste.

## Compressed Gases

**Description of hazard.** Water plant operators, associated maintenance staff, and laboratory technicians are often required to work with compressed gases in treatment plants, maintenance facilities, and associated laboratories. Numerous potential physical and health hazards are associated with compressed gases such as propane, oxygen, nitrogen, argon, chlorine, ammonia, and compressed air. Compressed gases can be stored in cylinders (Figure 6-6), portable tanks, or stationary tanks.

Compressed gases are hazardous because they are contained in high-pressure containers and can be released accidentally from a broken or leaking valve or safety device. When unsecured, uncapped cylinders can be knocked over, breaking the valve and releasing the high-pressure gas—turning the damaged cylinders into uncontrolled rockets or pinwheels and potentially causing severe injury and damage. Compressed gas in chemical reaction systems can cause vessels to burst if they are improperly released, create leaks in hoses, or produce runaway reactions.

**Common controls.** All workers handling or using cylinders must have basic training in the use of gas cylinders, emergency shutoffs, proper equipment design, leak-testing procedures, and the use of appropriate respiratory protection in the event of a release of a compressed gas. Other controls include the following:

- In storage, compressed gas cylinders must be restrained using straps, chains, or other suitable stand to prevent them from falling.


**Figure 6-6 Properly stacking and restraining pressure vessels reduces potential hazards.**

- Full cylinders must be segregated from empty cylinders and need to be legibly marked with the chemical or trade name of the gas.
- Storage areas need to be well ventilated to prevent accumulation of explosive concentrations of gas. No ignition sources are permitted in these areas.
- Hand trucks should be used for the transfer of cylinders from storage area to shop or laboratory areas.
- Valve protection covers must be in place during the transport of cylinders. Special procedures are required for changing cylinders of toxic, corrosive, and pyrophoric gases and liquids.
- Never use a cylinder that cannot be identified positively.
- Do not use compressed gas or air to blow away dust or dirt.
- When cylinders are not in use, close cylinder valves.
- On valves without hand wheels, use the wrench recommended by the gas supplier. The wrench must remain on the valve while the container is in use.
- On valves with hand wheels, never use wrenches or hammer a hand wheel to open or close a valve.

#### *Regulatory information and other resources*

OSHA regulations 1910.251 through 255 for welding, cutting, or brazing operations

Canadian Centre for Occupational Safety and Health. www.ccohs.ca/oshanswers/chemicals/compressed/compress.html#_1_3

Compressed Gas Association. www.cganet.com

## Asbestos, Lead, and Mercury

**Description of hazard.** Exposure to asbestos, lead, and mercury has serious health implications; these substances primarily affect the nervous system, kidney functions, blood cells, and blood pressure, and may have reproductive and developmental effects. Acute (short-term, high-level) exposure leads to a wide variety of neurological symptoms including weakness and exhaustion, insomnia, loss of appetite, and kidney disease. Chronic (long-term, high-level) exposure can severely affect the gastrointestinal and central nervous systems, leading to hypotension, hearing loss, male infertility, adverse reproductive effects in women, fetal effects, kidney failure, anemia, lethargy, and brain disorders.

Workers can be exposed to these materials through three main routes:

- *Inhalation* occurs when a worker breathes in particulates. Particulates can be generated by a variety of work processes and maintenance tasks. Dust and/or fumes can be produced from processes such as cutting, welding, and grinding.
- *Ingestion* occurs when a worker consumes products either directly or through cross-contamination from work surfaces or processes to the hands, and then into the body via food, drink, gum, smoking, etc.
- *Absorption* through the skin is a lesser route of exposure, but workers should be aware of the potential for hazardous materials to pass through the skin and into the body.

**Common controls.**

Hazard Identification.

The first step in preventing exposure to hazardous materials is identifying the presence of a potential hazard. Several identification and analytical methods are used:

- Surface test kits
- Usage records
- Lab analysis of samples
- X-ray fluorescence (XRF)
- Purchasing records
- MSDS database
- Material/substance inventories
- Awareness training

Risk Assessment.

Next, evaluate the risk of exposure to the material.

*Low-risk activities* are those in which workers may be exposed, but the airborne exposure is not likely to exceed the action level for the eight-hour time-weighted average (TWA) exposure limits. Exposures are only expected in rare circumstances as low-risk activities are not likely to disturb products to a degree that would lead to concern.

*Moderate-risk activities* include actions that directly disturb hazardous materials, through manual or powered methods that may produce airborne exposures and become a health hazard by approaching the eight-hour TWA exposure limits.

*High-risk activities* are those that may significantly disturb hazardous materials to a degree that airborne particles or fumes are likely to exceed occupational exposure limits.

Exposure Controls.

Control measures should be considered according to the hierarchy discussed in chapter 2 (elimination, substitution, engineering, administrative, behavior, and PPE). Control measures are *not* mutually exclusive, and several methods should be used in concert to control any hazard. Employ controls for higher-risk activities in addition to the control measures for lower-risk activities, e.g., if the risk activity is moderate, then both low-risk controls *and* moderate-risk controls must be used.

*Low-risk activity controls*

- Provide washing facilities where practicable, including wash basins, water, soap, and disposable towels.
- Make available appropriate hand cleaning products and disposable paper-type towels for field work.
- Prohibit eating, drinking, chewing gum, and smoking in the work area.
- Require hands to be washed before eating, drinking, smoking, or leaving the work area.
- Provide a clean area separate from the work area for coffee and lunch breaks.
- Clean up all dust and waste and place it in marked waste containers that are dust-tight.
- Keep the work area clean. Do not use compressed air or dry sweeping to remove dust.

*Moderate-risk activity controls*

- Erect barriers to prevent access by unprotected workers whenever practicable.
- Secure the area and restrict entry to those with appropriate training and personal protective equipment.

- Wear disposable coveralls if notable amounts of hazardous materials have the ability to contaminate clothing.
- Keep the work area clean using cleaning methods that minimize the generation of dust, such as wet dusting, sweeping, or vacuuming using a vacuum with a HEPA filter on the exhaust.
- Construct partial or full enclosures (if practicable) around work areas where significant scraping, sanding, or demolition will take place.
- Wear a half-face or full-face elastomeric respirator equipped with P100 HEPA cartridges or powered air-purifying respirator (PAPR) equipped with P100 HEPA cartridges. Choose the type of respirator depending on the amount of material removed and the duration of the work.

*High-risk activity controls.* Do not allow workers to engage in the regular or routine work activities that are associated with significant known exposure potential. Should high-risk work activities be identified, management needs to address the issue during the project planning stage and prior to commencement of the activity.

#### *Regulatory information and other resources*

Asbestos, lead, and mercury are regulated by OSHA 1910 Subpart Z, Toxic and Hazardous Substances.

The Agency for Toxic Substances and Disease Registry, a branch of the CDC, has a Toxic Substances Portal that details important information about toxic substances and how they affect our health: www.atsdr.cdc.gov/substances/index.asp.

## Hazardous Waste

**Description of hazard.** Sudden injuries or illnesses, some of which may be life threatening, can occur when employees are exposed to safety or health hazards in hazardous waste operations. Activities where hazardous conditions may exist include cleanup operations, corrective actions, treatment, storage, disposal operations, and emergency response. For instance, as a result of an uncontrolled spill of a toxic water treatment chemical, employees may be exposed to harmful toxins in the air and can suffer significant damage to their health; some of it may even be permanent or life threatening.

**Common controls.** Proper hazardous waste management is crucial for minimizing risks to employee health and the environment. Employers must make an effort to properly characterize all waste streams to determine which ones may meet the criteria for being classified as hazardous (ignitability, corrosivity, reactivity, toxicity, or listed). Site characterization, analysis, and control are required to identify specific hazards, to determine the appropriate health and safety control procedures needed to protect employees from identified hazards, and to control the hazardous exposures to employees before cleanup begins.

An employer must know its hazardous waste generator status in order to employ the specific programs and controls in place, such as obtaining a USEPA identification number, storage requirements, and specific employee training. Hazardous waste can only be moved offsite by a regulated hazardous waste transporter. When moving hazardous waste via a transporter, a hazardous waste manifest must be used to track it to its final destination and fate.

Employers who have staff working in hazardous waste operations and emergency response must develop and implement a written safety and health program to identify, evaluate, and control the safety and health hazards. The employer must also provide adequate training to all employees working on the site who may be exposed to harmful substances and situations. Proper training is a control method that gives each employee the

knowledge to prepare for the work to be done, including knowing what the hazards are at the site, learning how to use the PPE needed to perform tasks safely, understanding the work practices that will reduce risks, using safe engineering controls and equipment, and recognizing the signs that may indicate overexposure to a hazard.

#### *Regulatory information and other resources*

OSHA Hazardous Waste Operations and Emergency Response standard is 29 CFR 1910.120.

USEPA standards for hazardous waste management, including identification, storage and handling, can be found in 40 CFR 263.

The handling, transportation, communications, emergency response, training requirements, and security plans for hazardous materials can be found in 49 CFR 171–179.

*Environmental Compliance Guidebook: Beyond US Water Quality Regulations*, by Christine Herndon and Shelly Hemming, provides guidance in developing hazardous waste management programs for complying with federal environmental requirements.

## Pesticides (Licensed Applicators)

**Description of hazard.** Water plant operations and maintenance tasks sometimes involve the application of pesticides. These work activities include the handling of pesticides. Workers must be properly trained and licensed to handle these products. Storage of pesticides and empty containers must not be in proximity to water wells or other water treatment facilities to avoid accidental contamination or vandalism.

**Common controls.** Regulatory programs have developed specific rules for pesticide safety, including information on about the following:

- Pesticide selection
- Handling, mixing, and loading pesticides
- Application of pesticides
- Re-entry into treated fields and required posting
- Protective clothing and equipment and its care and maintenance
- Pesticide poisoning effects, symptoms, and first aid
- Medical supervision for pesticide applicators
- Toxicity of pesticides
- Minimizing exposure
- Risk assessment
- Personal safety and hygiene
- Types of spray equipment
- Equipment parts, with emphasis on nozzles
- Sprayer maintenance and cleaning
- Sprayer storage
- Pesticide transfer—closed systems

The licensed applicator should be made familiar with the various types of hand, ground, and aerial equipment available and with the various parts and functions of spray equipment. The applicator must be skilled in sprayer equipment calibration, maintenance, cleaning, and storage. The applicator should know that proper calibration of spray

equipment is one of the most important factors in pesticide application equipment and should understand the importance of performing frequent calibration.

To protect all workers and the general public from pesticide exposure, licensed applicators must oversee all aspects of transporting, storage, and disposal of pesticides. The following activities must be carefully planned and implemented as needed:

- Emergency response to spills and fires
- Bulk storage and handling, disposal, and reuse of dilute (leftover) spray mixture
- Pesticide record keeping

Workers must be trained in the proper decontamination techniques and the approved disposal alternatives for empty pesticide containers and unused or unwanted portions of pesticides.

#### *Regulatory information and other resources*

Standards for certification of applicators of restricted use pesticides were first printed in the *Federal Register* on October 9, 1974. The general standards from which these were derived are found in the Code of Federal Regulations, 40 CFR Parts 171.1–171.6 (categories for minimum standards) and 40 CFR Parts 171.7–171.11 (regulations for state plans for implementing certification).

Federal Worker Protection Standard, 40 CFR Part 170, covers pesticides

Local, state, provincial, and federal rules related to right-to-know laws, endangered species, pest resistance (local problems), and chemical/irrigation issues.

NIOSH training materials are available at www.cdc.gov/niosh/topics/outdoor/.

Iowa State University Extension and Outreach website www.extension.iastate.edu/workerprotection

*Environmental Compliance Guidebook: Beyond US Water Quality Regulations* provides guidance in developing pesticide management programs for complying with federal environmental requirements.

## PERSONAL (OR HEALTH) HAZARDS

### Drug and Alcohol Abuse in the Workplace

**Description of hazard.** The harmful use of drugs and alcohol in the workplace adds to the cost of injuries, absenteeism, lost production, worker compensation, and rehabilitation. It is estimated that the direct cost to industry of sickness and death from drug and alcohol abuse to industry is $3.7 billion per year.

Harmful use of drugs and alcohol can create a range of problems in the workplace. Employees with drug and alcohol problems can cause injury to themselves and others, jeopardize their job, and damage their physical and mental health.

Two kinds of drinking behavior and drug abuse significantly contribute to work-performance problems. One behavior is abusing alcohol or illegal/nonprescription drugs right before or during working hours (during lunch or company functions). The other is drinking alcohol or using illegal/nonprescription drugs the night before, causing hangovers during work the following day.

In the workplace, the impact of alcohol and drug abuse affects four major areas: accidents, productivity, medical expenses, and employee morale.

*Accidents.* Safety is a vital concern for organizations. Operating machinery under the influence of alcohol or drugs increases the likelihood of accidents and injuries. The American Council for Drug Education reports that substance abusers are about three and a half times more likely to be involved in accidents on the job and five times more likely to hurt themselves at work. They are also five times more likely to file for workers' compensation. Substance abusers are also responsible for 40 percent of all industrial fatalities. OSHA reports that 10 to 20 percent of US workers who die at work test positive for drugs and alcohol.

*Productivity.* Employee drug and alcohol use results in lost efficiency and quality, because substance-abusing employees are 33 percent less productive when they are at work than those who are sober, according to the American Council for Drug Education. These employees also increase human resource costs related to additional recruitment and training because substance abusers are 10 times more likely to miss work. Replacing an employee can cost anywhere from 25 to 200 percent of that employee's annual compensation.

*Medical expenses.* Employee substance abuse results in higher health care expenditures for illnesses and injuries, increasing premium costs. US Department of Health and Human Services studies show that drug abusers use twice as many medical benefits as their coworkers and are directly responsible for health care costs that are three times higher than the national average.

*Employee morale.* An organization that tolerates substance abusers runs the risk of losing conscientious and hardworking staff. Over time, the best workers will tire of working harder while substance abusers produce less and enjoy more time off. An estimated 3.1 percent of employed adults admit they've used illicit drugs before reporting to work and 7.1 percent say they drank on the job one or more times in the past year, according to sources cited by the US Department of Labor.

Additional problems from substance abusers can include: tardiness and sleeping on the job, theft, poor decision making, increased likelihood of having trouble with coworkers and supervisors or tasks, higher turnover, and disciplinary procedures.

**Common controls.** Work can be an important and effective place to address alcoholism and other drug issues by establishing or promoting assistance policies, training, and programs. Back in the late 1940s and early 1950s, the National Council on Alcoholism and Drug Dependence (NCADD) found that the workplace was ideally suited to address alcoholism through a focus on employee job performance and access to treatment. NCADD founded the employee assistance program (EAP) concept—then known as Operational Alcoholism Programs—as a joint labor-management program and wrote the first EAP manual and standards.

Without question, establishment of an in-house EAP is the most effective way to address resources and services. By encouraging and supporting treatment, employers can dramatically assist in reducing the negative impact of alcoholism and drug abuse in the workplace, while reducing related costs. Research has demonstrated that treatment programs pay for themselves in reduced health care costs that begin as soon as people begin treatment. Treatment programs also improve an individual's ability to function, leading to increased productivity at work.

In short, the steps to reducing the effects of drug and alcohol abuse in the workplace are:

1. Establish and enforce policies again drug and alcohol use.
2. Train supervisors and staff on recognizing impaired behavior and signs of drug/alcohol use.

3. Conduct employee testing when employee exhibits signs of impairment of drug/alcohol use.
4. Implement random testing procedures.
5. Establish an EAP.

#### *Regulatory information and other resources*

The National Council on Alcoholism and Drug Dependence has information about drugs and alcohol in the workplace at www.ncadd.org.

## Ergonomic Hazards

**Description of hazard.** Ergonomics is the science of fitting workplace conditions and job demands to the capabilities of the worker. Effective and successful "fits" help ensure high productivity, reduce illness and injury risks, and increase satisfaction among the workforce. Although the scope of ergonomics is much broader, the term here refers to assessing those work-related factors that may pose a risk of musculoskeletal disorders (MSDs) and recommendations to alleviate them.

Vibration and cold may add risk to these work conditions. Jobs or working conditions presenting multiple risk factors will have a higher probability of causing an MSD. The level of risk depends on the intensity, frequency, and duration of the exposure to these conditions. Environmental work conditions that affect risk include intensity, frequency, and duration of activities.

**Common controls.** Several approaches may be used individually or in combination to determine whether conditions in the workplace might be contributing to employees developing MSDs.

*Review and analyze injury and illness records*, including OSHA 300 logs and supporting 301 forms and workers' compensation claims, to determine whether there is a pattern of ergonomic-related injuries in certain jobs or work tasks.

*Analyze the jobs* or work tasks to identify potential ergonomic problems before employee injuries occur. Determine if jobs present ergonomic risks that may contribute to MSDs. Much of this work can be done in conjunction with the Job Safety Analysis discussed in chapter 2.

Be aware of common contributing conditions within the industry or job classifications. If other water organizations have ergonomic-related problems, then these problems may be common throughout the industry and should be looked at in each facility or utility.

A wide variety of possible solutions can be implemented to reduce or eliminate the ergonomic risk associated with jobs or work tasks in the water treatment industry.

#### *Regulatory information and other resources*

OSHA Ergonomic eTools are stand-alone, interactive, web-based training tools and are available at https://www.osha.gov/SLTC/etools/computerworkstations/index.html.

OSHA publications, *Job Safety and Health Quarterly* articles, and information from other agencies and sources

## First Aid and Access to Medical Assistance

**Description of hazard.** Sudden injuries or illnesses do occur in the workplace. Without immediate intervention, some injuries or illnesses may be life threatening. Sudden cardiac arrest (SCA) from asphyxiation, electrocution, or exertion may occur. Many utilities are located far from medical facilities, and the response time for emergency medical services (EMS) could be long.

**Common controls.** Designated staff should be trained as first-aid providers at all workplaces of any size if there is no medical facility nearby. Training in cardiopulmonary resuscitation (CPR) is particularly important because of the possibility of SCA. CPR may keep a victim alive until EMS arrive to provide the next level of medical care. An on-site automatic external defibrillator (AED) further increases the chances for survival.

Regular first-aid training is just one part of a workplace first-aid program, which should also include first-aid kits in accessible locations, including vehicles, a designated person who stocks and maintains the first-aid kits, knowledge of the response times for the local fire and rescue service or emergency medical professionals, written policies and procedures, and management commitment and worker involvement.

The first-aid program should reflect the known and anticipated risks of the workplace, with specific response training and supplies for injuries and illnesses that are known to occur in similar work environments, many of which are discussed in this manual.

A well-stocked first-aid kit includes:

- Abdominal pad
- Individually wrapped adhesive dressings (sterile gauze pads, rolls of gauze bandage, field dressings, triangular bandages)
- Antiseptic wipes
- Aspirin and non-aspirin for pain
- Burn cream
- Cold pack
- Dressing
- Eye wash
- First-aid cream
- First-aid manual
- Latex gloves
- Safety pins
- Scissors
- Splints and splint padding
- Sterile bandage compresses
- Tweezers

### *Regulatory information and other resources*

The OSHA Recording and Reporting Occupational Injuries and Illnesses regulation, 29 CFR 1904 provides specific definitions of *first aid and medical treatment.*

A specific example of the minimal contents of a workplace first-aid kit is described in American National Standards Institute ANSI Z308.1–2003, *Minimum Requirements for Workplace First Aid Kits.*

OSHA *Best Practices Guide: Fundamentals of a Workplace First-Aid Program,* https://www.osha.gov/Publications/OSHA3317first-aid.pdf

OSHA standard on medical services and first aid, 29 CFR 1910.151

Occupational Exposure to Bloodborne Pathogens standard 29 CFR 1910.1030; OSHA standards requiring CPR training: Permit-Required Confined Spaces,1910.146

Qualifications of Dive Team, 1910.410; and Construction Subpart V, Power Transmission and Distribution, 1926.950

## Lone Worker

**Description of hazard.** Working alone can be more hazardous than performing the same job when other people are present. A lone worker is defined as an employee who performs an activity that is intended to be carried out in isolation from other workers, without close or direct supervision. Such staff may be exposed to risk because there is no one to assist them should they be injured. If a lone worker is injured or an emergency occurs, the worker won't have access to help if no one is within shouting distance. If the worker is rendered unconscious, it may be hours before help arrives, and by then it may be too late.

**Common controls.** The following are safety recommendations for a variety of situations for lone workers.

- Conduct a risk assessment of the job activity to determine if it can be done safely by a lone worker under most circumstances.
- Communicate with employees about the specific risks they face and how to minimize them. If work cannot be rescheduled and must be performed alone, treat the tasks the same as any other, with a Job Safety Analysis that clearly spells out the risks.
- Require those who work alone to carry a cell phone, two-way radio, or personal alarm.
- Implement a call-in system where cell phones or two-way radios are used to communicate with coworkers at regular intervals. This may be adequate in low-risk working alone situations.
- Require lone workers to file a travel plan that describes their anticipated destinations.
- Ensure that foot travel paths, especially those traveled after sundown, are free of potential trip and fall hazards and that they are properly illuminated.

This is OSHA's underground construction rule for tunnels, shafts, chambers, and passageways: "Any employee working alone underground in a hazardous location, who is both out of the range of natural unassisted voice communication and not under observation by other person, shall be provided with an effective means of obtaining assistance in an emergency." Although no other federal OSHA rules specifically apply to working alone, the broad requirements of the safety and health regulations still apply.

### *Regulatory information and other resources*

OSHA regulation 29 CFR 1926.8000 for Underground Construction Rule for Tunnels, Shafts, Chambers, and Passageways

Blackline GPS is a safety tracking system provider: http://www.blacklinegps.com.

## Respiratory Hazards

**Description of hazard.** Water plant operators and associated maintenance staff are frequently exposed to various respiratory hazards, including dusts, chemical vapors, and gases. When engineering controls, such as general and local exhaust ventilation systems, are not adequate to control the hazard, workers must be required to use respiratory protection. Emergency procedures may also require the use of emergency escape or self-contained respiratory protective equipment.

**Common controls.** In order for workers to be protected, a respiratory protection program must be developed and followed. A worksite-specific respiratory program includes

1. Procedures for selecting respirators
2. Medical evaluation to ensure fitness to wear a respirator

3. Fit-testing protocol
4. Training in respirator use, cleaning, storage, and inspection
5. Air quality testing methods for atmosphere-supplying respirators (SCBA and airline supplies)

As with other safety programs, the respiratory protection program should be written and communicated to all affected employees. Include a sample request for medical clearance for respirator use and a sample respirator use and maintenance record form in the written program.

Training in respiratory protection is critical to worker protection. Retraining is required annually or whenever changes in the type of respiratory protection occur. Only NIOSH-certified respirators can be used in the workplace.

#### *Regulatory information and other resources*

OSHA regulation on respiratory protection 1910.134

NIOSH training materials are available at www.cdc.gov/niosh/topics/.

## Sanitation and Disease Prevention

**Description of hazard.** Many harmful infectious agents are potentially present in raw-water supplies, along waterways, and in waste materials generated by water treatment operations. These infectious agents include a variety of bacteria, viruses, and other agents. Working outdoors also introduces exposure to vector-borne diseases, including Lyme disease, West Nile virus, and other mosquito-borne diseases. Open water reservoirs also attract waterfowl and wildlife that may carry disease organisms.

**Common controls.** Maintaining clean and sanitary conditions is a primary concern in the water industry and ensures a workplace that protects the public health. General housekeeping requirements, water supply, toilets, washing facilities and lavatories, locker rooms, and eating and food storage areas are all covered by workplace health and safety regulations.

Floors need to be maintained in a clean and dry condition to avoid worker injuries from slips, trips, or falls. Waste receptacles should be maintained in a sanitary condition, and all garbage and refuse should be removed daily to prevent the entrance or harborage of rodents, insects, and other vermin. Nonpotable water inside a facility must be posted or marked to indicate the water is unsafe for drinking, personal cleaning, cooking, or washing clothes. Food and beverages should not be stored in toilet rooms or in any area that is exposed to toxic chemicals, such as laboratory refrigerators or coolers.

If workers are potentially exposed to vector-borne diseases spread by infected ticks and mosquitoes, they should use insect repellent and wear long-sleeved shirts and long pants that can be tucked into boots or socks. After potential exposure, skin and clothing need to be checked for ticks, which should be removed using tweezers. Anyone who develops symptoms of a tick-borne disease should seek medical attention promptly. In warmer months, working outdoors during dawn and dusk should be avoided if mosquitoes are present.

#### *Regulatory information and other resources*

OSHA regulations on sanitation, 1910.141

NIOSH training materials are available at www.cdc.gov/niosh/topics/

## Violence in the Workplace

**Description of hazard.** Workplace violence is violence or the threat of violence against workers. It can occur at or outside the workplace and range from threats and verbal abuse to physical assaults and homicide, one of the leading causes of job-related deaths. However it manifests itself, workplace violence is a growing concern for employers and employees nationwide.

**Common controls.** *Hiring process.* Efforts to avoid workplace violence start with the hiring process. Organizations should require all hiring managers to follow guidelines for screening job applicants in an effort to reveal problematic behavior that could create an unsafe workplace. Employees should also participate in preventing violence by alerting their employers about potentially harmful behavior demonstrated by coworkers.

*Zero-tolerance policy.* Reducing and preventing workplace violence starts at the top. Management must demonstrate its commitment by sponsoring and funding a violence-free workplace program, including a zero-tolerance policy. The policy should prohibit any violence by anyone on the company property or involved in any business-related activities. It should include reporting, investigation, and discipline procedures, along with a confidential communication process so employees can report threats or acts of violence without fear of retaliation. All employees and managers should receive training on the policy.

*Conduct a workplace violence risk assessment* to identify potentially violent situations. Take a look at environmental conditions, such as physical conditions at the work site; organizational issues, such as recent restructuring or workforce reductions; drug and alcohol use in the workplace; and bullying or intimidation. Evaluate each potential risk and develop a plan to address those identified as high risk and those most likely to cause serious injuries.

*Workplace safety.* Make it clear to employees that everyone is responsible for workplace safety. Encourage employees to report to supervisors disturbing behavior that could lead to violence among coworkers. This includes incidents of a worker harassing, stalking, or threatening another worker. Companies that require employees to wear photo-identification badges or carry key cards to enter offices should establish security rules. For example, employees should be aware of disciplinary actions they might face if they lend their key cards to people who aren't authorized to enter company offices. Such actions could allow a dangerous person to enter the workplace.

*Employee conflict.* Supervisors should be required to set an example for appropriate workplace behavior. They must make it clear to subordinates that threatening behavior in the workplace will not be tolerated. Supervisors need to promptly address conflicts between coworkers that could turn violent, especially if the same employees are the source of the conflicts. A company's human resources department should be ready to advise supervisors on appropriate measures to take to address conflicts and head off potentially violent situations among employees.

The Crisis Prevention Institute recommends these tips for preventing workplace violence:

*Assess the work environment.* Critically examine all areas of the work environment, including parking lots, entryways, reception areas, work areas, and offices for safety. Is the lighting adequate? Are there convenient escape routes? What is the method to summon assistance?

*Pay attention to the warning signs.* Many people who become violent communicate their intentions in advance. Threats from customers, coworkers, or third parties should be reported immediately.

*Promote respect.* The best way to prevent violence in the workplace is to foster a day-to-day attitude of respect and consideration in the work environment.

*Eliminate potential weapons.* Take a mental inventory of objects available in the immediate work area that could be potential weapons. Remove or secure objects that could be thrown.

*Know violence response procedures.* Violence response procedures are simple plans designed to minimize injury during a violent incident. These procedures should include a plan to summon assistance and move people to a safe area.

*Trust your instincts.* Don't ignore your internal warning system. If you sense impending danger, react accordingly.

*Employ the buddy system.* If you are in a situation in which hostility could occur, use the buddy system so you aren't alone in places where violence could occur.

### *Other resources*

OSHA has a workplace violence fact sheet at https://www.osha.gov/OshDoc/data_General_Facts/factsheet-workplace-violence.pdf.

CDC has Occupational Violence Resources available at www.cdc.gov/niosh/topics/violence.

Crisis Prevention Institute provides training and literature in workplace violence awareness and prevention at www.crisisprevention.com.

## CONCLUSION

Additional information specific to safety during emergencies can be found in AWWA Manual of Water Supply Practices M19, *Emergency Planning for Water Utilities.* To ensure a full understanding of the hazards, further research is recommended. Also, additional topic-specific safety tips are provided for weekly safety meetings in AWWA's annual publication *Let's Talk Safety: 52 Talks on Common Utility Safety Practices.*

The OSHA website, www.OSHA.gov, has various publications, standards, technical assistance, and compliance tools. OSHA offers extensive assistance through its many safety and health programs: workplace consultation, voluntary protection programs, grants, strategic partnerships, state plans, training, and education. Guidance such as *OSHA's Safety and Health Management Program Guidelines* identify elements that are critical to the development of a successful safety and health management system.

In states with their own programs (see www.osha.gov/dcsp/osp/index.html) utility managers should review the state requirements, as sometimes they differ from OSHA requirements. For Canadian utilities, the links listed in the appendix, Canadian Water Works Safety References, should be used. Also, consider contacting AWWA Section Safety Committees to inquire how others are addressing various hazards.

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## Appendix

# Canadian Water Works Safety References

This section provides a brief listing of regulatory federal and provincial legislation that governs safety issues in Canada and the websites where these regulations can be obtained. Also in this section is a list of websites for mandatory documents that every private and municipal water operation should have access to, with preference of a hard copy at each facility. The web links will require some independent research to assess the importance of each topic as it applies to specific Canadian jurisdictions.

Websites are listed for federal and provincial legislation and acts and the web links—current as of the publication of this manual—to access these documents are provided. Note that the judicial system in Canada is at the top of the hierarchy for final approval, watch guarding, and enforcing safety regulations and standards.

In general, the US Occupational Safety and Health Administration workplace health and safety regulations and standards are followed almost exactly in Canada. Some differences from OSHA do exist in the Canadian federal and provincial safety standards. Canadians must comply with Canadian law with respect to safety, so it is necessary to have a good base of documentation and understanding of the Canadian Legal Acts. The links provided here will be of assistance in obtaining these critical documents for referencing, implementing programs, and providing valuable information when creating site-specific manuals regarding safety at any Canadian water works facility. The AWWA M3 *Safety Practices for Water Utilities* should be used as a template for Canadian safety activities.

This list serves as an introduction to assist Canadian water works safety officers, joint safety committees, and management in quickly obtaining safety information for starting a safety program and for continuing current information on safety topics as they pertain to water works operations.

# CANADIAN LINKS FOR HEALTH AND SAFETY IN THE WATER INDUSTRY

## Federal Code, Regulations, and Acts

At any water facility, a copy of the following four Codes, Regulations, and Acts should be in management's possession.

Canada Labour Code (R.S., 1985, c. L-2)

http://laws.justice.gc.ca/PDF/Statute/L/L-2.pdf

http://laws.justice.gc.ca/eng/L-2/index.html

Canada Occupational Health and Safety Regulations

http://laws.justice.gc.ca/PDF/Regulation/S/SOR-86-304.pdf

http://laws.justice.gc.ca/eng/SOR-86-304/index.html

Hazardous Products Act (R.S., 1985, c. H-3)

http://laws.justice.gc.ca/PDF/Statute/H/H-3.pdf

http://laws.justice.gc.ca/eng/H-3/index.html

Transportation of Dangerous Goods Act, 1992 (1992, c. 34)

http://laws.justice.gc.ca/PDF/Statute/T/T-19.01.pdf

http://laws.justice.gc.ca/eng/T-19.01/index.html

**Additional important federal links**

Workplace Hazardous Materials Information System–Official National Site

http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php

Environmental & Workplace Health – Water Quality – Drinking Water

http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/index-eng.php

Environmental and Workplace Health

http://www.hc-sc.gc.ca/ewh-semt/occup-travail/index-eng.php

Environmental Scan on Workplace Health in Canada (2009)

http://www.healthyworkenvironments.ca/announcements/

environmental-scan-on-workplace-health-in-canada

Government of Canada Health for Industry

http://canada.ca/en/services/health/industries.html

## Provincial Codes, Regulations, and Acts

**Alberta**

Occupational Health and Safety Act

http://www.qp.alberta.ca/574.cfm?page=O02.cfm&leg_type=Acts&isbncln=0779749200

Occupational Health and Safety Regulation

http://www.qp.alberta.ca/574.cfm?page=2003_062.cfm&leg_type=Regs&isbncln=077971752X

**British Columbia**

Workers Compensation Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/96492_02

Occupational Health and Safety Regulation

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/296_97_01

**Manitoba**

The Workplace Safety and Health Act

http://web2.gov.mb.ca/laws/statutes/ccsm/w210e.php

**New Brunswick**

Occupational Health and Safety Act

http://www.gnb.ca/0062/acts/acts/o-00-2.htm

Occupational Health and Safety Act Regulations

http://www.gnb.ca/0062/regs/o-0-2reg.htm

**Newfoundland and Labrador**

An Act Respecting Occupational Health and Safety in the Province

http://www.assembly.nl.ca/Legislation/sr/statutes/o03.htm

Newfoundland and Labrador Regulation 70/09

http://www.assembly.nl.ca/Legislation/sr/Regulations/rc090070.htm

**Nova Scotia**

Occupational Health and Safety Act

http://www.gov.ns.ca/legislature/legc/statutes/occph_s.htm

Occupational Safety General Regulations

http://www.gov.ns.ca/just/regulations/regs/ohsgensf.htm

**Northwest Territories**

Mine Health and Safety Act

http://www.justice.gov.nt.ca/Legislation/..%5CPDF%5CREGS%5CMINE_HEALTH_SAFETY/Mine_Health_and_Safety.pdf

**Nunavut**

Consolidation of Mine Health and Safety Regulations

http://www.canlii.org/en/nu/laws/regu/nwt-reg-nu-125-95/latest/part-1/nwt-reg-nu-125-95-part-1.pdf

**Ontario**

Occupational Health and Safety Act

http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm

Part X Regulations

http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm#BK79

**Prince Edward Island**

Occupational Health and Safety Act

http://www.gov.pe.ca/law/statutes/pdf/o-01_01.pdf

**Quebec**

An Act Respecting Occupational Health and Safety

http://www.canlii.org/en/qc/laws/stat/rsq-c-s-2.1/latest/rsq-c-s-2.1.html

**Saskatchewan**

The Occupational Health and Safety Act, 1993

http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/O1-1.pdf

The Occupational Health and Safety Regulations, 1996

http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/O1-1R1.pdf

**Yukon**

O.I.C. 2006/178 Occupational Health and Safety Act

http://www.gov.yk.ca/legislation/regs/oic2006_178.pdf

## Additional Websites for Provinces and Territories

Federal page with links to the official government websites of Canada's provinces and territories

http://www.pco-bcp.gc.ca/aia/index.asp?lang=eng&page=relations&doc=offices/offices-eng.htm

The Occupational Health Clinics for Ontario Workers Inc.

http://www.ohcow.on.ca/

Links to Workers' Compensation Boards/Commissions

http://www.awcbc.org/en/linkstoworkerscompensationboardscommissions.asp

# Acronyms

| | |
|---|---|
| AED | automated external defibrillator |
| AFH | arc flash hazards |
| AIHA | American Industrial Hygiene Association |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ASSE | American Society of Safety Engineers |
| BPVC | Boiler and Pressure Vessel Code |
| CCPS | Center for Chemical Process Safety |
| CCR | Consumer Confidence Report |
| CDC | Centers for Disease Control and Prevention |
| CFR | Code of Federal Regulations |
| CPR | cardiopulmonary resuscitation |
| dBA | decibel A-weighted |
| DEET | N,N-diethyl-meta-toluamide |
| DMV | Department of Motor Vehicles |
| EAP | employee assistance program |
| EMR | Experience Modification Rating |
| EMS | emergency medical services |
| ERTW | early return to work |
| GHS | globally harmonized system |
| HASP | health and safety plan |
| HPS | hantavirus pulmonary syndrome |
| HSE | health, safety, and the environment |
| HIV | human immunodeficiency virus |
| IIPP | injury and illness prevention programs |
| IIR | incident investigation report |
| ITCP | internal traffic control plan |
| IT | information technology |
| IWA | International Water Association |

| | |
|---|---|
| JHA | Job Hazard Analysis |
| JSA | Job Safety Analysis |
| LWD | lost workday |
| MP | management programs |
| MSD | musculoskeletal disorder |
| MSDS | material safety data sheet |
| NA | not applicable |
| NASA | National Aeronautics and Space Administration |
| NCADD | National Council on Alcoholism and Drug Dependence |
| NFPA | National Fire Protection Association |
| NIOSH | National Institute for Occupational Safety and Health |
| O&M | operations and maintenance |
| OCIR | Office of Community & Intergovernmental Relations |
| OHP | occupational health provider |
| OHSAS | Occupational Health and Safety Assessment Series |
| OSH | Occupational Safety and Health |
| OSHA | Occupational Safety and Health Administration |
| PAPR | powered air-purifying resperator |
| PCT | physical capacity test |
| PPE | personal protective equipment |
| psi | pounds per square inch |
| PSM | process safety management |
| PtD | Prevention through Design |
| PTO | power takeoff |
| RMP | risk management program |
| ROPS | rollover protective structures |
| RTW | return to work |
| SCA | safety and compliance assistance |
| SCA | sudden cardiac arrest |
| SCBA | self-contained breathing apparatus |
| SDS | safety data sheet |
| TB | tuberculosis |
| TCP | traffic control plan |
| TWA | time-weighted average |
| USEPA | US Environmental Protection Agency |
| WRF | Water Research Foundation |
| WTP | water treatment plant |
| XRF | X-ray fluorescence |

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Note: *f*. indicates figure; *t*. indicates table, *n*. indicates (foot)note

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# Accident Investigation Program

These procedures are to be followed by the victim [you] of an accident or near miss.

## I. Program

In order to prevent recurrences, the Utility investigates all workplace accidents. All accidents, regardless of severity, will be analyzed to determine the best method of prevention. Listed below are procedures that are to be followed after an accident. These procedures will ensure that you are taken care of after being involved in an accident, all pertinent information is gathered, and that all preventive measures are followed through.

## II. Procedures

### A. Near Miss

A near miss is an incident where no injury occurred, but under slightly different circumstances, could have involved injury/injuries.

1. You shall report to your supervisor by the end of the workday.
2. If possible, remove the hazard or take action to prevent reccurrence immediately.
3. You and your supervisor will complete a near-miss form (forms are located _____).
4. Turn a copy of the near-miss form into the Safety Coordinator by the next workday for review (keep a copy to review with your crew).
5. Review the near miss and actions taken at your next crew meeting. Turn in a copy of the meeting minutes to the Safety Coordinator.
6. The Safety Coordinator will review all information with the Safety Committee.
7. Your Safety Committee representative will report any recommendations from the Safety Committee at your next crew meeting.

### B. First-Aid Injury

A first-aid injury is a minor injury that can be treated on site and does not cause days away from work or a job transfer.

1. You shall report to your supervisor by the end of the workday.
2. If possible, remove the hazard or take action to prevent reccurrence immediately.
3. You and your supervisor will complete an injury report form (forms can be found _____).

# Accident Investigation Program

4. Turn a copy of the injury report form into the Safety Coordinator by the next workday for review (keep a copy to review with your crew).
5. The Safety Coordinator will meet with you to review the incident and evaluate the status of your injury.
6. The Safety Coordinator will look for similar injuries incurred while performing the same task, that occurred within the past 5 years. If a similar injury is found, a root-cause analysis must be done.
7. Review accident at your next crew meeting. Turn in a copy of the meeting minutes to the Safety Coordinator.
8. The Safety Coordinator will review information with the Safety Committee.
9. Your Safety Committee representative will report any recommendations from the Safety Committee at your next crew meeting and turn in a copy of the meeting minutes to the Safety Coordinator.

C. **Major Injury**

An injury that requires professional medical attention, days away from work, or job transfer is considered a major injury.

1. If necessary, call 911.
2. Report to your supervisor as soon as possible.
3. If an ambulance is not necessary, your supervisor will transport you to the nearest medical facility (a post-accident drug and alcohol test will be requested).
4. Your supervisor will notify the Safety Coordinator.
5. The Safety Coordinator will initiate investigation of the accident, start the 801 form, and notify the Utility's Worker's Compensation carrier.
6. As soon as possible, you will be asked to provide information for the injury report and the 801 form.
7. If the injury results in admission to a medical-care facility for medical treatment, the Safety Coordinator will report to Occupational Safety and Health Administration (OSHA) within 24 hours.
8. A root-cause analysis will be done within two (2) days of the accident. The Safety Coordinator and the Emergency Planning, Risk & Security Coordinator will conduct this analysis.
9. Based on the root cause(s) identified, recommendations will be made to prevent a reccurrence.
10. The Safety Coordinator will bring the results of the analysis, along with recommended actions, to the Safety Committee.
11. The Safety Committee representatives will share the information with their departments.

# Accident Investigation Program

D. **Fatality/Catastrophe**

If an accident results in a fatality or a catastrophe [two (2) or more fatalities or three (3) or more admitted to a medical-care facility] the following will be done.

1. The Safety Coordinator and/or the Human Resources Manager will contact family members.
2. The Safety Coordinator will contact OSHA within 8 hours.
3. An investigation and root-cause analysis will be conducted (see Major Injury steps 8–11).

E. **Vehicle Accident**

1. If you or anyone else involved in the accident are injured, assess injury/injuries and call 911, if necessary.
2. Police response is required if a fatality occurs, an injury requires transport by ambulance, a person involved appears to be under the influence of intoxicants, or the accident involved a hazardous materials spill.
3. Notify your supervisor as soon as possible after the accident.
4. Supervisor will notify the Safety Coordinator and/or the Emergency Planning, Risk & Security Coordinator and coordinate a response.
5. You and/or the response team will gather all necessary information. Follow the procedure defined in the Utility Driving Policy.
6. Turn in the Accident Report and Department of Motor Vehicles (DMV) report by the end of the shift.
7. DMV report will be submitted to DMV within 72 hours.
8. Drug and alcohol testing will occur according to Driving and/or Substance Abuse policies.
9. The Emergency Planning, Risk & Security Coordinator will turn information into the Utility's insurance carrier.
10. Accident will be investigated to determine if it was preventable.
11. If the accident is deemed preventable, your DMV record will be evaluated per the Driving Policy.
12. Findings and recommendations will be shared with you and the Safety Committee.
13. Safety Committee representatives will share information with their groups.
14. If you are injured, the severity of the injury will be determined and the procedures outlined above will be followed.

# Accident/Incident Analysis

Immediate supervisor should complete this form promptly with affected worker.

☐First Aid
**FILE 801, IF BOXES BELOW ARE CHECKED**
☐Medical Care
☐Time Loss
☐Fatal

**SYSTEM CHALLENGES**

**Management**
Policy Enforcement
Hazard Recognition
Accountability
Supervisor Training
Corrective Action
Production Priority
Proper Resources
Job Safety Training
Hiring Practices
Maintenance
Adequate Staffing

**Employee**
Following Procedure
Training
Previous Injury
Mental Ability
Physical Capacity
Equipment Use
Short Cuts
PPE Worn
Safety Attitude

**Equipment**
Proper Tool Selection
Tool Availability
Maintenance
Visual Warnings
Guarding

**Environment**
Plant Layout
Chemical
Temperature
Noise
Radiation
Weather
Terrain
Vibration
Ergonomics
Lighting
Ventilation
Housekeeping
Biological

**Additional Causal Factors:**
☐Faulty Equipment
☐Non-Employee
☐Prior Injury
☐Late Reporting
☐Off-the-Job Injury
(Describe checked boxes on another sheet)

Employee:_____

Occupation/Department:_____

Where Incident Occurred:_____

Date:_____ Time:_____ am☐ pm☐

If injury, describe (nature/body part):_____

Treatment: ☐ None ☐ First Aid Only ☐ Doctor ☐ Hospital

Treating Physician:_____

Treating Facility:_____Phone:_____

Witnesses:_____

Describe Accident/Incident Fully:

## If this injury required first aid, please fill out fields below.

Identify factors that contributed to or caused accident (refer to list on left):

| | |
|---|---|
| **Management:** | **Employee:** |
| **Equipment:** | **Environment:** |

| | |
|---|---|
| **Countermeasures/best practices to prevent recurrence:** | |
| **By Whom:** | **By When:** |

(Attach additional sheet if needed)

Safety Committee Review Date:_____

If accident/incident was caused by a person not employed by us, who?
Name: _____ Phone:_____

Date: _____ Supervisor's Signature_____

PASSWORD TO UNLOCK FORM: AWWAM3

*[Insert Water Utility Name]*

| | |
|---|---|
| **Title: Conservation Coordinator**<br><br>**Reporting to: Manager, Office of Community & Intergovernmental Relations (OCIR)** | **Job Grade: 7**<br><br>**Department: OCIR** |

***[Insert Water UtilityName] believes that each employee makes a significant contribution to our success. That contribution should not be limited by the assigned responsibilities. Therefore, this job description is designed to outline primary duties, qualifications and job scope, but not limit the incumbent nor the organization to just the work identified. It is our expectation that each employee will offer his/her services wherever and whenever necessary to ensure the success of our endeavors.***

**Overall Purpose of the Job:** The Conservation Coordinator supports the implementation of the Utility's water conservation goals by developing, coordinating, implementing and monitoring Utility conservation programs. This position is responsible for ensuring that the Utility's programs are consistent with Utility, Regional and State requirements and regulations. Specifically, this position will include: planning and implementing Utility conservation programs and events; evaluating and making recommendations to improve programs and events; compiling and analyzing data regarding the Utility's conservation programs. This position is part of a team of employees working to develop conservation opportunities, information and tools.

**Essential Job Functions:**

- Develop, measure and implement residential conservation program; recommend changes to ensure efficiency and effectiveness of the program.
- Develop a schedule for marketing of Utility conservation programs and activities, including public presentations.
- Provide conservation assistance to residential customers.
- Actively participate and assist in the coordination and organization of Utility conservation-related events.
- Coordinate activities with other related internal and external programs.
- Provide budget recommendations to the Manager of the Office of Community and Intergovernmental Relations (OCIR); assist in tracking, reporting and monitoring the conservation portion of the budget.
- Research and develop additional conservation programs for consideration.
- Represent the Utility at local, regional and state conservation activities and committees.
- Coordinate with regional partners to enhance the effectiveness and ensure consistent messages of both the Utility's and Region's conservation programs, goals and work plans.
- Monitor federal, state and local requirements and regulations. Collect, analyze and report on compliance of the conservation program. Make recommendations based on findings.
- Participate in development of water conservation related material for distribution to schools, businesses and residential water users.
- Serve as a resource to the community and government organizations regarding water conservation programs.
- Provide information, direction and assistance to customer service representatives and other Utility staff to facilitate delivery of water conservation information to customers and the public.
- Participate in collection and analysis of water consumption data for trends and forecasting of water needs for the Utility.
- Coordinate the updating of the Utility's Demonstration Garden, including all informational materials, kiosk, signage and promotion of the Garden and events.
- Implement special projects and other duties as assigned by the OCIR Manager.
- Driving is a job function, your driving record must comply with the Utility's driving policy.

**Knowledge Required:**

- Knowledge of the water industry and conservation programs, regulations, policies and procedures at the federal, state and local levels.
- Knowledge of budgeting principles and practices.
- Knowledge in performing research, analysis and report preparation including program evaluation.
- Excellent knowledge of basic computer operations and Microsoft applications such as Word, Excel, Outlook, etc.

**Special Skills and Qualities:**

- Excellent communication skills, both oral and written, including strong public presentation skills, experience developing reports and community education materials.
- Excellent analytical ability, including the ability to evaluate alternatives and make sound, creative recommendations and present recommendations to individuals from all levels of the Utility, as well as individuals outside the Utility.
- Excellent customer service skills.
- Ability to make decisions independently in accordance with established policies and use.
- Good judgment in carrying out tasks and responsibilities with little supervision or guidance.
- Ability to learn the Utility's customized utility billing computer program and any supporting programs.
- Good organizational skills.

**Minimum Requirements:**

- Bachelor's Degree with two years of experience in areas that relate to conservation, water use, public relations, or related fields **or** an Associate's Degree with six years of experience in the drinking water industry or water-related profession, **or** equivalent work experience.
- A valid State Driver's License; have and maintain a safe driving record.

**Working Conditions:**

- Lift, carry and set-up awkward display equipment.
- Work nine hours per day and other hours as required.
- Have regular and predictable attendance.
- Attendance at meetings and events at various locations in and out of the Metro Area, often outside of normal working hours.
- Daily focus on personal computer screen.
- Verbal communication on a daily basis both in person and on the telephone.
- Prolonged periods of sitting or standing.
- Respond and work, without advanced notice, in times of adverse weather, natural disaster, emergency, or other unusual events as determined by the Utility.

# *[Insert Water Utility Name]*

Physical Capacities Requirements

**Position: Conservation Coordinator**

In terms of a 9 hour workday:
"Occasionally" equals 1% to 33% "Frequently" equals 34% to 64% "Continually" equals 65% to 100%

**In a 9 hour workday, the worker will be:**

| (Total hours at one time) | (Total hours during entire workday) |
|---|---|
| Standing 0 ½ 1 2 3 4 5 6 7 8 9 Occasionally | Standing 0 ½ 1 2 3 4 5 6 7 8 9 Occasionally |
| Sitting 0 ½ 1 2 3 4 5 6 7 8 9 | Sitting 0 ½ 1 2 3 4 5 6 7 8 9 |

**Job requires repetitive use of hands for:**

| | *Right* | *Left* |
|---|---|---|
| Simple Grasping | Yes | Yes |
| Pushing & Pulling | Occasionally | Occasionally |
| Fine Manipulating | Occasionally | Occasionally |

**Job requires repetitive movement of feet as in operating foot controls:**

*Right* *Left*

**Both**

N//A N/A N/A

| **Job requires worker to lift:** | Never | Occasionally | Frequently | Continually |
|---|---|---|---|---|
| Up to 5 lbs. | | | X | |
| 6 to 10 lbs. | | X | | |
| 11 to 20 lbs. | | X | | |
| 21 to 50 lbs. | | *Rare, yet 25 lbs might occur | | |
| 51 to 100 lbs. | X | | | |

| **Job requires worker to carry**: | Never | Occasionally | Frequently | Continually |
|---|---|---|---|---|
| Up to 5 lbs. | | | X | |
| 6 to 10 lbs. | | X | | |
| 11 to 20 lbs. | | X | | |
| 21 to 50 lbs. | | *See note above | | |
| 51 to 100 lbs. | X | | | |

| **Job requires worker to:** | Never | Occasionally | Frequently | Continually |
|---|---|---|---|---|
| Bend | | X | | |
| Squat | X | | | |
| Crawl | X | | | |
| Reach above shoulder level | | X | | |
| Walk or work on uneven surfaces | | X | | |

**Job requires the following activities:**

| | Never | Occasionally | Frequently | Continually |
|---|---|---|---|---|
| Being around machinery | X | | | |
| Operating heavy equipment | X | | | |
| Exposure to dust, fumes, and gases | X | | | |

Comments: Will need to be able to set up and take down displays that may be awkward. Will need to be able to work independently with out assistance.

Manager's Signature:_____Date:_____

## Purpose

*[Insert Water Utility Name]* has developed a program to assist workers who temporarily have restrictions due to an injury or illness. This program is called the "Early Return to Work" (ERTW) program.

## Policy

Although it is not a requirement that the Utility provide such a benefit, studies show that an Early Return to Work Program is therapeutic and helps speed the recovery process. In addition, injured employees stay in touch with the speedy transition back to their normal job.

### I. Reporting

A. To qualify for the Utility's ERTW program, you must report all injuries and illnesses that affect your ability to return to your regular work responsibilities.

B. All injuries/illnesses reported by the employee as work-related and/or filed with the Utility's workers' compensation carrier will be investigated.

### II. Work-Related Injury/Illness

A. If you sustain a work-related injury/illness, report it to your supervisor immediately. Your supervisor will first determine the appropriate action to take based on your condition, then report to the Safety Coordinator and ensure that an Injury Report is filed. If the injury or illness requires a visit to a physician, the Safety Coordinator will provide you with the appropriate forms to be given to the treating physician. If the injury or illness requires immediate emergency medical care, the Safety Coordinator will ensure all forms are forwarded to your treating physician.

B. If a visit to a physician is necessary, you must file an 801 Form (Report of Job Injury or Illness) within 24 hours of reporting the injury or illness. If the injury or illness requires immediate emergency medical care, the 801 Form must be filed within 5 days of your visit to the doctor.

C. If you are unable to return to work, you must notify your supervisor of your status the next work day. You must also contact Human Resources to determine if you are eligible for Family Medical Leave.

D. The Utility has contracted with *(Insert Provider Name)* to provide managed care services for Utility workers that are injured on the job. However, you have the right to be treated by your own physician, at your expense, provided your doctor agrees to follow and cooperate with the Utility's Early Return to Work Program. If the injury or illness is determined to be work-related and Workers' Compensation benefits are provided, the Utility's insurance carrier may select a managed care organization. You will be required to seek treatment with a panel-approved medical provider who is familiar and willing to treat occupational injuries. The Utility's insurance carrier will provide an extensive list of local providers for you to choose from. Your primary care physician may/may not be on the panel.

E. You may be asked, based on the details of the incident, to submit to a drug and alcohol test. (See the Substance Abuse Policy in the Employee Manual).

F. If your injury results in the need for immediate emergency medical care, you will remain on regular time until you are admitted to a medical care facility for medical treatment or the treating physician determines you cannot return to regular duty.

G. If you are required to submit a drug and alcohol test, you will be placed on light-duty until the Utility receives the results. During this period, you will remain on regular time.

H. If, as a result of a work-related injury, you are admitted to a medical care facility for medical treatment and the physician or other licensed health care professional determines you cannot return to regular duty or recommends followup visits, you may use sick time, vacation or comp time. If the claim is accepted by the Utility's Workers' Compensation Insurer, the insurer may reimburse your time-lost wages. In this case, the Utility will work with you to exchange the time you have taken for the wages the Utility has paid you.

I. While performing transitional work because of an accepted workers' compensation claim, you will receive your regular rate of pay for the hours worked. If you work your regular full shift, there will be no loss of wages. If you work less than your regular full shift, a temporary partial benefit will be payable in accordance with the state's Workers' Compensation Law which provides 2/3 of your 52-week average weekly wage, tax free. Any time that is not paid by workers' compensation can be supplemented with sick time, vacation or comp-time.

J. Your manager may allow you to use regular straight time, not to exceed 8 hours, when time loss is authorized for doctor visits or follow-up medical treatment. After the initial 8 hours of time loss, you may use sick time, vacation, or comp time.

K. The Utility does not determine an employee's ability to return to work. All lost time or restricted duty must be recommended by a physician or other licensed health care professional.

## III. Non-Work Related Injury/Illness

A. If you sustain a non-work related injury or illness and you cannot report to work, you must notify your supervisor. Your supervisor will notify the Safety Coordinator. If you are being treated by a physician, the Safety Coordinator will send you all appropriate forms to be forwarded to your treating physician.

B. You must also contact Human Resources to determine if you are eligible for Family Medical Leave or Short-term Disability.

C. It is your responsibility to make sure all forms are received by your treating physician and the appropriate forms are returned to the Utility in a timely manner.

D. You must use a physician of your choosing. The Utility does not offer managed care for non-work related injury or illness. If questions regarding your ability to return to work arise, the Utility may select a treating physician for a second opinion at the Utility's expense. There is no drug and alcohol testing requirement.

E. While performing transitional work, you will receive your regular rate of pay for the hours you work. If you work a regular shift, there will be no loss in wages. If you work a partial shift and have been on short-term disability, the Utility will pay you for your time worked and you will get a partial short-term disability benefit for your time off. If you have not been on short-term disability, you will get paid for time worked; the remainder of time off can be filled in with sick time, vacation or comp time.

## IV. Return to Work

A. Restricted Release

1. If your doctor determines that you are not able to return to your regular duties but are capable of some level of work activity, your doctor must complete a release-to-work form indicating the restrictions and conditions for transitional work. The Utility will attempt to provide a temporary transitional work position until you are able to resume regular duties. If the release-to-work form does not adequately describe your restrictions so that a transitional work position can be developed, the Utility may ask for more detailed information before providing a temporary transitional work position.

2. When you return your release-to-work form, the Utility will develop a transitional tasks description. The transitional duties will be discussed with you and you will be asked to sign the description of duties to acknowledge your acceptance. In order to return to work, you must sign this transitional task description.

3. All transitional work positions are subject to Utility management's review and approval. The determination may be made by any of the following: your department manager, supervisor, the Safety Coordinator, the Human Resources Director, or the Chief Executive Officer. If the workload of another department is involved, the determination will also include that manager and supervisor.

4. Once an approved transitional tasks description is signed, your supervisor will ensure that you are not asked to do anything outside of the duties described in the transitional tasks description. It is your responsibility to follow all restrictions set by your physician. It is also your responsibility to notify the Utility if you are asked to perform duties outside the restrictions or the job is going beyond your physical capabilities.
5. While performing transitional work, you will still be expected to follow all Utility policies.
6. This is a transitional program in which the nature of tasks may increase in level of physical demands as you recover. You must report any change in restrictions within one business day to your supervisor. This program is not intended to create transitional work positions.
7. The transitional duties will be for the length of time your doctor requests, but not for more than 60 days. After 60 days, the work availability and restrictions will be re-evaluated on a case-by-case basis.
8. If transitional work positions are limited, a worker with an active Workers' Compensation Claim, depending on the restrictions, will take priority.

## V. Return to Full Duty

A. To return to full and unrestricted duty, you are required to provide a release from your treating physician. An additional release by the Utility's physician of choice may be required.

**The Utility may modify, change, or discontinue the Early Return to Work Program or conditions of the program at any time dependent on Utility needs.**

## Hazard Summary/Action List

| Date | Source | Site/ Equipment | Hazard | Safety Committee Review | Action Leader(s) | Action items | Completion Date (Goal) | Completion Date (Actual) | Status | Further Explaination |
|---|---|---|---|---|---|---|---|---|---|---|
| 01/11/11 | Injury Report | Parking lot | Employee fell on black ice when walking across the parking lot. | Yes | Mike J, Collin F | Look into the availability of ice/frost indicators that will notify employees of potentially slippery conditions | 02/11/11 | 02/11/11 | Done | Collin has purchased indicators and will be installing them by the end of February. |
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| HOT WORK PERMIT | | File # |
|---|---|---|
| Contractor: | Issued Date: | Issued Time: |
| Work Area: | | Valid until: |
| Job Description: | | |

| Items To Check | Yes | No | Remarks |
|---|---|---|---|
| **Area** | | | |
| 1. Has the area been roped off? | ☐ | ☐ | |
| 2. Have flammable materials been removed? | ☐ | ☐ | |
| 3. If flammables cannot be removed, have they been protected from spark contact? | ☐ | ☐ | |
| 4. Has the area been checked for gases? | ☐ | ☐ | |
| 5. Is wind direction a factor? | ☐ | ☐ | |
| 6. Is a Fire Watch required? | ☐ | ☐ | |
| 7. Are all openings in floors and walls within 10 m (35 ft) covered to prevent hot sparks from falling below or entering walls? | ☐ | ☐ | |
| **Equipment** | | | |
| 1. Has equipment been: | | | |
| Isolated? | ☐ | ☐ | |
| Depressured or drained? | ☐ | ☐ | |
| Steamed or washed? | ☐ | ☐ | |
| Blanked at all process connections? | ☐ | ☐ | |
| Tested for gases? | ☐ | ☐ | |
| 2. Is equipment under pressure? | ☐ | ☐ | |
| What pressure? | | | |
| Chemicals involved? Specify. | ☐ | ☐ | |
| Above or below liquid level? | ☐ | ☐ | |
| **General** | | | |
| 1. Has a fire extinguisher been provided? | ☐ | ☐ | |
| 2. Are safe job procedures understood by all? | ☐ | ☐ | |
| 3. Are fire resistant curtains / UV shields required? | ☐ | ☐ | |
| 4. Are there smoke detectors, heat detectors or sprinkler heads that could be affected by this work? | ☐ | ☐ | |
| 5. Are there other safety considerations not discussed above? Specify. | ☐ | ☐ | |

| | | |
|---|---|---|
| Issued by: | Date:<br>Time: | Comments |
| Checked by: | Date:<br>Time: | |
| Job Completed: | Date:<br>Time: | |

**All questions must be answered. If not applicable, use N/A.**

| **Area to be checked 3 hours after completion of job to ensure no fire:** | | |
|---|---|---|
| Checked by: | Date:<br>Time: | Comments: |

# Instructions for Completing a Job Safety Analysis Form

Job Safety Analysis (JSA) is an important analyzing tool that works by finding hazards and eliminating or minimizing them before the job is performed, and before hazards have a chance to cause injuries or do damage. Use JSA for job clarification and hazard awareness, as a guide in new employee training, for periodic contact with and retraining of senior employees, as a refresher on jobs that run infrequently, and for informing employees of specific job hazards and protective measures. JSA can also be used as an incident investigation tool.

Set priorities for doing JSAs: jobs that have a history of causing injury or damage, jobs that have produced disabling injuries, jobs with high potential for disabling injury or death, and new jobs. Select a job to be analyzed. Before filling out a JSA form, consider the following: The purpose of the job—What has to be done? Who has to do it? The activities involved—How is it done? When is it done? Where is it done? In summary, to complete the JSA form, consider the purpose of the job, the activities it involves, and the hazards it presents. If unfamiliar with a particular job or operation, interview an employee who is. In addition, observing an employee performing the job, or walking through the operation step-by-step may give additional insight into potential hazards. Consider videotaping the job and analyzing the tape. Here's how to conduct the three parts of a JSA.

## Sequence of Basic Job Steps

Examining a specific job by breaking it down into a series of steps or tasks enables discovery of potential hazards employees may encounter. Each job or operation consists of a set of steps or tasks. For example, the job might be to move a box from a conveyor in the receiving area to a shelf in the storage area. To determine where a step begins or ends, look for a change of activity, direction, or movement. Picking up the box from the conveyor and placing it on a handtruck is one step. The next step might be to push the loaded handtruck to the storage area (a change in activity). Moving the boxes from the truck and placing them on the shelf is another step. The final step might be returning the handtruck to the receiving area. Be sure to list all the steps needed to perform the job. Some steps may not be performed each time; an example could be checking the casters on the handtruck. However, if that step is generally part of the job, it should be listed.

## Potential Hazards

A hazard is a potential danger. The purpose of the JSA is to identify ALL hazards—both those produced by the environment or conditions and those connected with the job procedure. Examine each step carefully to find and identify hazards—the actions, conditions, and possibilities that could lead to injury, illness, or damage. Consider the following hazard types:

**Chemical Hazards**
__Inhalation
__Skin contact
__Absorption
__Injection
__Ingestion

**Biological Hazards**
__Bloodborne Pathogens
__Brucellosis
__Building-Related Illness (BRI)
__Legionnaires' Disease
__Mold
__Plant and Insect Poisons
__Tuberculosis (TB)
__Water and Wastewater

**Physical Hazards**
__Electrical
__Fire/Explosion
__Noise
__Radiation
__Thermal Stress
__Caught In/On/Between; Pinch Points
__Slips/Falls
__Striking Against
__Struck By

**Ergonomic Hazards**
__Repetition
__Forceful Exertions
__Awkward Postures
__Contact Stress
__Vibration
__Work Area Design

## Recommended Action or Procedure

After evaluating and recording the job steps and potential hazards, decide what actions or procedures are necessary to eliminate or minimize those hazards that could lead to an injury, illness, or damage. Begin by trying to: 1) engineer the hazard out; 2) provide guards, safety devices, etc.; 3) provide personal protective equipment (PPE); 4) provide job instruction training; 5) maintain good housekeeping; 6) ensure good ergonomics (positioning the person in relation to the machine or other elements in such a way as to improve safety).

List the recommended safe operating procedures. Begin with an action word. Say exactly what needs to be done to correct the hazard, such as, "Lift using your leg muscles." Avoid general statements such as "be careful." List the required or recommended PPE necessary to perform each step of the job. Provide a recommended action or procedure for each hazard. Serious hazards should be corrected immediately. The JSA should then be changed to reflect the new conditions. Finally, review all the input for accuracy and completeness. Determine if the recommended actions or procedures have been put in place. Reevaluate the job safety analysis as necessary.

| JOB SAFETY ANALYSIS | JOB TITLE: | | DATE: | Page of<br>New ☐<br>Revised ☐ |
|---|---|---|---|---|
| TITLE OF PERSON WHO DOES JOB: | Supervisor: | Foremen: | FIRST REVIEWED BY: DATE: | |
| Department: | Division: | Crew: | FINAL REVIEWED BY: DATE: | |
| REQUIRED PERSONAL PROTECTIVE EQUIPMENT: | | | - | |
| | | | | |

| SEQUENCE OF BASIC JOB STEPS | POTENTIAL HAZARDS | ACTION OR PROCEDURE |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| | | |

| JOB SAFETY ANALYSIS | JOB TITLE: Wastewater Gravity Main Cleaning | | DATE: XX-XX-XXXX | Page of 1 of 2 New Revised |
|---|---|---|---|---|
| JOB SAFETY ANALYSIS | TITLE OF PERSON WHO DOES JOB: Service workers / Jet-Vac | Supervisor: Joe Supervisor | Foreman: Jill Foreman | |
| Department: Utilities | Division: Field Operations / Wastewater Transmission | Crew: John Crew Member | Supervisor's Review: Date: Joe Supervisor XX-XX-XX | |
| REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT/RECOMMENDATIONS: | | | Superintendent's Review: Date Al Superintendent XX-XX-XX | |
| Hard hat, Hearing protection, Safety Vest , Rubber or PVC Gloves, Heavy Duty Gloves, Safety glasses, Safety Shoes | | | | |

| SEQUENCE OF BASIC JOB STEPS | POTENTIAL HAZARDS | ACTION OR PROCEDURE |
|---|---|---|
| 1. Position Truck | 1. Physical - Struck by local traffic. | 1. Be alert and aware of traffic. Wear safety Vest. Evaluate volume of traffic to determine if assistance from another crew is needed. |
| 2. Set up MOT and evaluate work area. | 2. Physical - Inadequate MOT set up. Struck by vehicle traffic. | 2. Refer to work zone design booklet. Use flashers on vehicle. Utilize a slow/stop paddle to alert traffic to slow down. |
| 3. Open manhole. | 3. Ergonomic Chemical Physical - Back sprain / Fall hazard / Poisonous gases, caught/scraped fingers. | 3. Use manhole hook and bend with your knees. Wear Heavy Duty Gloves. If you need to enter a manhole refer to the manhole entry JSA. |
| 4. Observe for the presence of hazardous conditions such as vapors or the existence of heavy grease or tree roots. | 4. Chemical Physical- Inhalation or skin contact Combustible Vapors / Eye or Skin irritation. Objects obstructing the flow of the manhole or pipe lines. | 4. Visible inspection of manhole. Document any obstructions that need to be removed. |
| 5. Select appropriate nozzle for the proper size of main to be cleaned. Position high pressure hose, nozzle and | 5. Physical - Struck by nozzle head. Trip hazard. | 5. Awareness of the location of the nozzle. Be aware of tiger tail tie off. Be aware of the weight of the nozzle on the hose. |
| 6. Position nozzle into invert of sewer pipe and tie off tiger tail. Use mirror or flashlight if needed. Reset reel counter to zero. | 6. Physical - Struck by high pressure nozzle head / Noise / Debris from back pressure. | 6. Tiger tail may be used to position nozzle into the invert. Ensure nozzle is completely in the pipe before applying minimal pressure. |

| | | Page 2 of 2 |
|---|---|---|
| **7. Turn on high pressure pump and slowly send the nozzle up stream.** | **7. Physical - Struck by- back lashing of pressure hose and nozzle head. Debris from back pressure-eye injury. Pinch point- spinning hose reel-hand or finger injury. Noise level-hearing damage .** | **7. Turn on pump to minimal pressure required (depending on pipe conditions) to obtain at least the leader hose is completely into the main. The PSI gauge should not exceed 500 PSI. Use hearing and eye protection.** |
| **8. After the leader hose is completely into the main, adjust the high pressure pump as needed for proper cleaning.** | **8. Physical - Struck by- back lashing of pressure hose and nozzle head. Debris from back pressure-eye injury. Pinch point- spinning hose reel-hand or finger injury. Noise level-hearing damage .** | **8. Stand in a safe position of spinning hose reel. Use hearing protection. Wear heavy duty gloves and eye protection.** |
| **9. Continue the cleaning process by slowly sending the hose upstream of the pipe.** | **9. Physical - Struck by - back lashing of pressure hose and nozzle head. Debris from back pressure-eye injury. Pinch point- spinning hose reel-hand or finger injury. Noise level-hearing damage .** | **9. Stand in a safe position of the moving hose reel. Co-worker is to communicate when the nozzle reaches the required destination to prevent back lash. Use hearing protection.** |
| **11. Continue the cleaning process by slowly sending the hose upstream of the pipe.** | **11. Physical - Stuck by high pressure nozzle head. Noise level-hearing damage. Debris from back pressure-eye injury.** | **11. During the cleaning process on the return, reduce pressure when nozzle approaches 15 feet on the reel counter .** |
| **12. When the cleaning process is complete secure the hose, nozzle and tigertail.** | **12. Physical - Stuck by nozzle head.** | **12. Awareness by keeping proper distance.** |
| **13. If necessary set up vacuum tubes to clean any debris inside the manhole.** | **13. Ergonomic Physical - Back strain / Struck by vacuum tubes. Pinch fingers by connection clamps.** | **13. Assemble vacuum tubes above ground when possible. Wear a hard hat and heavy duty gloves (See JSA on Jet-Vac Vacuuming).** |
| **14. Close up manhole and break down MOT.** | **14. Ergonomic Physical - Back strain. Struck by vehicle traffic.** | **14. Proper lifting procedures. Flag man alerts and directs vehicle traffic if needed (See on manhole entry JSA).** |

# Passing Criteria
## *Insert Water Utility Name*
## Valve, Maintenance, & Construction Crew

| PCT Tests | Passing Criteria |
|---|---|
| Step Test | 3 Levels – 3 minutes each<br>(72, 104, 124) |
| Twist Test | Rotate entire body to the right and left each way. 5× |
| Maximal Lift, Carry & Flexibility Test | Lift 50-lb bag off the floor, carry 50 ft, and set on floor.<br>Squat onto your heels, hold for 3 seconds, then stand up on your tiptoes, arms stretched overhead and hold for 3 seconds. 3×<br>Lift 75-lb 4 in. valve off of the floor, carry 50 ft, and set back on the floor.<br>Lift 90-lb crate off the floor to 43 in. high top landing on stairs and set back on the floor. 2×<br>Lift 30-lb crate off the floor to 67 in. high and set back on the floor. 3× |
| Push/Pull Tests | 95-lb vertical pull upwards hold 3 sec. 2×<br>80-lb 40-in. horizontal push 3 sec. 3×<br>100-lb 40-in. horizontal pull 3 sec. 3×<br>Pull 125-lb drag bag 40 ft. |
| Shovel Test | Scoop 13.6-lb shovel from the floor to 45 in. and back to the floor. 2× |
| Double Step Test | Step up onto second and fourth rung of stepladder and back down. 3× |
| Valve Turn Test | |
| Body Mechanics (Lifting) | Erect spine (3), load close to body (2), pivot feet (2), bend knees (2), wide base of support (1). Total of 10 points |

Enter Utility Name

# Physical Capacities Requirements

**Position:** Click here to enter text.

**In a 9 hour workday, the worker will be:**

| | *(Total hours at one time)* | | *(Total hours during entire workday)* |
|---|---|---|---|
| **Standing** | 1/2 | **Standing** | 1/2 |
| **Sitting** | 1/2 | **Sitting** | 1/2 |

**Job requires repetitive use of hands for:**

| | *Right* | *Left* | *Both* |
|---|---|---|---|
| **Simple Grasping** | ☐ | ☐ | ☐ |
| **Pushing & Pulling** | ☐ | ☐ | ☐ |
| **Fine Manipulating** | ☐ | ☐ | ☐ |

**Job requires repetitive movement of feet as in operating foot controls:**
*Right* ☐ *Left* ☐ *Both* ☐

*"Occasionally" equals 1% to 33%* *"Frequently" equals 34% to 64%* *"Continually" equals 65% to 100%*

| **Job requires worker to lift:** | **Never** | **Occasionally** | **Frequently** | **Continually** |
|---|---|---|---|---|
| Up to 5 lbs. | ☐ | ☐ | ☐ | ☐ |
| 6 to 10 lbs. | ☐ | ☐ | ☐ | ☐ |
| 11 to 20 lbs. | ☐ | ☐ | ☐ | ☐ |
| 21 to 50 lbs. | ☐ | ☐ | ☐ | ☐ |
| 51 to 100 lbs. | ☐ | ☐ | ☐ | ☐ |
| **Job requires worker to carry:** | **Never** | **Occasionally** | **Frequently** | **Continually** |
| Up to 5 lbs. | ☐ | ☐ | ☐ | ☐ |
| 6 to 10 lbs. | ☐ | ☐ | ☐ | ☐ |
| 11 to 20 lbs. | ☐ | ☐ | ☐ | ☐ |
| 21 to 50 lbs. | ☐ | ☐ | ☐ | ☐ |
| 51 to 100 lbs. | ☐ | ☐ | ☐ | ☐ |
| **Job requires worker to:** | **Never** | **Occasionally** | **Frequently** | **Continually** |
| Bend | ☐ | ☐ | ☐ | ☐ |
| Squat | ☐ | ☐ | ☐ | ☐ |
| Crawl | ☐ | ☐ | ☐ | ☐ |
| Reach above shoulder level | ☐ | ☐ | ☐ | ☐ |
| Walk or work on uneven surfaces | ☐ | ☐ | ☐ | ☐ |
| **Job requires these activities:** | **Never** | **Occasionally** | **Frequently** | **Continually** |
| Being around machinery | ☐ | ☐ | ☐ | ☐ |
| Operating heavy equipment | ☐ | ☐ | ☐ | ☐ |
| Exposure to dust, fumes & gases | ☐ | ☐ | ☐ | ☐ |

**Comments:** Click here to enter text.

**Manager's Signature:**_____ **Date:**_____

# RELEASE TO RETURN TO WORK

| Name of worker | Claim number |
|---|---|
| | |

## Please fill out this form and return it to us at the address indicated above.

1. Is the worker medically stationary? ☐ Yes ☐ No Date _____ (Provide closing information and complete Form 827.)
   Next scheduled appointment date _____
2. Worker is released to:
   ☐ full duty without limitations Date _____ (Do not complete lines 3 through 11. Sign below.)
   ☐ modified duty from (date) _____ through (date) _____ (specify limitations below.)
   ☐ modified hours — specify _____ from (date) _____ through (date) _____

| | Hours: No limitations | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 3. In an eight-hour workday, worker can stand/walk a total of | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4. At one time, worker can stand/walk | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5. In an eight-hour workday, worker can sit a total of | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6. At one time, worker can sit | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

7. The worker is released to return to work in the following range for lifting, carrying, pushing/pulling:

| **Pounds** | **<10** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **55** | **60** | **65** | **70** | **75** | **80** | **85** | **90** | **95** | **100** | **>100** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Occasionally | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Frequently | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

8. Worker can use hands for repetitive:

| | **Right** | **Left** | |
|---|---|---|---|
| a. Fine manipulation | ☐ Yes ☐ No | ☐ Yes ☐ No | Dominant hand |
| b. Pushing and pulling | ☐ Yes ☐ No | ☐ Yes ☐ No | ☐ Right ☐ Left |
| c. Simple grasping | ☐ Yes ☐ No | ☐ Yes ☐ No | |
| d. Keyboarding | ☐ Yes ☐ No | ☐ Yes ☐ No | |

9. Worker can use feet for repetitive raising and pushing (as in operating foot controls): ☐ Yes ☐ No

10. Worker is able to:

| | **Continuous 67-100% of the day** | **Frequently 34-66% of the day** | **Occasionally 6-33% of the day** | **Intermittently 1-5% of the day** | **Not at all** |
|---|---|---|---|---|---|
| a. Stoop/bend | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Crouch | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Crawl | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Kneel | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. Twist | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. Climb | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. Balance | ☐ | ☐ | ☐ | ☐ | ☐ |
| h. Reach | ☐ | ☐ | ☐ | ☐ | ☐ |
| i. Push/pull | ☐ | ☐ | ☐ | ☐ | ☐ |

11. Other functional limitations or modifications necessary in worker's employment:

**Additional comments may be written on back of form.**

| Signature of medical service provider* | Printed name | Date |
|---|---|---|
| | | |

# Pre-Placement Physical Capacities Test

*Insert Utility Name*

Job title/Crew:

Applicant Name: _____

## I. STEP TEST

| Stages | Metronome | Time Stopped | Comments |
|---|---|---|---|
| Level 1 | 72 | | |
| Level 2 | 104 | | |
| Level 3 | 124 | | |

Must complete 3 minutes at each level to pass.

Pass/Fail

**II. TWIST TEST:** Rotate entire body to the right and left each way 5×. _____

## III. MAXIMUM LIFT, CARRY, & FLEXIBILITY TEST

A. Lift 50-lb bag off the floor, carry 50 ft, and set on floor. _____
B. Squat onto your heels hold for 3 seconds, then stand up on tiptoes, arms stretched overhead, and hold for 3 seconds. 3× _____
C. Lift 75-lb 4-in. valve off the floor, carry 50 ft, and set back on the floor. _____
D. Lift 90 lb off the floor to 43 in. high top landing on stairs, set back on the floor. 2× _____
E. Lift 30 lb off the floor to 67 in. high and set back on the floor. 3× _____

## IV. PUSH AND PULL TEST

| | **Distance To Floor** | **Time Held** | **Max.Weight** | **Limit** | **Reason For Termination** |
|---|---|---|---|---|---|
| Vertical pull upwards | | | | 95 lb | |
| *3 sec × 2 reps* | | | | | |
| 40 in. horizontal push | | | | 80 lb | |
| *3 sec × 3 reps* | | | | | |
| 40 in. horizontal pull | | | | 100 lb | |
| *3 sec × 3 reps* | | | | | |
| Pull 125 lb drag bag | | | | | |
| *40 ft × 1 rep* | | | | | |

## V. SHOVEL TEST

Scoop 13.6 lb shovel from floor to 45 in. and back to floor. 25× _____

## VI. DOUBLE CLIMB TEST

Step up onto second and fourth rung of stepladder and back down. 3× _____

## VII. VALVE TURN TEST: _____

## VIII. BODY MECHANICS:

Erect spine (3), load close to body (2), pivot feet (2), bend knees (2), wide base of support (1). Total of 10 points. _____
(0-10 points)

Comments:

_____
_____
_____
_____
_____

Evaluator's Name_____ Date_____

# Hazard Communication Safety Data Sheets

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. As of June 1, 2015, the HCS will require new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

**Section 1, Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

**Section 2, Hazard(s) identification** includes all hazards regarding the chemical; required label elements.

**Section 3, Composition/information on ingredients** includes information on chemical ingredients; trade secret claims.

**Section 4, First-aid measures** includes important symptoms/ effects, acute, delayed; required treatment.

**Section 5, Fire-fighting measures** lists suitable extinguishing techniques, equipment; chemical hazards from fire.

**Section 6, Accidental release measures** lists emergency procedures; protective equipment; proper methods of containment and cleanup.

**Section 7, Handling and storage** lists precautions for safe handling and storage, including incompatibilities.

**Section 8, Exposure controls/personal protection** lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

**Section 9, Physical and chemical properties** lists the chemical's characteristics.

**Section 10, Stability and reactivity** lists chemical stability and possibility of hazardous reactions.

**Section 11, Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

**Section 12, Ecological information***

**Section 13, Disposal considerations***

**Section 14, Transport information***

**Section 15, Regulatory information***

**Section 16, Other information,** includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

**Employers must ensure that SDSs are readily accessible to employees.**

See Appendix D of OSHA 1910.1200 for a detailed description of SDS contents.

For more information: www.osha.gov, (800) 321-OSHA (6742)

From Occupational Safety and Health Administration, US Department of Labor
www.osha.gov/Publications/HazComm_QuickCard_SafetyData.html

# SAFETY DATA SHEET

## 1. Identification

**Product identifier** **Sodium Hypochlorite, 17 - 30%**

**Other means of identification**

**SDS number** 10000032, 10000077

**Synonyms** HyPure® Sodium Hypochlorite 20-30%, Hypo, Liquid Bleach, Bleach, Hypochlorite, Javel Water.

**Recommended use** Swimming pool chlorinator, hard surface cleaner, mildecide, Water treatment chemical, Biocides, bleach solutions and bleach fixer solutions

**Recommended restrictions** None known.

**Manufacturer/Importer/Supplier/Distributor information**

**Company name** Olin Chlor Alkali Products

**Address** 490 Stuart Road, NE
Cleveland, TN 37312

**Company name** Pioneer Americas, LLC (d/b/a Olin Chlor Alkali Products)

**Address** 490 Stuart Road, NE
Cleveland, TN 37312

**Company name** Olin Canada ULC (d/b/a Olin Chlor Alkali Products)

**Address** 2020 University, Suite 2190
Montreal, Quebec H3A 2A5

**General Information**

**Telephone** (888) 658-6SDS (737)

**Website** olinchloralkali.com

**Contact person** ORC SDS Control Group

**Emergency phone number** CHEMTREC
US: 1-800-424-9300 Canada: 1-800-567-7455

## 2. Hazard(s) identification

| | | |
|---|---|---|
| **Physical hazards** | Corrosive to metals | Category 1 |
| **Health hazards** | Skin corrosion/irritation | Category 1 |
| | Serious eye damage/eye irritation | Category 1 |
| | Specific target organ toxicity, single exposure | Category 3 respiratory tract irritation |
| **Environmental hazards** | Hazardous to the aquatic environment, acute hazard | Category 1 |
| | Hazardous to the aquatic environment, long-term hazard | Category 2 |

**OSHA defined hazards** Not classified.

**Label elements**

**Signal word** Danger

**Hazard statement** May be corrosive to metals. Causes severe skin burns and eye damage. May cause respiratory irritation. Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

**Precautionary statement**

**Prevention** Wear protective gloves/protective clothing/eye protection/face protection. Do not breathe mist or vapor. Use only outdoors or in a well-ventilated area. Wash thoroughly after handling. Keep only in original container. Avoid release to the environment.

**Response** If swallowed: Rinse mouth. Do NOT induce vomiting. If inhaled: Remove person to fresh air and keep comfortable for breathing. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Wash contaminated clothing before reuse. Absorb spillage to prevent material damage. Collect spillage.

**Storage** Store in a well-ventilated place. Keep container tightly closed. Store locked up. Store in corrosive resistant container with a resistant inner liner.

| | |
|---|---|
| **Disposal** | Dispose of contents/container in accordance with local/regional/national/international regulations. |
| **Hazard(s) not otherwise classified (HNOC)** | None known. |

**Supplemental information**

Contact with acids liberates toxic gas.

## 3. Composition/information on ingredients

**Mixtures**

| Chemical name | CAS number | % |
|---|---|---|
| Sodium hypochlorite | 7681-52-9 | 17-30 |
| Sodium hydroxide | 1310-73-2 | 1-5 |

## 4. First-aid measures

| | |
|---|---|
| **Inhalation** | Move to fresh air. Call a physician if symptoms develop or persist. |
| **Skin contact** | Take off immediately all contaminated clothing. Wash off IMMEDIATELY with plenty of water for at least 15-20 minutes. Get medical attention immediately. Wash contaminated clothing before reuse. Call a physician or poison control center immediately. |
| **Eye contact** | Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately. |
| **Ingestion** | Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. |
| **Most important symptoms/effects, acute and delayed** | Corrosive effects. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. |
| **Indication of immediate medical attention and special treatment needed** | Treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. |
| **General information** | Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. |

## 5. Fire-fighting measures

| | |
|---|---|
| **Suitable extinguishing media** | Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2). |
| **Unsuitable extinguishing media** | Do not use water jet as an extinguisher, as this will spread the fire. Do not use dry extinguishing media that contains ammonium compounds. |
| **Specific hazards arising from the chemical** | During fire, gases hazardous to health may be formed. |
| **Special protective equipment and precautions for firefighters** | Self-contained breathing apparatus and full protective clothing must be worn in case of fire. |
| **Fire-fighting equipment/instructions** | In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. |
| **General fire hazards** | No unusual fire or explosion hazards noted. |

## 6. Accidental release measures

| | |
|---|---|
| **Personal precautions, protective equipment and emergency procedures** | Keep unnecessary personnel away. Wear appropriate personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Absorb spillage to prevent material damage. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see Section 8 of the SDS. |
| **Methods and materials for containment and cleaning up** | Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.<br><br>Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.<br><br>Never return spills in original containers for re-use. For waste disposal, see Section 13 of the SDS. |
| **Environmental precautions** | Do not discharge into drains, water courses or onto the ground. Environmental manager must be informed of all major releases. |

## 7. Handling and storage

| | |
|---|---|
| **Precautions for safe handling** | Wear appropriate personal protective equipment. Do not get in eyes, on skin, on clothing. Chemical attack increases with solution strength. Use with adequate ventilation. Observe good industrial hygiene practices. Do not apply heat or direct sunlight. Temperature and product concentration affect product quality and decomposition rates. |

**Conditions for safe storage, including any incompatibilities**

Keep container tightly closed. Store in a cool and well-ventilated place. Store in a corrosive resistant container. Consult container manufacturer for additional guidance. Store away from and do not mix with incompatible materials such as acids, oxidizers, organics, reducing agents, and all metals except titanium. For frozen product, contact manufacturer for guidance.

## 8. Exposure controls/personal protection

**Occupational exposure limits**

**US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)**

| Components | Type | Value |
|---|---|---|
| Sodium hydroxide (CAS 1310-73-2) | PEL | 2 mg/m3 |

**US. ACGIH Threshold Limit Values**

| Components | Type | Value |
|---|---|---|
| Sodium hydroxide (CAS 1310-73-2) | Ceiling | 2 mg/m3 |

**US. NIOSH: Pocket Guide to Chemical Hazards**

| Components | Type | Value |
|---|---|---|
| Sodium hydroxide (CAS 1310-73-2) | Ceiling | 2 mg/m3 |

**US. Workplace Environmental Exposure Level (WEEL) Guides**

| Components | Type | Value |
|---|---|---|
| Sodium hypochlorite (CAS 7681-52-9) | STEL | 2 mg/m3 |

**Biological limit values** No biological exposure limits noted for the ingredient(s).

**Appropriate engineering controls** Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

**Individual protection measures, such as personal protective equipment**

**Eye/face protection** Wear safety glasses with side shields (or goggles) and a face shield. Wear a full-face respirator, if needed.

**Skin protection**

**Hand protection** Wear appropriate chemical resistant gloves.

**Other** Wear appropriate chemical resistant clothing. Reports indicate that sodium hypochlorite can react with various fabrics usually increasing with concentration. Reactions vary significantly depending on strength of chemical, material, fabric treatment and color of dyes. FRC treated cotton has a stronger response than plain cotton. Poly blend fabrics and meta aramid fabric have a weaker response than natural fibers. Contact the Personal Protective Equipment manufacturer for specific information about their products.

**Respiratory protection** If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

**Thermal hazards** Wear appropriate thermal protective clothing, when necessary.

**General hygiene considerations** Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

## 9. Physical and chemical properties

**Appearance**

**Physical state** Liquid.

**Form** Liquid.

**Color** Yellow to greenish.

**Odor** Pungent

**Odor threshold** 0.9 mg/m³

**pH** 12 - 14 (25 °C/77 °F)

**Melting point/freezing point** -17 °F (-27.22 °C) (16% solution)

**Initial boiling point and boiling range** Not available.

**Flash point** Not applicable

| | |
|---|---|
| **Evaporation rate** | No data available |
| **Flammability (solid, gas)** | Not available. |
| **Upper/lower flammability or explosive limits** | |
| **Flammability limit - lower (%)** | Not available. |
| **Flammability limit - lower (%) temperature** | Not applicable |
| **Flammability limit - upper (%)** | Not available. |
| **Flammability limit - upper (%) temperature** | Not applicable |
| **Explosive limit - lower (%)** | Not available. |
| **Explosive limit - upper (%)** | Not available. |
| **Vapor pressure** | 12 mm Hg (12.5% solution) |
| **Vapor density** | Not available. |
| **Relative density** | Not available. |
| **Solubility(ies)** | |
| **Solubility (water)** | Completely miscible |
| **Partition coefficient (n-octanol/water)** | Not available. |
| **Auto-ignition temperature** | Not applicable |
| **Decomposition temperature** | Not available. |
| **Viscosity** | Not available. |
| **Other information** | |
| **Bulk density** | Not applicable |
| **Molecular weight** | 74.5 g/mol |

## 10. Stability and reactivity

| | |
|---|---|
| **Reactivity** | The product is stable and non-reactive under normal conditions of use, storage and transport. |
| **Chemical stability** | Material is stable under normal conditions. |
| **Possibility of hazardous reactions** | Hazardous polymerization does not occur. |
| **Conditions to avoid** | Contact with incompatible materials. Avoid ultraviolet (UV) light sources. Excessive heat. Reacts violently with strong acids. Acid contact will produce chlorine gas. Amine contact will produce chloramines. |
| **Incompatible materials** | Strong oxidizing agents. Acids. Metals. Organic compounds. Ammonia. |
| **Hazardous decomposition products** | No hazardous decomposition products are known. |

## 11. Toxicological information

**Information on likely routes of exposure**

| | |
|---|---|
| **Ingestion** | Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract. |
| **Inhalation** | Vapors and spray mist may irritate throat and respiratory system and cause coughing. |
| **Skin contact** | Causes skin burns. |
| **Eye contact** | Causes eye burns. |
| **Symptoms related to the physical, chemical and toxicological characteristics** | Corrosive effects. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. |

**Information on toxicological effects**

**Acute toxicity** Occupational exposure to the substance or mixture may cause adverse effects.

| Product | Species | Test Results |
|---|---|---|
| Sodium Hypochlorite, 17 - 30% (CAS Mixture) | | |
| **Acute** | | |
| *Dermal* | | |
| LD50 | Rabbit | > 2 g/kg |

| Product | Species | Test Results |
|---|---|---|
| *Oral* | | |
| LD50 | Rat | 3 - 5 g/kg |

* Estimates for product may be based on additional component data not shown.

**Skin corrosion/irritation** Causes severe skin burns and eye damage.

**Serious eye damage/eye irritation** Causes serious eye damage.

**Respiratory or skin sensitization**

**Respiratory sensitization** No data available.

**Skin sensitization** No data available.

**Germ cell mutagenicity** No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

**Carcinogenicity** This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

**IARC Monographs. Overall Evaluation of Carcinogenicity**

Sodium hypochlorite (CAS 7681-52-9) 3 Not classifiable as to carcinogenicity to humans.

**Reproductive toxicity** No data available.

**Specific target organ toxicity - single exposure** May cause respiratory irritation.

**Specific target organ toxicity - repeated exposure** No data available.

**Aspiration hazard** Not classified, however droplets of the product may be aspirated into the lungs through ingestion or vomiting and may cause a serious chemical pneumonia.

**Chronic effects** Prolonged or repeated overexposure causes lung damage.

**Further information** Prolonged inhalation may be harmful.

## 12. Ecological information

**Ecotoxicity** Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

| Product | | Species | Test Results |
|---|---|---|---|
| Sodium Hypochlorite, 17 - 30% (CAS Mixture) | | | |
| **Aquatic** | | | |
| Fish | LC50 | Bluegill (Lepomis macrochirus) | 2.9 mg/l, 96 hours |
| | | Oncorhynchus mykiss | 0.9 mg/l, 0.5 hours |
| | | Pimephales promelas | 1.4 mg/l, 96 hours |

* Estimates for product may be based on additional component data not shown.

**Persistence and degradability** No data is available on the degradability of this product.

**Bioaccumulative potential** No data available for this product.

**Mobility in soil** Not available.

**Other adverse effects** No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

## 13. Disposal considerations

**Disposal instructions** Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

**Hazardous waste code** The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

**Waste from residues / unused products** Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

**Contaminated packaging** Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

## 14. Transport information

**DOT**

**UN number** UN1791

| | |
|---|---|
| **UN proper shipping name** | Hypochlorite solutions |
| **Transport hazard class(es)** | |
| **Class** | 8 |
| **Subsidiary risk** | - |
| **Packing group** | III |
| **Special precautions for user** | Read safety instructions, SDS and emergency procedures before handling. |
| **Special provisions** | IB3, N34, T4, TP2, TP24 |
| **Packaging exceptions** | 154 |
| **Packaging non bulk** | 203 |
| **Packaging bulk** | 241 |

**IATA**

| | |
|---|---|
| **UN number** | UN1791 |
| **UN proper shipping name** | Hypochlorite solution |
| **Transport hazard class(es)** | |
| **Class** | 8 |
| **Subsidiary risk** | - |
| **Label(s)** | 8 |
| **Packing group** | III |
| **Environmental hazards** | Yes |
| **ERG Code** | 8L |
| **Special precautions for user** | Read safety instructions, SDS and emergency procedures before handling. |

**IMDG**

| | |
|---|---|
| **UN number** | UN1791 |
| **UN proper shipping name** | HYPOCHLORITE SOLUTION |
| **Transport hazard class(es)** | |
| **Class** | 8 |
| **Subsidiary risk** | - |
| **Label(s)** | 8 |
| **Packing group** | III |
| **Environmental hazards** | |
| **Marine pollutant** | Yes |
| **EmS** | F-A, S-B |
| **Special precautions for user** | Read safety instructions, SDS and emergency procedures before handling. |

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**

## 15. Regulatory information

**US federal regulations** This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

**TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**

Not regulated.

**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)**

Not listed.

**CERCLA Hazardous Substance List (40 CFR 302.4)**

| | |
|---|---|
| Sodium hydroxide (CAS 1310-73-2) | LISTED |
| Sodium hypochlorite (CAS 7681-52-9) | LISTED |

**Superfund Amendments and Reauthorization Act of 1986 (SARA)**

**Hazard categories**
Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

**SARA 302 Extremely hazardous substance**

Not listed.

**SARA 311/312 Hazardous chemical** Yes

**SARA 313 (TRI reporting)**

Not regulated.

**Other federal regulations**

**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List**

Not regulated.

**Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)**

Not regulated.

**Safe Drinking Water Act (SDWA)** Not regulated.

**US state regulations**

**US. Massachusetts RTK - Substance List**

Sodium hydroxide (CAS 1310-73-2)
Sodium hypochlorite (CAS 7681-52-9)

**US. New Jersey Worker and Community Right-to-Know Act**

Sodium hydroxide (CAS 1310-73-2)
Sodium hypochlorite (CAS 7681-52-9)

**US. Pennsylvania Worker and Community Right-to-Know Law**

Sodium hydroxide (CAS 1310-73-2)
Sodium hypochlorite (CAS 7681-52-9)

**US. Rhode Island RTK**

Sodium hydroxide (CAS 1310-73-2)
Sodium hypochlorite (CAS 7681-52-9)

**US. California Proposition 65**

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

**US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance**

Not listed.

**International Inventories**

| Country(s) or region | Inventory name | On inventory (yes/no)* |
|---|---|---|
| Australia | Australian Inventory of Chemical Substances (AICS) | Yes |
| Canada | Domestic Substances List (DSL) | Yes |
| Canada | Non-Domestic Substances List (NDSL) | No |
| China | Inventory of Existing Chemical Substances in China (IECSC) | Yes |
| Europe | European Inventory of Existing Commercial Chemical Substances (EINECS) | Yes |
| Europe | European List of Notified Chemical Substances (ELINCS) | No |
| Japan | Inventory of Existing and New Chemical Substances (ENCS) | Yes |
| Korea | Existing Chemicals List (ECL) | Yes |
| New Zealand | New Zealand Inventory | Yes |
| Philippines | Philippine Inventory of Chemicals and Chemical Substances (PICCS) | Yes |
| United States & Puerto Rico | Toxic Substances Control Act (TSCA) Inventory | Yes |

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

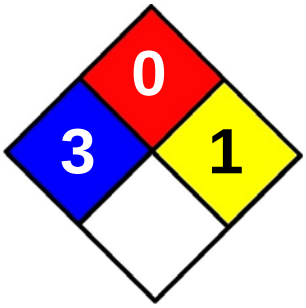
## 16. Other information, including date of preparation or last revision

**Issue date** 28-February-2014

**Revision date** 15-April-2014

**Version #** 02

**NFPA Ratings**



| | |
|---|---|
| **List of abbreviations** | LD50: Lethal Dose, 50%.<br>LC50: Lethal Concentration, 50%.<br>EC50: Effective concentration, 50%.<br>TWA: Time weighted average. |
| **References** | EPA: AQUIRE database<br>HSDB® - Hazardous Substances Data Bank<br>US. IARC Monographs on Occupational Exposures to Chemical Agents<br>IARC Monographs. Overall Evaluation of Carcinogenicity<br>ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices |
| **Disclaimer** | This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment. |

# Temporary Modified Duty Tasks

**General Tasks Description:**

The purpose of these temporary modified duty tasks is to facilitate your transition back to regular work duties.

Your modified duty assignments, which are listed below, are within the restrictions as identified by your treating physician. If you are assigned tasks which are outside of your restrictions, as identified by your treating physician, you are to report them to your supervisor, the Safety Coordinator, or the Human Resources Manager immediately.

You must report to the supervisor identified below. If this is a department other than the one you typically report to, review with the supervisor the expectations of that department. Any changes must be reported to and approved by the supervisor identified below.

These modified duty tasks are temporary and will be reevaluated in 60 days, when restrictions change, or when listed tasks are no longer available.

**Report to:**

**Tasks:**

**Restrictions:**

I have reviewed the above temporary modified duty tasks and feel that is in within my restrictions as identified by my treating physician. I also agree to notify my supervisor, the Safety Coordinator, or the Human Resources Manager if I am not able to perform assigned duties or my restrictions change.

Employee Name (Print):_____

Employee Signature:_____

Date:_____

Initials: Supervisor_____ Manager_____ Safety_____

| *[Insert Utility Name]* | |
|---|---|
| **Title: Field Operations –– Water Works Operator** | **Job Grade: 3 during training 6 after training & successful completion of trial service** |
| **Reporting to: Field Operations or Valve Crew Supervisor** | **Department: Field Operations** |

***[Insert Water Utility Name] believes that each employee makes a significant contribution to our success. That contribution should not be limited by the assigned responsibilities. Therefore, this job description is designed to outline primary duties, qualifications and job scope, but not limit the incumbent nor the organization to just the work identified. It is our expectation that each employee will offer his/her services wherever and whenever necessary to ensure the success of our endeavors.***

**Overall Purpose of the job:** To perform hands-on functions related to construction, operation, repair, and maintenance of the Utility's water system and related facilities. The position includes installation, repair, operations, maintenance and documentation of of water mains, services, hydrants and related appurtenances. The job requires the position to a wide variety of tools and equipment.

**This position has been identified as safety sensitive because one or more of the following are essential functions of the position:** Operating heavy equipment, operation of a commercial vehicle, setting up work zone traffic control, confined space work, trenching and excavation work, operation of a forklift, flagging, working with water treatment chemicals, driving (as a primary function of the position).

**Essential Job Functions:**

- Digging by hand and using hand and power tools are essential to this job function.
- Participate in proper construction, maintenance, operation, and repair of assigned water system infrastructure which may include: mains and related fittings, hydrants, valves, services, meters, regulators, vaults and other components using proper restraint, disinfection, and flushing methods per schedules, plans and/or the Supervisor's direction in a fashion consistent with the Utility Water System Standards and industry best practices.
- Operate various types of heavy equipment and tools, including excavation equipment, dump trucks, tank trucks, crane trucks, vacuums, hydraulic and air power tools, saws, compaction equipment, shoring systems and other miscellaneous types of tools.
- Properly maintain tools and equipment used by the crew.
- Assemble or organize parts, materials and tools appropriate to the task assuring they are available on the job site when needed to avoid unnecessary work delays.
- Performing traffic control in support of the crew's operations.
- Following sound environmental practices.
- Following sound safety practice.
- Acurately complete documention appropriate to assigned tasks in formats required, which may include mapping system updates, as-builts, work order documents, asset records, condition documentation, inventory and work time tracking among others.
- Participate in emergency system repairs and operations as required.
- Provide high quality workmanship in an efficient, cost conscious, and sustainable manner.
- Other duties as assigned.

**Knowledge Required:**

- General knowledge of water distribution system operations.
- Knowledge of routine water system construction, maintenance, and repair methods and procedures.
- Can understand and interpret maps and project plans. Can create clear and understandable field drawings, maps, and other documents appropriate to assigned tasks.
- Know proper operating practices of light and heavy tools and equipment used by the crew.
- Know and follow safety practices, and use safety equipment appropriate to the assigned tasks.

**Special Skills and Qualities:**

- Able to take and act on written and verbal instructions.
- Able to effectively use a pick, shovel, pry bar, jackhammer and other heavy hand tools.
- Good customer relations and communication skills, including the ability to effectively and tactfully work with difficult and unreasonable customers.
- Ability to establish and maintain harmonious relationships with others both inside and outside of the Utility.
- Able to learn and effectively work with computer applications and electronic equipment routinely used by the crew.

**Minimum requirements:**

- High School Diploma or equivalent.
- Ability to take and pass the Water Distribution System Operator I examination after a maximum of two years of holding the position.
- Ability to work as a team member in a crew environment.
- A valid Oregon State Driver’s License; have and maintain a safe driving record and the ability to obtain a Class A Commercial Driver's License (CDL) with airbrakes and tanker endorsement within six months of holding the position.
- Have and maintain a safe driving record.

**Working Conditions:**

- Work a minimum of nine hours per day and other hours as required.
- Able to work variable work schedule to accommodate project and customer constraints.
- Ability to have regular and predictable attendance.
- Take on-call duty as needed.
- Work in adverse weather conditions, and perform tasks requiring significant physical exertion, including repetitive lifting, digging, prying, and kneeling on a daily basis.
- Respond and work, without advanced notice, in times of adverse weather, natural disaster, emergency, or other unusual events as determined by the Utility.

# Maintenance and Construction Crew Waterworks Operator

## PHYSICAL ACTIVITIES

**In an eight-hour day, this job requires:**

**R – Rarely** Less than 1 hr or 1–5% per day

**F – Frequently** 2.5–5.5 hrs or 34–66% per day (34% = > 20×/hr, 66%=120×/hr or < 720x/day)

**O – Occasionally** 1–2.5 hrs or 10–33% per day 10% = 4–6×/hr, 33% = 20×/hr or < 60×/day)

**C – Continually** 5.5 – 8 hrs or 67–100% per day (67% = > 120×/hr or > 720×/day)

| | R | O | F | C | Notes |
|---|---|---|---|---|---|
| Assembly | | X | | | Pipe assembly, tighten fittings |
| Sitting | **X** | | | | Vehicles, meetings |
| Standing | | | **X** | | Repairs, flagging, operating equip, pogo |
| Walking | | | | **X** | Uneven ground, 100'+ in field |
| Squatting/crouching | | **X** | | | Repair water systems, trench |
| Driving | | | **X** | | Vehicles |
| Crawling | X | | | | Trench |
| Kneeling | | **X** | | | Repair meters |
| Digging/shoveling | **X** | | | | Landscape clean up |
| Stooping/bending | | | **X** | | Install/ repair pipe |
| Turn/twisting | | | **X** | | Handle equipment, handle pipes |
| Balancing | | **X** | | | Walking on pipe in trench |
| Reaching forward | | | **X** | | Install/ repair lines |
| Reaching overhead | **X** | | | | In ditch, reaching up for tools, from trench for tools |
| Climbing | | **X** | | | 16" & 26" step into dump truck, shallow ditches, truck |
| Ladder climbing | **X** | | | | 6'-10' ladder in/out of ditch |
| Wrist turning | | | **X** | | Hand tools, wrench |
| Grasping | | | | **X** | Tools, valves, wrench |
| Pinch/squeeze | | | | **X** | Hand tools |
| Finger manipulation | | | | **X** | Hand tools |

# Maintenance and Construction Crew Waterworks Operator

## LIFTING

**In an eight-hour day, this job requires:**

**R – Rarely** Less than 1 hr or 1–5% per day

**F – Frequently** 2.5–5.5 hrs or 34–66% per day (34% = > 20×/hr, 66%=120×/hr or < 720x/day)

**O – Occasionally** 1–2.5 hrs or 10–33% per day 10% = 4–6×/hr, 33% = 20×/hr or < 60×/day)

**C – Continually** 5.5 – 8 hrs or 67–100% per day (67% = > 120×/hr or > 720×/day)

| Weight | Object | Lowest point | Highest point | **R** | **O** | **F** | **C** |
|---|---|---|---|---|---|---|---|
| 29# | 2″ meter | Ground | 43″ | X | | | |
| 48# | Box of 8″ Bolts | Ground | 43″ | | | | |
| 45# | Pier block | Ground | 43″ | | X | | |
| 50# | 4′x8′ Thin Form Plywood | Ground | 32″ | X | | | |
| 54# | Brooks #4 Box | Ground | 43″ | X | | | |
| 60# | Tapping Motor | Ground | 43″ | | X | | |
| 60# | Concrete/Sand | Ground | 43″ | X | | | |
| 60# | 3″ Meter | Ground | 43″ | X | | | |
| 60# | Concrete Bag | Ground | 43″ | X | | | |
| 60# | Hydraulic Jackhammer | Ground | 43″ | X | | | |
| 70# | 3″ Meter | Ground | 43″ | X | | | |
| 70# | 6″ Tee | Ground | 43″ | X | | | |
| 71# | Hydraulic jackhammer | Ground | 43″ | X | | | |
| 73″ | Cart Saw | Ground | 43″ | X | | | |
| 73″ | Push bar | Ground | 43″ | X | | | |
| 75# | 4″ Valve | Ground | 43″ | X | | | |
| 90# | Roll 2″ Copper | Ground | 43″ | X | | | |
| 93#<br>46.5 | Trash Pump<br>1-person<br>2-person | Ground | 43″ | X | | | |
| 140#<br>70# | 6″ Valve<br>1-person<br>2-person | Ground | 43″ | X | | | |
| 130#<br>65# | 12″ Shell/Cutter Head<br>1-person<br>2-person | Ground | 43″ | X | | | |
| 95# | Jumping Jack Compactor | Ground | 30″ | X<br>Up to 6x per day | | | |

# Maintenance and Construction Crew Waterworks Operator

## CARRYING

**In an eight-hour day, this job requires:**

**R – Rarely** Less than 1 hr or 1–5% per day

**O – Occasionally** 1–2.5 hrs or 10–33% per day
10% = 4–6×/hr, 33% = 20×/hr or < 60×/day)

**F – Frequently** 2.5–5.5 hrs or 34–66% per day
(34% = > 20×/hr, 66%=120×/hr or < 720x/day)

**C – Continually** 5.5 – 8 hrs or 67–100% per day
(67% = > 120×/hr or > 720×/day)

| Weight | Object | Maximum distance carried | R | O | F | C |
|---|---|---|---|---|---|---|
| 45# | Pier Block | 5-10′ | | X | | |
| 48# | Box of 8″ Bolts | 50′ | X | | | |
| 54# | Brooks #4 Box | 20′ | X | | | |
| 60# | Concrete/Sand | 50′ | X | | | |
| 60# | Tapping Motor | 50′ | X | | | |
| 60# | Concrete Bag | 10′ | X | | | |
| 60# | Hydraulic Jackhammer | 5′-10′ | X | | | |
| 70# | 6″ Tee | 20′ | X | | | |
| 71# | Hydraulic Jackhammer | 50′ | X | | | |
| 73# | Push Bar | 100′ | | X | | |
| 73# | Cart Saw | 100′ | | X | | |
| 75# | 4″ Valve | 20′ | X | | | |
| 90# | Roll 2″ Copper | 20′ | X | | | |
| 93#<br>46.5 | Trash Pump<br>1-person<br>2-person | 5-10′ | X | | | |
| 130#<br>65# | 12″ Shell/Cutter Head<br>1-person<br>2-person | 20′ | X | | | |

## Maintenance and Construction Crew Waterworks Operator

## PUSH/PULL

| Weight | Object | Maximum distance | R | O | F | C |
|---|---|---|---|---|---|---|
| 38# | Operating valves | Turning with 1 arm | X | | | |
| 38# 1 arm | Valve turning-manual | Pull | X | | | |
| 43# | Operating hydrants | Turning valve | X | | | |
| 73# | Cart Saw | Push 100 feet | | X | | |
| 80# | 8" Pipe with Pry Bar | 3-6" Push | X | | | |
| 95# | Manhole Lid | Vertical pull upwards | X | | | |
| 120# | Tightening fitting with wrench | Pull and push | X | | | |
| 515# 150# | Cold Barrel Mix | Pull and tilt Push | X | | | |

## ENVIRONMENT EXPOSURES

## Maintenance and Construction Crew

Inside: 20 % Outside: 80 %
Temperature Range: _____ °F to _____ °F

| | Rarely | Occasionally | Frequently | Constantly | Comments |
|---|---|---|---|---|---|
| Chemicals: Contact: | x | | | | Chlorine, marking paint, solvents, gasoline |
| Inhalation | x | | | | See Chemical Contacts |
| Restricted Spaces | | x | | | Confined spaces and trenches |
| High Elevations | n/a | | | | |
| Moving Objects | | | | x | Vehicles and equipment |
| Noise | | | | x | Vehicles and equipment |
| Safety Equipment | | | | x | PPE |
| Slippery Surface | | | | x | |
| Special Clothing | n/a | | | | |
| Vibration | | | x | | Vehicles and equipment |
| Wetness | | | x | | |
| Lighting | x | | | | Night work |
| Floor Surface | n/a | | | | |