

PoolSafeBC



Best Practices Guide



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INTRODUCTION

There are between 80 and 100 time-loss injuries each year to aquatic staff. Although WorkSafeBC does not keep statistics, there have probably been at least that many medical aid claims. Most injuries arise from strains, sprains, falls, and being struck by objects.

About half of all aquatic staff are under the age of 22, the most vulnerable age group for accidents at work. Some young workers believe “it won’t happen to me,” and won’t raise questions if asked to do a dangerous task. Maybe they don’t have the experience to recognize the dangers, or maybe they don’t want to look bad in front of their boss or coworkers. But with 34 young workers being injured on BC jobsites every working day; 5 being permanently disabled each week, and about 5 dying each year at work, maybe image isn’t that important.

About 70% of injuries are to women — partly because there are more women than men working in pools.

There have been two worker fatalities in pools in BC.

In one instance the worker was working alone doing some repairs to the pool basin. The pool was full and in normal functioning mode. He inadvertently got too close to the pool drain and was sucked onto the grating, forming a seal. The differential pressures prevented the worker from releasing from the drain and he was held there till the air in his SCBA ran out.

This wouldn’t happen in newer pools because they have multiple main drains. If one is blocked, the other takes over. But there are still a number of older pools in the province with the single main drain design.

In the second case, a young worker was trying to repair wave chamber grates and was moving in and out of an underwater confined space. She ended up getting drawn onto an intake pipe for a waterslide. Because of the strong suction, she could not release herself.

Tragedies such as these can be prevented when we know the hazards and take the necessary steps to address them. Pool safety is everyone’s responsibility — workers and management alike.

SECTION 1

Rights and Responsibilities

Rights and Responsibilities of Employers and Workers

Employer Responsibilities

Employers have a number of legal responsibilities, according to the *Workers' Compensation Act* and the *WorkSafeBC Occupational Health and Safety Regulation*.

Their main responsibility is to ensure the health and safety of all workers at a jobsite, whether they are employees or contract workers. This involves:

- remedying hazardous conditions
- establishing health and safety policies and programs
- providing personal protective equipment
- complying with the laws and regulations
- providing education and training for workers and supervisors
- cooperating with the Joint Occupational Health and Safety Committee
- informing workers of actual or potential health and safety hazards

These are onerous responsibilities. An employer can be held accountable by employees and by WorkSafeBC officers. Employers that fail to meet their legal responsibilities could face a lawsuit or criminal prosecution.

Joint Occupational Health and Safety Committee

If an organization has 20 or more workers, the employer must have a Joint Occupational Health and Safety Committee.

The Joint Occupational Health and Safety Committee is comprised of elected worker representatives as well as representatives from management.

Both employer and worker representatives are involved in conducting investigations of incidents or injuries. These include serious injury or death, incidents with the potential for serious injury, structural failure, major release of a hazardous substance, or any case where a worker requires medical treatment. Anyone who is required to conduct investigations must have been trained to do so.

Investigations of incidents or accidents are important to help make sure they don't happen again.

A major release of a toxic or hazardous substance is defined by the Board as an incident causing one person to require medical aid or two people to require first aid. Also, it is considered a major

release when it is beyond the capability of the employer to clean it up quickly.

In the case of serious injury or death, structural failure, or major release of a hazardous substance, the Board must be notified immediately.

Safety Inspections

To prevent illness and injury, all workplaces must have frequent, regular safety inspections. Some inspections must involve members of the safety committee.

Pool Operators should consult manufacturer equipment/operator manuals to determine what equipment requires inspection, and how often.

Responsibilities of Supervisors

Supervisors have a big responsibility under the *Workers' Compensation Act*.

According to the Act, a supervisor is anyone who instructs, directs and controls workers in the performance of their duties.

This means that anyone responsible for overseeing the work of another person, even for a couple of hours, is a supervisor. Many workers are surprised to find that they are supervisors under the law.

In most organizations, people in the following positions are considered supervisors: Managers, aquatic supervisors, aquatic leaders, shift supervisors, and mentors. The titles may vary from organization to organization, so check with your employer to find out if your job falls under the definition of supervisor.

According to the *Workers' Compensation Act*, supervisors must:

- ensure the health and safety of all workers under their direct supervision
- be knowledgeable about the Act and the WorkSafeBC Regulations applicable to the work being supervised
- comply with the *Workers' Compensation Act*

and the Regulations and any applicable orders written by the Board

- ensure that the workers under their direct supervision are made aware of all health or safety hazards in their work area
- ensure that workers comply with the Act, the Regulation and any orders
- consult and cooperate with the Occupational Health and Safety Committee
- cooperate with the Board and any officers of the Board who may be at the workplace.

Here are some of the specific responsibilities of supervisors under WorkSafeBC regulations:

- correct any unsafe conditions or acts in the workplace, as reported by workers under their supervision
- investigate accidents or incidents
- investigate instances in which a worker is refusing to carry out what he or she feels is unsafe work
- prevent workers with a physical or mental impairment from working. Workers are expected to inform their supervisor of any impairment, but if they don't, supervisors must prevent them from working in an unsafe state
- ensure that workers have appropriate personal protective equipment, that they wear it correctly, and that the equipment is properly cleaned, inspected, maintained and stored

Workers' Responsibilities

Workers also have some legal responsibilities under the Act.

Their most important responsibility is to protect their own health and safety and that of other workers. Health and safety at work is based on teamwork.

Workers are also required to:

- follow established safe work procedures
- wear personal protective equipment if and as required
- report all hazards and injuries.

Workers' Rights

Workers have rights as well as responsibilities.

These include:

- being properly trained and supervised
- being provided with proper personal protective equipment
- refusing work that they consider hazardous to themselves or others

For more information about workers' and employers' rights and responsibilities, go to www.worksafebc.com.

In addition, the WorkSafeBC Prevention Information Line can answer your questions about workplace health and safety, worker and employer responsibilities, and reporting a workplace accident or incident. The Prevention Information Line accepts anonymous calls.

Phone 604 276-3100 in the Lower Mainland, or call 1 888 621-7233 (621-SAFE) toll-free in British Columbia.

To report after-hours and weekend accidents and emergencies, call 604 273-7711 in the Lower Mainland, or call 1 866 922-4357 (WBC-HELP) toll-free in British Columbia.

SECTION 2

Hazards

Swimming Pool Hazards

There are a number of potential hazards for workers in pool settings. The main ones include:

- Indoor Air Quality
- Heat Stress
- Biohazards
- Lockout
- Confined Spaces
- Fatigue
- Noise
- Slips, Trips, Falls
- Musculoskeletal Injuries

Indoor Air Quality

Poor air quality is a significant hazard in pools. Two types of chemical compounds can affect air quality—trihalomethane and chloramines.

Trihalomethanes result from reactions between organic materials in the water and the chlorine that has been added as a disinfectant.

Chloramines form when the chlorine in the water has been weakened by contaminants such as urine, perspiration, etc.

Both trihalomethanes and chloramines can be

released as gases in the air, which can have a negative effect on air quality.

Microbiological Growth

Organisms such as bacteria, fungi, viruses, protozoa, and amoebae are by-products of poor air quality. For details about the different types and their effects on people, see the information sheet on **Microbiological Organisms and their Effects** later in the Appendix.

Warm, moist places like pools are ideal for mould and bacterial growth. We must control biological growth in open water areas of the HVAC system, and in places like washrooms and change rooms. Moulds are everywhere and there are more than 100,000 different species. It's impossible to eliminate moulds from our homes or workplaces but we can control their growth. The best protection against these hazards is safe indoor air quality and proper cleaning. Washing thoroughly with the appropriate cleaners will prevent the problem from starting.

Here are some things that can be done to control organic matter in the pool:

- insist that bathers take showers with soap before entering the pool
- provide bathroom breaks for swimming classes

- educate the public about their responsibility to keep the pool clean
- post signs to remind them
- clean all surfaces every day.

Air Turnover, Humidity, and Temperature

WorkSafeBC has standards that govern temperature, humidity and air distribution in a building. For swimming pools, some of the normal ranges cannot apply. Obviously, humidity cannot be kept low in a pool environment, but it should be kept between 50% and 60%. Lower than 50% causes heating issues and makes it too cold for swimmers. Higher than 60% encourages corrosion and condensation problems as well as swimmer discomfort.

Air temperature should be kept at 1 or 2 degrees above the main pool temperature. For example, a pool temperature of 28°C requires an air temperature of 29°C. This temperature is appropriate for bathers, but it can cause heat, dehydration and fatigue concerns for lifeguards. That's why having water on deck and regular rotations are essential.



Air intake

Turnover of air in pools obviously has to happen more often than in the office area. Pool air handling systems need to be designed and calibrated to allow for 4 to 6 air changes per hour. Typical settings are for 50% fresh air being introduced on each air change.

Regular maintenance of air handling units, especially changing filters as per manufacturers' recommendations, is essential to ensure good pool air quality.

The water in the aquatic facility has a big impact on indoor air quality. Watch out for stagnant water and be sure to control water features that generate aerosols. The increased humidity caused by spray pools will impact the indoor air quality because it causes air pollutants to be more concentrated.

Complaints about Air Quality

When there is a complaint about air quality, Occupational Health and Safety regulations call for an immediate investigation.

This investigation will include an inspection of the ventilation rate, the distribution of air within the building, and the HVAC system. It may also involve taking samples of possible airborne contaminants.

The employer must keep a record of the complaint, the investigation, any findings, and any actions taken.

The Importance of Proper Maintenance

A regular maintenance schedule is essential for air quality. This includes: calibrating the sensors, cleaning duct work, cleaning areas where water has accumulated, cleaning air intake vents, checking drain traps, and inspecting HVAC systems.

The Keys to Healthy Air Quality

Here are the keys to healthy air quality in a pool:

- proper ventilation
- good water chemistry
- appropriate chlorine levels (studies suggest increased chlorine can reduce chloramines)
- adequate water turnover.

The *BC Health Act* establishes chlorine levels and water flow rates.

Water Turnover in Pools

The maximum water turnover time is 6 hours for the main pool and 2 hours for the leisure pool. The maximum turnover time for whirlpools is 1 hour.



Example of standing water

Turnover time calculation is based on a number of factors; a proper calculation based on these factors would determine the optimum turnover time for your size of pool.

For instance, high bather loads and use of water features like sprays may require a turnover of 4 hours for the main pool and 1½ hours for the leisure pool.

“The solution to pollution is dilution,” which is why experts recommend 40 litres of fresh water per bather per day. This may require additional heating equipment.

Heat Stress

Another hazard to workers in pools is heat stress. Heat stress can result from high temperature, high humidity, or a direct source like a boiler or even sunlight.

There are many heat-related disorders. The four main ones are heat rash, heat cramps, heat exhaustion, and heat stroke.

Supervisors need to be able to recognize the signs and symptoms of heat disorders, to monitor their staff to ensure they are not being affected, and to render appropriate first aid if necessary.

The table on page 13 provides a summary of heat-related disorders, their symptoms, and what can be done about them.

Heat Stress

OHS Regulations requires employee education and training, and other programs to prevent heat disorders.

The Wet Bulb Globe Thermometer (WBGT) measures the effect of heat on the body’s core temperature. It does this by combining the effects of radiant heat sources like the sun and heaters, with the ambient temperature and prevailing humidity. The WBGT also notes any air movement that would aid evaporation of moisture from the skin, a natural cooling mechanism.



Wet bulb globe thermometer

Here are the WBGT trigger points, assuming the humidity level is in the normal range of 50 to 60%:

Light Work	27.5°C
Moderate Work	25.0°C
Heavy Work	22.5°C

But without an expensive WBGT thermometer and/or if your dehumidifier isn’t working correctly, these temperatures can’t be used as trigger points. This is because they don’t take into account the high humidity in pool areas.

Heat Stress Exposure Control Plan

The best way to deal with heat stress issues is to assess the workplace and establish a heat stress exposure control plan.

There are three parts to an exposure control plan— temperature, work levels, and hierarchy of controls.

The first one, temperature trigger, is the threshold temperature at which heat stress could be an issue, usually 30°C.

The second factor is work level, whether it's light, moderate, or heavy. The employee's work clothing will also affect vulnerability to heat stress. Lifeguards and pool maintenance workers may both work in a pool, but their jobs are different and they wear different clothing.

The third component in a heat stress exposure control plan involves dealing with “a hierarchy of controls.” This is a series of measures to remove or reduce a hazard. They range from most effective to least effective:

- ❑ Elimination. The first and most effective would be eliminating the task.
- ❑ Substitution. Second would be substituting the task or process for one that is less hazardous.
- ❑ Engineering Controls. Third would be engineering controls such as modifying the HVAC system to eliminate or lessen the hazard.
- ❑ Administrative Controls. If the task cannot be eliminated or substituted and the HVAC system is working properly, the fourth measure would be administrative controls such as shortened shifts in the hot pool environment and putting staff on a rotation through an air-conditioned room. Providing cool drinking water and giving staff an opportunity to jump in the water, or walk under a water spray, will reduce their body temperature and diminish the risk of a heat exposure disorder.

- ❑ Personal Protective Equipment. A fifth measure would be personal protective equipment such as water-cooled vests, which wouldn't be feasible in a pool environment.

Guidelines for working in a hot environment:

- ❑ Thirst is not an adequate indicator. Relying on thirst will result in dehydration.
- ❑ Dehydration is difficult to reverse. Adequate fluid intake throughout the work shift is critical.
- ❑ Workers should drink one cup (150ml) of cool water every 15-20 minutes.
- ❑ Profuse sweating may call for a commercial electrolyte replacement drink. Some drinks are too concentrated and need to be diluted or consumed with water.
- ❑ Avoid salt tablets. They irritate the stomach and can cause vomiting, which results in further dehydration.

Biohazards

A major hazard in pool environments is exposure to others' blood or body fluids, which could be contaminated with hepatitis or AIDS. There are many ways to prevent such exposures.

Lifeguards, first aid workers, and others whose jobs entail physical contact with the public, are considered to have “occupational exposure.” Occupational exposure means they **could have** harmful contact, it does not mean that they **have had** harmful contact. The Occupational Health and Safety Regulation requires training in control procedures, which might include using protective equipment such as gloves.

All employees with occupational exposure must be offered a free Hepatitis B vaccination. This is a series of three shots (day 1, day 30, and six months later) that will protect you against Hepatitis B for life.

If there is a chance that someone has had harmful contact with blood or body fluids, they must

Table of Heat-Related Disorders

Disorder	Signs & Symptoms	Cause	Prevention	First Aid Treatment
Heat Rash	"Prickly Heat". Tiny raised, blister-like rash.	Skin is constantly wet from sweat. Sweat gland ducts become plugged, leading to inflammation.	Shower after working in hot environment	Keep skin clean & dry
Heat Cramp	Painful muscle spasms in arms, legs or abdomen during or after hard physical work	Not well understood. May be due to a loss of salt from sweating. Dehydration is a factor.	Adequate water intake and adequate salt intake at meals. Do not use salt tablets.	Rest. Drink water and eat more salty foods. If cramps persist, seek medical attention.
Heat Exhaustion	General weakness, tiredness and poor muscle control Dizziness & fainting Headache & nausea Pale, cool & clammy skin Rapid pulse Shallow breathing Sweating Muscle cramps Normal or slightly elevated temperature	Dehydration causes blood volume to decrease	Acclimatization. Drink plenty of water.	This is a medical emergency. Notify the first aid attendant and arrange for medical help as quickly as possible. First Aid procedure: <ul style="list-style-type: none"> • Immediately attempt to cool the worker. • If the worker is not breathing or is unconscious, follow regular first aid procedures. • Move worker to the coolest area available. • Loosen or remove outer clothing. • Constantly sponge or spray worker with water or cover with wet sheets. • Continue to cool worker while waiting for medical help or during transport. • If the worker is conscious, fully alert and not nauseated, give the worker cool drinks sprinkled with salt, and salty-tasting foods. Salt tablets are not recommended. • Continuously monitor the worker closely and give life-saving first aid as needed.
Heat Stroke	Hot, dry, flushed skin Usually sweating but may have stopped if advanced heat stroke is present Agitation & confusion Headache Nausea & vomiting Rapid, shallow breathing Irregular pulse Possible seizures & loss of consciousness Possible shock & cardiac arrest	Partial or complete failure of sweating mechanism. The body cannot get rid of excess heat.	Acclimatization Close monitoring of workers for signs and symptoms of heat-related disorders Medical screening for personal risk factors Drink plenty of water	This is a medical emergency. Notify the first aid attendant and arrange for medical help as quickly as possible First aid and treatment is the same as for heat exhaustion.

report to first aid immediately, and may be advised to seek immediate medical attention at a hospital emergency department. There is about a two-hour window after exposure to HIV in which anti-retroviral drugs can prevent the “bug” from taking hold. Only a physician can recommend a course of anti-retrovirals.

Lock-out

Lock-out means using a padlock to prevent anyone from energizing the system, whether it’s hydraulic, electrical, or gravity-based.

Those assigned to perform a lock-out are each given different locks. Everyone working on the system must lock out and must check to make sure the equipment cannot be started.

Here are the steps to performing a lock-out:

1. Turn the machine off with a stop button at the control panel. If you are locking out a breaker for changing a light panel, turn off the wall switch.
2. Lock out the main breaker for the machine or equipment. Always stand with back to the electrical panel and turn head away. Then, if there is a problem and the panel door blows open, the worker will be mostly in the clear.
3. Apply lock to the breaker. Follow this with a “do not start” tag, if specific lockout procedures require that.
4. Test the lock-out. Go back to the control panel and push the start button, or turn the wall switch back on, to ensure that the equipment cannot be activated, and that the correct breaker has been locked out.
5. Turn the machine or wall switch off again after testing it.

After performing the work, be sure to remove the lock. If not, management will have to remove it. They must follow a specific procedure for ensuring workers are okay before removing the lock.



Never work, even for a second, on equipment that has not been locked out.

Below is an example of a lock-out procedure for a circulation pump:

SAMPLE Equipment Lockout Procedure

Equipment to be locked out: **Chlorine pump**

Lockout Kit Station – Located in Arena lower lobby electrical room

Purpose:

To allow for the safe repair / maintenance of equipment and to ensure there is no possibility of energizing equipment while it is unsafe to do so.

Procedure:

1. Gather required lockout equipment from the lockout kit station
2. At MCC panel # 1 in the mechanical basement
 - a. Locate the appropriate chlorine pump
 - b. Turned the H-O-A (hand – off – auto) switch to O for Off position
 - c. Ensure motor is switched off.
 - d. Switch the motor circuit breaker to the off position
 - e. Install a lockout lock and tag to the lockout bracket on the right side of the circuit breaker switch. Label the tag with your name, date and reason for install with water soluble marker.
Each person working on the equipment must apply their own lock to the lock out bracket. If there is no room for additional locks you will need to install a scissor attachment from the lockout kit.
 - f. Ensure circuit breaker switch cannot be turn on
3. After work has been completed
 - a. Ensure all personnel are clear of area before removing locks
 - b. Remove lockout locks
 - c. Turn all switches back to working positions
 - d. Return lockout equipment to lockout station

Confined Spaces

Confined spaces are a hazard that is often ignored. Confined spaces are completely unforgiving. Workers are rarely injured in confined spaces—they die.

A confined space is not always a totally enclosed tank, and is sometimes difficult to recognize. It is officially defined in the Regulation as an enclosed, or partially enclosed, space that is:

- not intended for human occupancy
- big enough for a person to get inside to perform work
- difficult to get in and out of to perform rescue and/or first aid.

Workers entering an empty pool to do repair work are not required to follow all the requirements of the Confined Space Entry sections of the Regulation. However, if using epoxies or resins in the pool, or welding, or even using certain cleaning chemicals, the requirements may apply. The employer must ensure that any work to be done in the pool is done safely—particularly if any chemicals such as cleaners are used.

There are many confined spaces in a swimming pool setting, besides the pool basin. These include crawl spaces, the wave chamber, sump pump chambers, filter tanks, surge tanks, the DE settling pit, and the DE filter tank.

Confined spaces kill. Too many people have died in confined spaces because they have not recognized the hazard. It is impossible to see or smell an absence of oxygen. Often people have died, simply because they have gotten too close to the entrance and have been overcome by the unseen gas inside.

Workers who are required to enter confined spaces must receive specific training and education in confined space entry procedures. If workers have not yet received this training, confined spaces must not be entered.

Fatigue

Fatigue is another hazard in the workplace. Long work hours and/or many consecutive days of work can make workers feel tired, irritable, depressed, or giddy. Workers may lose appetite, have digestive problems, or be more vulnerable to catching a cold or flu.

Not only is fatigue bad for the worker, it is bad for the workplace. Fatigued workers may:

- react more slowly than usual
- respond incorrectly or not at all to things going on around them
- show poor logic and judgment
- have trouble concentrating
- be less motivated and more forgetful
- take more risks

Here are some ways that fatigued workers cope:

- working more slowly
- relying on fellow workers
- checking and rechecking their work
- choosing to carry out less critical tasks.

Most people need 7½ to 8½ uninterrupted hours of sleep each day. A single night's shortened or disrupted sleep may not be a problem, but repeated disruptions over days and weeks can affect performance.

A worker completing an extended work shift may have only 4 to 5 hours for sleep once travel, eating, and social time are taken into account.

The human body needs time to recover from the effects of workplace exposures, combined with fatigue. Employers need to consult an occupational hygiene specialist regarding exposure to hazards such as noise, vibration, chemicals, and extreme temperatures over a longer workday. Personal protective equipment such as respirators or specialized clothing can also have an effect if worn for extended work hours.

Fatigued workers mean more accidents and injuries. There are many hazards that can plague workers who are not alert. Work schedules need to take this into account.

Noise

Hearing protection is definitely required in some areas of every aquatic facility.

The 8-hour exposure limit for noise is 85 decibels.

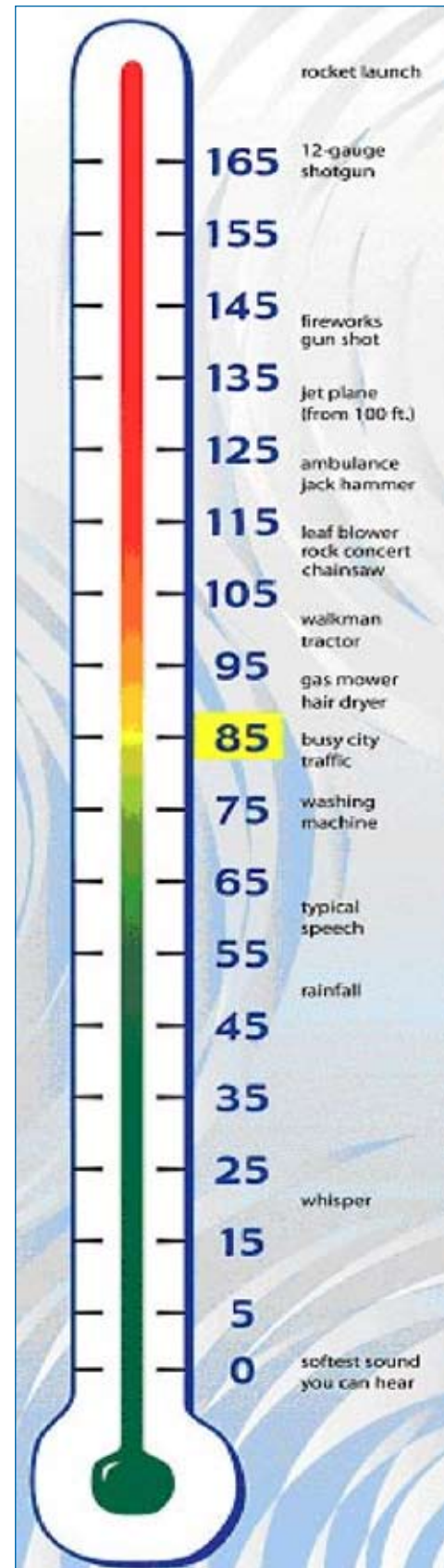
Employers must take noise level sampling wherever a worker is exposed or might be exposed to noise levels above 82 decibels. An exception is when the employer knows that workers are exposed to levels above 82 decibels. In that case, sampling isn't required, but the employer must offer a program of education and training, and must attempt to eliminate or lessen the noise.

Any mechanical room likely has noise levels that exceed 82 decibels. If the noise hazard cannot be eliminated, it must be reduced, if possible. If it cannot be reduced to levels below 82 decibels, then administrative controls—keeping workers out of the high noise area, posting warning signs, and personal protective equipment such as earplugs or ear muffs need to be provided. Annual hearing tests must be conducted for workers exposed to noise in excess of the exposure limits.

If the exposure is long enough, hearing can be damaged at 82 decibels. The louder the noise, the less exposure is needed to permanently damage hearing.

Here are the approximate noise levels of some common equipment and situations:

Source	dB
heavy city traffic	85
gas lawn mower	90
hair dryer	90
chainsaw	110
jackhammer	125



Slips, Trips, and Falls

Given the mechanics of walking, it is surprising that humans don't fall more often.

Slips

Slips most commonly occur when the back heel strikes the ground and weight is transferred to the lead foot. If the lead foot slips out, the support base is lost and a fall occurs.

Many lower back injuries occur when a person carrying or lifting an object tries to recover from a slip or loss of balance.

To prevent slips, wear appropriate footwear and keep walking surfaces clean. Walking surfaces should be suitable for pushing, pulling, and carrying. They should provide adequate foot grip but allow wheels to roll freely.

Rough, deeply textured surfaces are not the best way to prevent slipping because they can cause tripping.

Wet surfaces are invariably slippery, and expected in your work environment. Always remember this and take extra care. Be aware, also, that sloped surfaces could be far more slippery than flat surfaces.

Trips

Abrupt changes in the height of a walking surface present a tripping hazard, even if the change is as little as 1 cm. Making the transition from a low-slip resistance surface such as a sand-covered loading ramp to a high-slip resistance surface such as a clean, dry, asphalt pad, can also cause tripping.

To prevent tripping, make a point of adapting your walk to the surface. Some other precautions include keeping as few objects as possible on walking and working surfaces; eliminating abrupt changes in walking surface height; and, where possible, replacing stairs with ramps between levels.

Falls

Falls are often underestimated. Serious injury can occur with a fall on the same surface, let alone a

fall of a few or several feet. People have died after falling just a few feet.

Falls from ladders cause serious injuries each year. Here are a few precautions:

- ❑ Always inspect the ladder before use to be sure it is in good condition. If not, remove it from service.
- ❑ Always place ladders on a secure, level surface. Never place them on boxes, barrels or other unstable bases, to obtain greater height.
- ❑ Never work from the top two rungs or steps of any ladder.
- ❑ Always face the ladder when climbing up or down.
- ❑ Use the three point contact rule: Two hands and one foot or two feet and one hand in contact with the ladder at all times.

In order to prevent falls, this is the hierarchy that must be followed.

The hierarchy applies when working at a height of 3 meters or more, or from lower heights if there are other hazards such as rebar sticking up through the concrete.

The first measure would be guardrails. If installing them is not possible, then there needs to be some kind of fall restraint. In the absence of guardrails or fall restraint, there needs to be a fall arrest device to keep you from falling more than 1.2 meters. If none of these measures are possible, there needs to be a monitoring system such as a fellow worker standing by to alert you if you are getting too close to the drop off.

When there is the risk of a fall of 7.6 meters or more, there must be a written fall protection program.

If working from a boom lift, personal protective equipment such as a harness and lifeline are mandatory as soon as the worker enters the bucket.

Musculoskeletal Injury

Musculoskeletal injuries (MSIs) are the single largest type of injury suffered by workers in BC. Strains and sprains from physical exertion, physical activity, or poor body mechanics account for more than 800 days of time loss by lifeguards every year.

Injury occurs when the demands on the joints, discs, ligaments, and muscles trying to hold the spine together are too great.

Here are some actions that can result in MSIs:

- repeated movements involved in loading—i.e., lifting, pushing, pulling and carrying
- repeated forward bending
- sitting for too long—this leads to more injuries than lifting.

Common aquatic centre tasks that could cause MSIs include

- moving lane ropes/bulkheads
- lifting clients (children, disabled)
- lifting chemical containers (sacks are very awkward to lift)

Here are four principles to prevent back strain when lifting.

1. Keep the natural curve in your lower back
2. Contract your abdominal muscles. This improves spine stability
3. Avoid twisting
4. Hold the load as close to your body as possible

Being in good physical shape is also necessary.

Microbiological Organisms and their Effects

Bacteria

Below are the formal and common names of some of the bacterial infections that might arise in pools. Some symptoms are also included.

- ❑ *Thermophilic actinomyces* (humidifier lung)
- ❑ *Klebsiella oxytoca* (humidifier lung)
- ❑ *Shigella* genus Shigellosis (gastrointestinal tract infection)
- ❑ *Reiter's syndrome* (chronic joint pain similar to arthritis)
- ❑ *Salmonella* genus Salmonellosis (gastrointestinal tract infection)
- ❑ *Escherichia coli* (gastrointestinal infection)
- ❑ *Streptococcus fecalis* and *viridans* (gastrointestinal infection)
- ❑ *Staphylococcus aureus* and *pyogenes* (eye, ear and skin infections including impetigo, boils and carbuncles)
- ❑ *Legionella pneumophilia* Legionellosis (Legionnaires' disease and Pontiac fever)
- ❑ *Leptospira Leptospirosis* (fever, headache, chills, muscle ache, gastrointestinal upset, rash, kidney failure, meningitis, and liver and respiratory failure)
- ❑ *Mycobacterium* genus:
 - *Swimming Pool Granuloma* (chronic pulmonary inflammation),
 - *Scrofula* (infection of the lymph nodes in the neck)
 - *Mycobacterium Avium Complex* (pulmonary infection)
- ❑ *Pseudomonas aeruginosa*
 - *External Otitis* (inflammation of the ear)
 - *Folliculitis* (skin infection resulting in a rash, corneal ulcers, urinary tract infections)

Several bacteria species are reported to be capable of causing inflammation of the conjunctiva in the eye, commonly called "Pink Eye."

Fungi

These include mushrooms, toadstools, or allied plants, including moulds, which feed on organic matter. Here are some of the fungal infections that might arise in pools.

- ❑ *Sphaeropsidales* genus (humidifier lung)
- ❑ *Penicillium* genus (humidifier lung)
- ❑ *Epidemophyton*, *Trichlphyton* and *Microsporium* genera (ringworm, athlete's foot)

Like bacteria, several fungal species are capable of causing Pink Eye.

Viruses

Here are some of the viral infections that might arise in pools, along with some of the symptoms.

- ❑ *Poliovirus* (paralysis, meningitis, fever)
- ❑ *Echovirus* (meningitis, respiratory disease, rash, diarrhea, fever, vomiting)
- ❑ *Coxsackievirus A* (herpangina, meningitis, respiratory disease, fever)
- ❑ *Coxsackievirus B* (myocarditis, congenital heart abnormalities, rash, fever, meningitis, respiratory disease, and pleurodynia)
- ❑ *Enterovirus Type 68-71* (meningitis, respiratory disease, acute hemorrhagic conjunctivitis, fever)
- ❑ *Hepatitis Type A* (infectious hepatitis)
- ❑ *Norwalk Virus* (vomiting, diarrhea, fever, abdominal cramps, headache, fever, chills, dehydration)
- ❑ *Rotavirus* (vomiting and diarrhea)
- ❑ *Adenovirus* (respiratory disease, conjunctivitis)
- ❑ *Parainfluenza virus* (influenza [flu])
- ❑ *Human papillomavirus* (warts)
- ❑ *Molluscum contagiosum* (red rash/lesions that can spread if not treated)

Protozoa

Here are some of the illnesses that might arise from these unicellular organisms.

- ❑ *Cryptosporidium parvum* (gastrointestinal illness)
- ❑ *Giardia lamblia* Giardiasis (diarrhea)

Amoebae

Here are some of the illnesses and symptoms that might arise from these unicellular organisms.

- ❑ *Naegleria Fowleri* (rare but potentially fatal amoebic meningoencephalitis with the symptoms of headache, fever, stiffness,

gastrointestinal upset, confusion, lack of attention, loss of balance, seizures and hallucinations)

- ❑ *Acanthamoebae* genus (corneal infections)

The best protection against any disease is to follow Universal Precautions. Universal Precautions requires that all human blood and other potentially infectious material be treated as if it were known to be infectious. Follow safe procedures for all tasks and use appropriate personal protective equipment for the exposure.

SECTION 3

Chemical Safety

Swimming Pool Chemical Safety

There are numerous types of chemicals in use in swimming pools. These include

- toxic process gases — chlorine or ozone
- hypochlorites
- bromine
- treatment chemicals
- testing chemicals
- WHMIS

Toxic Process Gases

Toxic process gases meet the toxicity criteria within WHMIS definitions. The two used in pools are chlorine and ozone.

The employer must conduct a risk assessment to determine how workers could be exposed to chlorine or ozone gases. Once the risk assessment is completed, an exposure control plan must be developed. The control plan

- details written work procedures for performing hazardous tasks
- includes details of any necessary personal protective equipment
- determines which workers are actually authorized to enter hazard areas.

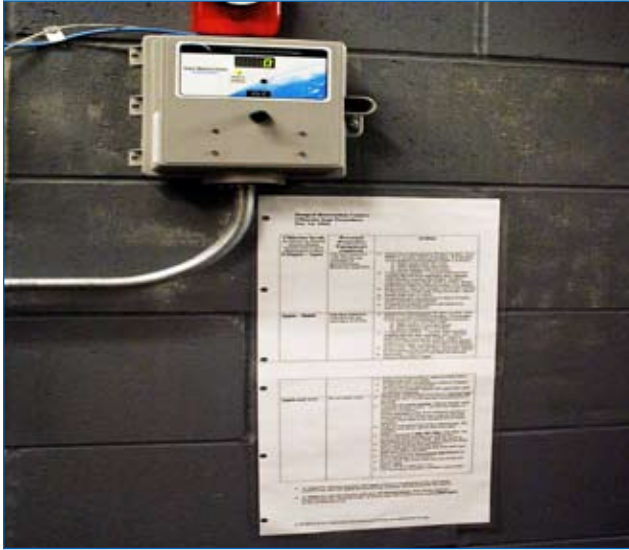


In line with the requirement for an employer to make workers aware of all hazards in the workplace, an education program must be prepared to develop this awareness.

The chlorine gas and ozone generator and contact tanks must be located in sealed enclosures. The entry/exit point for piping must be sealed.

There must be sufficient ventilation to control the occasional fugitive emission and to control heat and humidity. In addition, there must be an emergency ventilation system, capable of

safely exhausting the leaked gas to outside (not exhausted directly into the ventilation system of the pool, for instance).



Chlorine alarm and emergency procedure

Twenty-four hour monitoring is mandatory. The monitor must be able to set off an audible and visible alarm to alert workers to a release of chlorine or ozone. The monitor must be calibrated at least annually. While calibration is being done, the workplace must still be protected, so if at all possible, the calibration should be done on-site.



Chlorine gas room through viewing window

In salt ‘chlorination,’ chlorine is generated when pool water with adequate salt content passes through a series of units containing electrically charged metal fins as part of the pool circulation system. The amount of chlorine generated is controlled by the operator and is water-based causing no potential for a leak. However, another salt-based system of generating chlorine does so in an open tank with accompanying hazards and the need for personal protective system. At this time, this system has not been used in a public pool in BC.



Electrolytic chlorine generators

Hypochlorites

Calcium hypochlorite is a powerful oxidizing agent and will react with anything organic such as oil and grease, mineral spirits, paint, gasoline, etc. In fact, a video produced for WorkSafeBC showed calcium hypochlorite reacting with a little spilled gasoline to ignite a wooden pallet in less than four minutes. Sodium hypochlorite, also known as “liquid chlorine” or bleach, is also noted as an oxidizer, but the fact that it is an aqueous solution limits any rapid reactions.

All hypochlorites react instantly with acidic materials (many cleaners) to release chlorine gas. Breathing just a few parts per million can be

extremely dangerous. In one pool, workers routinely added muriatic acid to the water, then adjusted by adding a little more bleach—but always using the same bucket. Almost all the staff at this facility were affected by eye, nose, and throat irritations.

Sodium hypochlorite has a pH of about 13 (on a scale of 0–14). It is instantly corrosive to eyes and rapidly burns skin and other tissue. Solid hypochlorites will dissolve in body moisture or mucous membranes in the eyes, nose, throat, lungs and alimentary tract to cause the same problems.

All hypochlorites decompose on standing, even in ideal storage conditions—cool and dark. Bleach will lose almost half the available chlorine in just four months. The gas that builds up is toxic. When opening a container of a solid hypochlorite, always be in a well ventilated area and wear a respirator.

General safety tips for working with hypochlorites:

- always turn lights on in a chlorine room
- when working on chemical feed pumps, always depressurize the system and use eye protection.

Bromine

Bromine-based chemicals have some advantages over chlorine disinfection systems. They may provide

- higher disinfection effect at higher pH values
- lower volatility at higher temperatures
- less promotion of corrosion
- less generation of odours and irritation of the mucous membrane.

However, bromine is still a hazardous chemical, particularly when inhaled. As recommended by the MSDS, a respirator should be worn to prevent an overexposure situation.

Treatment Chemicals

Soda Ash

Soda ash, also known as sodium carbonate, is a powder that is used to raise the pH of the pool water. Soda ash will dissolve in water or body moisture to



form a very corrosive solution. When handling, a dust mask should be worn. Other chemicals such as caustic soda are used for the same purpose and require the same personal protective equipment.

Muriatic Acid

Muriatic acid, otherwise known as hydrochloric acid, is used to lower the pH of a pool and also for some cleaning tasks. The acid must be stored separately from any chlorine compounds. In most cases of use in pool operations, muriatic acid can not be bulk delivered and must be decanted from 20 litre carboys into an acid storage vat where it is diluted 50/50 with water. Note that it is important to do this in the correct order: the water is in a tank and the acid is added to the water. Water is never added to acid.

This manual handling raises hazard risk and appropriate precautionary measures must be taken including chemical suit, gloves, boots, and full face respirator. Vapour release will cause a reaction with sweat and moisture in eyes, creating hydrochloric acid.

Storage vats containing muriatic acid should be inspected on a regular basis. Tanks should be replaced every ten years as the plastic becomes brittle and is susceptible to fracturing.

Organic Chlorines

There are several organic chlorine chemicals—the family of isocyanurates—and these are also strong oxidizers. The same precautions must be taken with these as with hypochlorites.

Pool Brighteners

Many of the pool brighteners and other treatment chemicals are also oxidizers and similar precautions are required. Always protect your eyes when using pool brighteners.

Diatomaceous Earth

For those systems with diatomaceous earth (DE) filters, the concern is with breathing the dust when the DE is being added to the system. DE contains “free silica,” which may cause lung cancer.

To minimize the hazards associated with using DE:

- always use a respirator with a HEPA filter
- always use full bags of DE, never leave open bags of DE sitting around
- cut DE bags open under water
- never accept DE deliveries if bag has been damaged
- conduct regular hosing and pipe washing to minimize possible airborne dust exposure.

Testing Chemicals



The small plastic box with the testing chemicals is a mix of several hazardous chemicals—from hydrochloric acid, to DPD and other dangerous substances.

Workers must know the identity and hazards of all dangerous materials in the workplace and the employer must write safe work procedures for all tasks involving these chemicals.

WHMIS

Every worker in Canada must know, understand, and be able to use the WHMIS system. The

Workplace Hazardous Materials Information System provides for detailed labels on all industrial products, the provision of material safety data sheets (MSDS) for all hazardous chemicals, and requires that employers provide education in WHMIS and the hazards of the chemicals in use in the workplace.

Following that education, employers must provide training in the work procedures designed to prevent exposure to the hazardous chemicals.

Material safety data sheets must be available in the workplace for every chemical in use, and every worker has both the **right** and the **responsibility** to read the MSDS for a chemical before actually using it. Material safety data sheets contain important information about

- Physical Data (how to recognize the material)
- Fire and Explosion Data (precautions to take to prevent fires)
- Reactivity Data (how to keep the material from adversely reacting with other substances)
- Preventive Measures
- First Aid Measures

If working with chemicals, be sure staff know where the material safety data sheets are kept, and review them for all chemicals in the workplace.

Unfortunately, some chemicals are exempt from parts of this program. Pesticides and products bought at a retail store must meet the requirements of other legislation such as consumer labelling legislation. These do not require provision of MSDS, although they are available for almost all products. If there is no MSDS for a product covered by consumer labelling legislation, read the label—it will have safe handling information.

Even though the product may not fall under WHMIS regulation, the employer is still required to provide education and training in the safe use of the products used in the workplace.

Personal Protective Equipment for Chemical Safety

Personal protective equipment is used in everything we do—from wearing non-slip shoes on the pool deck to goggles when dealing with chemicals.

The following are types of personal protective equipment (PPE) that must be used in a pool environment when working with chemicals.

Eye Protection

Ordinary eyeglasses do not constitute eye protection. Adding side-shields will help, but a full face shield is needed when dispensing corrosive chemicals, or goggles when there is a risk of splashing into the eyes.

In addition, an effective eye wash and shower are needed in chemical dispensing areas. A one litre squeeze bottle will not suffice. An eye wash must provide a full 15 minute supply of tempered (room temperature) water.



Foot Protection

Foot protection is often overlooked in aquatic facilities.

Bare feet or running shoes are not acceptable when working with chemicals. Spilled chemicals will soak through canvas and do considerable damage to the feet. Leather or rubber shoes or boots are mandatory. If there is danger of injury to the toes, shoes or boots with safety toes should be worn.

Skin Protection

Skin protection comes in many forms. Certainly, you will need appropriate gloves when handling chemicals. Check the MSDS or safety supply company for the appropriate material.

T-shirt and shorts are not appropriate for protection from chemicals. Proper clothing must be worn. You may need to wear a rubber apron as well.

Respirators

Different types of respirators are required in different situations. For all, the respirator must be clean and sanitary and each person who may be required to wear it must have an initial, and an annual, fit-test to ensure a proper seal with the face. To ensure a proper fit, you must be clean-shaven where the respirator seals with the face.

Any person entering the chemical enclosure—no matter what the reason—must carry an escape respirator. An escape respirator may be, for chlorine, either a bite-block or a half-facepiece respirator with acid gas cartridges. The bite-block respirator also has a nose clip, which must be worn to prevent the corrosive gas being drawn up the nose. If, instead of a bite-block respirator, the employee wears a half-facepiece respirator, that employee must have an annual qualitative fit-test to ensure that the respirator actually does seal with the face.

For ozone, only a half-facepiece respirator is available—fitted with otherwise unused organic vapour cartridges. Bite blocks are not available for ozone.

If any work is to be done on the gas delivery system, all persons in the enclosure **must** wear an approved respirator. This could be a half-facepiece respirator with

additional gas-tight goggles to protect the eyes, or a full-face respirator. As before, any person authorized to work on the system must have an annual fit-test with the respirator they will actually wear. The emergency procedure must include a standby person ready to effect rescue. Training in the use of SCBA must be provided and documented.

Workers must do a fit-check **every** time the respirator is put on. The fit-check is very simple: put the respirator on, cover the inhalation valves—over the respirator cartridge—breathe in, and hold your breath for a few seconds. The respirator should stay collapsed against your face. If it doesn't, you have an air leak and the respirator does not fit you well enough. Another test is to cover the exhalation valve gently, and breathe out. There shouldn't be any air escaping around the edge of the mask.



An annual fit-test must be done by a qualified person. In this fit-test, a solution with a definite smell is waved around the respirator. If you can smell the solution, you're not getting a good enough fit. If the smell can get through, then the hazardous products you're trying to protect against, can get through as well.

All respirators have an approved maximum allowable concentration (MAC). In order for any employer or worker to know that it is safe to use a respirator in any given situation, it is crucial to know the actual airborne concentration of the contaminant in question—in this case, chlorine gas or ozone. If the airborne concentration is not known, then a SCBA (self-contained breathing apparatus) is the minimum acceptable form of respirator.

It isn't sufficient to just have a SCBA unit on site. Workers must be trained in its use, must have regular training drills and the air must be changed every six months.

If an employer expects a worker to go into an area in which a respirator is required, then a proper respirator program is required.

SECTION 4

Emergency Preparation and Response

Preparing for and Responding to Emergencies

As mentioned earlier in this guide, there have been two fatalities in BC pools in recent years. Both fatalities were a result of workers doing repairs while diving in pools.

Is it legal for employees to do this?

No. Only commercial divers following regulations are permitted to dive for maintenance purposes, not lifeguards, even if they are SCUBA certified.

Avoidable tragedies such as these highlight the need to know the safety rules and to abide by them.

It is also important to have procedures in place to deal with emergencies.

Emergency Response Plans

There are many emergencies in a pool setting that require effective response plans.

What happens if there is a motor vehicle accident in the parking lot? if several patrons get trapped in the waterslide? if there is a fire? if there is a chlorine leak?

Do your staff and patrons immediately recognize the signals for an evacuation? What does the chlorine alarm sound like?

All emergency plans must answer these simple questions:

- What is the emergency?
- When, or under what circumstances, might it happen?
- Why is an emergency plan necessary? What are the potential negative effects of this emergency?
- How do staff deal with the emergency?
- Who is responsible for taking the required action?

Other than first aid, there are some less obvious considerations:

- Who will perform crowd control? (e.g., keeping away the general public)
- Who will assist the ambulance to get into the building entrance?
- Who will check the wind direction to ensure that people stay upwind of vented chlorine gas?
- Does someone have sufficient knowledge and appropriate PPE to start the cleanup after a structural collapse or a chemical spill?

Emergency Drills

Along with emergency plans, there must be emergency drills. Here are some issues to bear in mind in developing successful drills:

- Do workers understand the emergency signals?
- Does everyone know what to do in the event of an emergency?
- Do patrons understand the signals? What do staff do when they don't?
- Drills must be held at least once a year.

First Aid

First aid is another important consideration in dealing with emergencies.

The employer must do an assessment of the risk to employees in a workplace to determine what first aid is appropriate, and follow the Regulation to determine the first aid attendant level, room and equipment necessary.

Those expected to offer first aid to other workers or to the public will have occupational exposure to blood-borne pathogens. Vaccination against Hepatitis B is available and recommended.

Working Alone or in Isolation

In developing emergency procedures, circumstances in which employees are working alone or in isolation must be taken into account.

According to the Regulation, working alone or in isolation means that if something were to happen to a worker, no one would be available to provide assistance in an emergency. If there are members of the public who could call for assistance, then the worker is not considered to be working alone.

Here are the key elements to the Working Alone/ In Isolation program:

- The risk assessment. See sample in the Appendix for procedures for assessing the risk of working alone or in isolation.

- The person-check procedure—to be developed in consultation with the worker and the Occupational Health and Safety Committee. The procedure will determine how often and under what circumstances an employee working alone should check in.
- An emergency procedure would deal with some of the following situations. What if the check-in person doesn't get a call at the designated time? How would anyone know if the worker didn't make it home at the end of the shift? There may be instances in which a check in and check out procedure has to be established between the supervisor and the worker.

There is a sample check-in procedure for employees working alone provided in the Appendix.

Workplace Violence

Workplace violence is a very real issue in pool settings.

Typical violence in the pool setting might include:

- a lifeguard being pushed or struck by an irate parent or troubled youth
- a pool maintenance worker interrupting a drug deal in a parking lot
- an icemaker, recreation attendant, or custodian being assaulted during a public function (often alcohol is a factor).

A risk assessment must be conducted at any workplace where there is a possibility of violence to workers. This means any workplace in our municipality/regional district. See the procedures for assessing the risk of violence in the workplace provided in the Appendix.

Workers must be trained in the following:

- recognizing the potential for violence
- the policies, procedures and workplace arrangements to eliminate or reduce violence
- the appropriate response to violent incidents—including how to get help
- procedures for reporting incidents of violence.

Incidents of violence must be reported immediately so that the employer can inform others about the risk, and can make sure the procedures are adequate for eliminating or reducing the risk of violence in the workplace.

What can be done to reduce the hazard from violence?

As with many other hazards, there is a hierarchy of controls:

- ❑ **Elimination.** First, try to eliminate the risk. Does the task have to be completed? Does it have to be done by an employee? Restricting access of violent clients to the facility also comes under the category of “elimination.”
- ❑ **Substitution.** Second would be substituting the task or process for one that is less hazardous. Is there a different procedure that can be followed? Can the current procedure be changed? This could include arranging the seating to allow workers to exit without being blocked by physical barriers or the client.
- Counting cash in a separate office, away from the public eye, is another preventative measure.
- ❑ **Engineering Controls.** These would include guards or barriers around staff selling tickets and handling cash. Panic buttons or office alarm systems are other examples of engineering controls.
- ❑ **Administrative Controls.** These would include ensuring all staff are alerted to a client with a history of violence or threats, instructing employees not to sit with their back to the main office door, directing them to leave the building and call the police instead of challenging someone who enters the building after hours. Administrative controls also include training workers in recognizing and defusing hostile situations.
- ❑ **Personal Protective Equipment.** There isn't any appropriate PPE available to minimize the risk of violence in our workplaces. It would not be suitable to carry around pepper spray or batons as protection from workplace violence.

APPENDICES

Appendix 1: Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

(Sample Only)

Sodium Hypochlorite 5 – 15%

SECTION 1 – Product Information

Product Identifier Hypochlor-12, Miraclean-12, Sodium Hypochlorite, 5 – 15 trade percent		WHMIS Classification (optional) E	
Product Use Disinfectant, bleaching agent, source of available chlorine, deodorizer.			
Manufacturer's Name RealClean Products Ltd.		Supplier's Name Pool Resources Ltd.	
Street Address 7002 Columbia Road		Street Address 1102 Yukon Street	
City, Province, PC Carp, BC V0N 0N0	Emergency Tel. 604.555.1234	City, Province, PC Plamor, BC V0D 0D0	Emergency Tel. 604.555.2345

SECTION 2 – Hazardous Ingredients

Hazardous Ingredients (specific)	%	CAS #	LD ₅₀ of Ingredient (specify species & route)	LC ₅₀ of Ingredient (specify species)
Sodium Hypochlorite	5.4 – 13.2	7681-52-9	8910 mg/kg (oral rat)	> 10,000 mg/m ³ (inhalation rat 1 hr)
Sodium hydroxide	0.1 – 0.5	1310-73-2	N/A	N/A
Sodium chloride	4.0 – 12.0	7647-14-5	N/A	N/A

SECTION 3 – Physical Data

Physical State Liquid	Odour & Appearance Clear, greenish-yellow solution. Strong chlorine odour.		Odor Threshold (ppm) N/A
Specific Gravity 1.17 at 20°C (12.5 wt %)	Vapour Density (air = 1) N/A	Vapour Pressure 12.1mm Hg at 20°C (12.5 wt %)	Evaporation Rate N/A
Boiling Point (°C) Decomposes N/A	Freezing Point (°C) ~ -15°C (12% trade)	pH < 12	Water/Oil Distribution Coefficient N/A

SECTION 4 – Fire and Explosion Data

Flammability Non-flammable	If yes, under what conditions?		
Means of Extinction Product does not burn. Use proper extinguisher for material that is supplying the fuel to the fire.			
Flashpoint (°C) N/A	Upper Flammable Limit (% by volume) N/A	Lower Flammable Limit (% by volume) N/A	
Explosion Data Pressure build-up in containers could result in an explosion when heated or in contact with acidic fumes. Vigorous reaction with oxidizable organic materials may result in a fire.			

SECTION 5 – Reactivity Data

Chemical Stability Unstable at temp above 40°C, in sunlight and in contact with acid	Incompatibility with Other Substances Incompatible with strong acids, ammonia, oxidizable materials, nickel, copper, tin, manganese and iron.		
Hazardous Products of Decomposition Chlorine (by reaction with acids), oxygen (by reaction with nickel, copper, tin manganese, iron), sodium chloride, sodium chlorate, with increased temp.			

Appendix 1 (continued)

SECTION 6 – Toxicological Properties*Sodium Hypochlorite (Page 2 of 2)*

Routes of Entry Inhalation – irritant of nose & throat, causing coughing, difficulty breathing & pulmonary edema.	
Exposure Limits (value, source, date) None established. Chlorine TLV = 1 ppm	Irritancy Strong
Sensitization (if yes, explain) N/A	Carcinogenicity (if yes, explain) Not considered carcinogenic (IARC & ACGIH)
Reproductive Toxicity (if yes, explain) N/A	Teratogenicity (if yes, explain) N/A
Mutagenicity (if yes, explain) N/A	Synergistic Products (if yes, explain) N/A

SECTION 7 – Preventive Measures

Personal protective equipment <u>Eyes</u> – Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; may contribute to severe eye injury. <u>Respiratory</u> – A NIOSH-approved respirator suitable for chlorine is recommended. Where a higher level of protection is required, use a self-contained breathing apparatus. <u>Gloves</u> – Impervious gloves of chemically resistant material <u>Clothing</u> – Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing with soap and water, dry thoroughly before re-use. <u>Footwear</u> – Impervious boots of chemically resistant material should be worn at all times	
Engineering Controls (specify, such as ventilation, enclosed process) Mechanical ventilation (dilution or local exhaust), process or personnel enclosure, control of process conditions. Supply sufficient replacement air to make up air removed by exhaust system. Emergency shower and eyewash should be in close proximity.	
Leak & Spill Procedure Wear proper PPE; ventilate area; only enter with PPE; stop or reduce leak if safe to do so; prevent from entering sewers; neutralize with sodium sulphite for no chlorine residual, then with hydrochloric acid until pH is 7.	
Waste Disposal Dispose in accordance with all federal, provincial, and/or local regulations including the Canadian Environmental Protection Act.	
Handling Procedures & Equipment Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene & housekeeping practices. Wash thoroughly after handling. Avoid situations that could lead to harmful exposure.	
Storage Requirements Store in a cool, dry, well-ventilated place. Keep container tightly closed, and away from incompatible materials. Venting of containers is advisable.	
Special Shipping Information Secure full & empty containers with hold-down devices during shipment	PIN UN1791

SECTION 8 – First Aid Measures

Inhalation -	Remove victim to fresh air; give artificial respiration only if breathing has stopped. If breathing is difficult, give oxygen. Seek immediate medical attention.
Ingestion -	Do not induce vomiting. If vomiting occurs, lean victim forward to prevent aspiration of vomitus. Give large amounts of water. Do not give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.
Skin Contact -	Remove contaminated clothing. Wash affected area with soap and water. Seek medical attention if irritation occurs or persists.
Eye Contact -	Flush immediately with water for at least 20 minutes. Forcibly hold eyelids apart to ensure complete irrigation of eye tissue. Seek immediate medical attention.

SECTION 9 – Preparation Information

Prepared by (group, department, etc.) RealClean Products Ltd.	Telephone Number 604-555-1234	Preparation Date May 5, 2007
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Appendix 2: Template for Chlorine Exposure Control Plan

This is a sample only. Each Municipality must create an Exposure Control Plan in compliance with WorkSafeBC Occupational Health & Safety Regulation 6.119 (Toxic Process Gas)

Procedure/Task: Changing Chlorine Cylinders	
Department: Manager/supervisor:	Job Classification:
Name of Hazardous substance: Chlorine Gas	Emergency contact phone #:
Statement of Purpose: To minimize the risk of exposure to Chlorine Gas in [name of aquatic facility, municipality]	
<p>Responsibilities:</p> <p>■ Department Manager:</p> <ul style="list-style-type: none"> • Ensure Exposure Control Plan is reviewed annually. • Ensure drills are held to ensure familiarity with responsibilities and roles in the event of an emergency related to changing chlorine gas cylinders • Ensure all workers are trained and qualified to perform their duties and are knowledgeable in the hazards and risks of the task • In the event of a chlorine leak during cylinder change, ensure the Chlorine Leak Procedure is followed <p>■ Supervisor:</p> <ul style="list-style-type: none"> • Follow the Chlorine Cylinder Change safe work procedures established by the facility • In the unlikely event of a chlorine leak during a cylinder change, ensure workers follow the Chlorine leak Procedure appropriate to the level of chlorine leak. • Ensure that all workers being supervised are made aware of all the hazards in the area • Ensure that all workers receive the education and training required by the WorkSafe BC OHS Regulation • Participate in drills to ensure familiarity with responsibilities and roles in the event of an emergency relating to changing chlorine gas cylinders <p>■ Worker:</p> <ul style="list-style-type: none"> • Use personal protective equipment, in accordance with training and instruction and inspect the equipment before use • Report to the supervisor or [name of corporation] the absence of, or any defect in any protective equipment, device or clothing, or the existence of any other hazard, that they consider is likely to endanger a worker or any other person • Follow the Chlorine Leak Procedure appropriate to the level of leak, if required • Report to supervisor, signs and symptoms of overexposure to chlorine • Participate in drills to ensure familiarity with responsibilities and roles in the event of an emergency relating to chlorine leaks • Participate in training in appropriate emergency procedures 	

Appendix 2 (continued)

Risk/Hazard Identification Summary

Acute Effects:

- Inhalation: Chemical burns to respiratory tract, chest pain, difficulty breathing
- Ingestion: not possible
- Skin: chemical burns to skin
- Eyes: chemical burns to eyes

Chronic Effects:

- Inhalation: Chronic lung damage, loss of smell
- Ingestion: not possible
- Skin: skin burns, skin disorders
- Eyes: Chemical burns to eyes

Exposure/Risk Assessment Summary

WorkSafeBC exposure limits for Chlorine gas are:

- 0.5 PPM 8-hour EL
- 1 PPM 15-min EL
- 10 PPM (IDLH) immediately dangerous to life and health

Air sampling was conducted in the past?: No. Monitor system in place.

Research findings:

Risk of overexposure is : LOW MODERATE HIGH

Based on the results of the risk assessment, changing the Chlorine Cylinder is a high-risk task.

Exposure Controls

Elimination: Can exposure be eliminated under certain conditions, describe YES or NO.

NO, chlorine gas is used to disinfect water supplies and is required under other Provincial health regulations.

Substitution: Can exposure be substituted under certain conditions, describe if YES or NO

NO, system designed specifically for the delivery of chlorine gas. No other chemical can be substituted.

Engineering Controls

Fixed exhaust ventilation within the Chlorine cylinder room. Door open during cylinder change.

Administrative Controls:

Chlorine Alarm set points:

Low alarm: 0.25 ppm 1.0 ppm

Medium alarm: 1.0 ppm to 5 ppm

High alarm: 10 PPM

Follow established safe work procedure, including requirement for standby worker equipped and able to rescue entry worker.

Personal Protective Equipment:

Respirator Required: YES

Respirator type: One staff member (changing cylinders): Full-face respirator with Chlorine cartridges, or half-mask respirator with Chlorine Cartridge and goggles. Standby worker: SCBA.

Gloves: Leather or Rubber

Footwear: steel-toe boots

Appendix 2 (continued)

Written Work Procedures Required

- Set up
- General Work
- Clean up and Decontamination of Site
- Clean up and Decontamination of PPE

Work procedures located: in Pool Maintenance Workers Room (basement)

Worker Education and Training Requirements:

- Educated about health hazards
- Trained in the use of exposure control equipment
- Trained in the use and set up of ventilation control
- Trained and understand safe work procedures of the job task
- Trained in the use, limitations and maintenance of respirators

Additional Comments: **Chlorine Leak procedures posted outside of chlorine cylinder room.**

Name of Person Completing Site Exposure Plan:

Signature:

Proposed Date of Next Site Exposure Control Plan Review:

Appendix 3: Risk Assessment for Exposure to Hazardous Substance form

Hazardous Substance and Job Task	A Likelihood of accidental over exposure Expected=10 50/50 chance=6 Unusual event=3 Not happened for years=1	B Frequency of exposure Continuous=10 Once/day=6 Once/week=3 Monthly=2 Yearly=1	C Health effect Consequence Death or disabled=10 Irreversible HE=6 Severe reversible HE=3 Reversible HE=1	D Task Duration 8-6 hrs=10 6-3 hrs=6 3hrs-1hrs =3 1hrs-15 min=2 less 15 min=1	E Exposure Process Gas/mist/dust/aerosol=10 Evaporation/Heat=6 liquid=3 solids=1	Exposure Risk Score (AxBxCxDxE)
Changing Chlorine Cylinders	3	3	10	2	10	1800
Documented by:	Date:	Exposure Risk Score Rating (1-242) - LOW (243-599) - MODERATE ♦ consider controls (600+) - HIGH ♦ implement controls				

Appendix 4: Sample Daily Check-in Procedure

Check-in Procedure for: _____ (insert position[s])

Daily Procedure in Compliance with Working Alone Program

- The person initiating the call makes contact with the “to” person, by cell phone.
- Each staff member should have a reasonably good idea where the other staff members are working or going to be working within the next check-in time period, and note that on the form.
- If a check-in does not occur at the designated time:
 1. The person who was to receive the call makes a call back to the person who was to have made the call.
 2. If the worker responds, make a note that the contact was made and by whom.
 3. If the worker does not respond, attempt to contact him/her one more time by phone or radio. If still no contact,
 4. Use the horn paging system, if available. Wait no more than five minutes, if still no response,
 5. Contact the police by calling 9-1-1. Notify dispatch that there is possibly a worker in trouble. Give the last known location of the worker. Ask dispatch for assistance in locating the worker and to provide a call back with results.
 6. Notify the supervisor once dispatch is contacted, and again with the final results of the search.
- All workers working alone or in isolation are responsible for ensuring that contact is made and received at the required time. The supervisor is responsible for ensuring check-in sheets are completed daily and submitted to the manager for review.
- Any staff member who will be performing tasks that increase the risk of an injury and would render him/her unable to get assistance on his/her own, should call the contact person or other worker, communicate what, where and when s/he will be performing the task, and arrange for a call back (5 or 10 minutes). If the call is not received at the designated time, the procedures listed above are to be followed.
- Workers with relatively little contact with other staff during their shift must contact their supervisor at the start of shift and at the end of shift. The supervisor is responsible for noting on the check list that the contact has been made. If no contact is made at the end of shift, the supervisor must initiate the following process to determine the whereabouts of the employee.
 1. Attempt to contact the employee by radio. If no contact,
 2. If the employee has a personal cellular phone, call the cell phone. If no contact, or no phone,
 3. Call the employee’s home. If the employee has not reached home, find out when s/he would normally be home. Leave a message for the employee to call the foreman as soon as s/he gets home. If no call is received by the normal arrival time:
 4. Call the employee’s home again.
 5. If still not home, Determine, from the information on the call in sheet, where the employee was working last, and go to that site to find him/her.

Appendix 5: Check-in Assessment Work Sheet for Working Alone

Job Title: _____ Assessment Done By: _____

Task: _____ Date: _____

(A) Kinds of Hazard (Based on History)	(B) Examples	(C) Worst probable accident that could happen to worker	(D) Likelihood of the accident happening. See Table 1	(E) Likelihood of disabling Injury See Table 2	(F) Likelihood of Help Available See Table 3	(G) Rating (D) x (E) x (F) If above 250 check-in required
Stored Energy	Bins, chutes, elevated equipment, pressurized vessels or pipes, volumes of liquid, stacked materials					
Mechanical Energy	Hydraulic, air valve or operation, tools, equipment					
Energy Inadequate Or stopped	Failure of part or linkage, external influence, fuel sources, spills, lack of ventilation, blocked exits, lighting					
Kinetic Energy	Struck by, struck against, pinch points, falling - same level, falling to lower level, high angle work, animal attack					
Chemical Energy	Corrosion, oxidation, asphyxiation, poisoning, explosion, infection, drowning					
Thermal Energy	Fire, ultra-violet & infrared radiation, steam, hot materials, cold, freezing					
Electrical Energy	Power lines, step potential, static, grounding, lightning					
Nuclear Energy	Radioactive isotopes, microwave sources, X-ray, laser light					
Social Energy	Violence, bomb threats, terrorism, assaults, vandalism, sabotage					
Other						

Instructions:

1. Complete this work sheet with the worker for each situation where a worker is working alone and may be at risk of an injury that would prevent him/her from obtaining help.
2. Consider which hazards in column (A) might apply and specify the injury in column (C)
3. For column (D), assess the probability of the accident, using Table 1.
4. For column (E), assess the likelihood that the accident would result in an injury serious enough to be disabling, using Table 2.
5. For column (F), assess the likelihood of help being available for the worker, using Table 3
6. Rate the requirement for check-in by multiplying the number in Column (D) by the number in column (E) by the number in Column (F) and enter the number in Column (G). For Values of (G) up to 250 (low), no further action is required. For values of (G) between 251 and 400 (moderate), a check-in procedure must be instituted. For values of (G) higher than 400 (high), the checks must be frequent.

Appendix 6: Risk Assessment Tables for Working Alone or in Isolation

Table 1 - Likelihood of an Accident Occurring

The risk factors for performing this task mean that an accident	Value
Is the most likely outcome in this situation.	10.0
Has a very high likelihood of occurring.	8.0
Is quite possible, would not be unusual.	6.0
Would be an unusual sequence or coincidence.	4.0
Would be a remotely possible coincidence.	2.0
Extremely remote but conceivably possible.	0.5
Practically impossible sequence or coincidence; a “one in a million” possibility. Has never happened in spite of exposure over many years.	0.1

Table 2 - Likelihood of a Disabling Injury

The seriousness of a likely accident mean that a disabling injury (one that would prevent calling for help)	Value
Would be the expected result of an accident.	10.0
Would be the probable result of an accident.	8.0
Would be an unusual result of an accident	6.0
Would be the remotely possible result of an accident	4.0
Would be the practically impossible result of an accident	2.0

Table 3 – Likelihood of Help being available for Injured Workers

Work Situation	Availability of Help	Value
Worker is in an isolated area with no one likely to pass by or see the worker (over a bank, in the forest, night shift cleaning staff)	Never	12.0
Worker is working at night or in areas where there is occasional traffic (residential area, urban area at night)	Rare	8.0
Worker is in isolated area where there is regular traffic (rural road, industrial road)	Occasionally	6.0
Worker is out of site or isolated, but any delay in returning would be noted and commented on, and action taken (building basement maintenance, construction site inspection)	Usual	4.0
Worker is in an area used by other people who pass by often enough that there is a high likelihood of witnesses. (Roadside work on secondary road, maintenance work in building corridors)	Frequently	2.0
Worker is in an area surrounded by potential assistants (driving on freeway or main arterial road, working in mall parking lot during business hours)	Continuous	1.0

Appendix 7: Risk Assessment Worksheet – Violence in the Workplace

Violence Rating Score

CONSEQUENCES	
Degree of Severity of Consequences	Rating
Catastrophic: numerous fatalities	100.0
Several fatalities	75.0
Fatality	50.0
Extremely serious injury or occupational disease (permanent disability)	30.0
Disabling injuries, reversible tissue damage, post traumatic stress	10.0
Minor cuts, bruises, irritations, minor damage, feeling of intimidation	2.0
EXPOSURE	
The hazard event occurs:	Rating
Continuously (or many times daily)	10.0
Frequently (approximately once daily)	6.0
Usually (from once per week to once per month)	3.0
Occasionally (from once per month to once per year)	2.0
Rarely (it has been known to happen)	1.0
Very rarely (not known to have occurred but considered remotely possible)	0.5
LIKELIHOOD	
The likelihood of violence or threat of violence, including the consequences:	Rating
Is the most likely and expected result if no changes are made	10.0
Is quite possible, would not be unusual, has an even 50/50 chance	6.0
Would be an unusual sequence or coincidence	3.0
Would be a remotely possible coincidence, it has been known to happen	1.0
Extremely remote but conceivably possible, has never happened after many years of exposure	0.5
Practically impossible sequence or coincidence, a “one in a million”: chance, has never happened in spite of exposure over many years	0.1
RISK SCORE	
Consequences X Exposure X Likelihood	Score
High – must be corrected immediately	> 250
Medium – must be corrected	101 - 250
Low – Indicator – situation must be examined and may have to be corrected	1 - 100
Risk Acceptable – no change required	< 1

Total Risk Chart

Low		Medium						High			
20	50	90	125	150	175	200	225	250	350	450	750

Appendix 8: Risk Assessment Worksheet for Violence

(A) Nature of threat or violence	(B) Threat or violence resulting from:	(C) Probable violence that could happen in this, or similar workplaces due to location or circumstances	(D) Consequence	(E) Exposure	(F) Likelihood	(G) Risk Score
Rebellion against authority						
Against the organization						
Against a representative of the organization						
Against individuals						
Opportunistic						
Other						

Instructions and Score Sheet:

1. Complete this worksheet for each situation where a worker or group of workers may be at risk of violence.
2. Review the types of threats from column (A) and the examples in column (B).
3. In column (C) list the type of violence that could occur.
4. Turning to Appendix C, list the score for the probable violence under column (D) consequence, column (E) exposure, and column (F) likelihood.
5. Multiply the numbers in column (D), (E), and (F) and put the resulting number in column (G) under risk score.
6. For values of (G) lower than 1 the risk is acceptable. Between 1 and 100, the score indicates potential problems that must be examined. Between 100 and 250, the score indicates problems that must be corrected. Scores higher than 250 indicate a problem that must be dealt with immediately.
7. Examples of solutions to problems are available in Appendix D.

