Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise causing detrimental results:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- High wind speed
- Solar radiation

The following list of practices and measures to reduce or avoid the potential problems of hot weather concreting are:

- Select concrete materials and proportions with satisfactory records in hot weather conditions.
- Cool the concrete.
- Use a concrete consistency that permits rapid placement and effective consolidation.
- Minimize the time to transport, place, consolidate and finish the concrete.
- Plan the job to avoid adverse exposure of the concrete to the environment; schedule placing operations during times of the day or night when weather conditions are favorable.
- Protect the concrete from moisture loss during placing and curing periods and
- Schedule a pre-placement conference to discuss the requirements of hot weather concreting.

Potential problems for concrete in the freshly mixed state are:

- Increased water demand.
- Increased rate of slump loss and corresponding tendency to add water at the job site.
- Increased rate of setting, resulting in a greater difficulty with handling, compacting and finishing and a greater risk of cold joints.
- Increased tendency for plastic shrinkage cracking.
- Increased difficulty in controlling entrained air content.

Potential deficiencies to concrete in the hardened state may include:

- Use of cements with increased rate of hydration.
- Use of high-compressive-strength concrete, which requires higher cement contents.
- Design of thin concrete sections with correspondingly greater percentages of steel, which complicate placing and consolidation of concrete.
- Economic necessity to continue work in extremely hot weather and
- Use of shrinkage-compensating cement.
This document should not be used as a substitute for competent engineering advice, experience or project specifications. Cemstone cannot be responsible for misuse of these guidelines. Please contact your Cemstone Representative at 800-CEMSTONE or go to cemstone.com for more information.
July 1, 2017

To: All Cemstone Customers

RE: Alkali Silica Reactivity (ASR) Sand Pop-Outs

As warmer weather approaches, Cemstone is sending this annual reminder for contractors to take precautions to avoid ASR sand pop-outs in concrete slabs. ASR occurs when the alkalis (potassium and sodium) present in cement react with certain siliceous aggregates, such as opaline shall. When this reaction occurs, a gel is formed and when in the presence of moisture, the gel expands causing internal pressure which often leads to cracking and/or surficial pop-outs. These pop-outs predominately occur in high evaporation rate conditions, often including higher ambient temperatures around the slab. Almost all of the natural sand in Minnesota and Iowa has the potential to contain a small amount of opaline shale which can potentially cause a sand pop-out when these conditions occur. These fine aggregate pop-outs can start soon after finishing.

To minimize this, Cemstone uses low alkali cement in our ready-mix production to reduce the amount alkalis in our concrete mixtures. While these pop-outs do not affect the integrity and structural performance of the slab, they can present an aesthetic problem. The problem can be even more troublesome when they occur below resilient flooring material.

By using the nomograph, Figure 4.2, in ACI 305R-10, “Guide to Hot Weather Concreting”, you can calculate the rate of evaporation for the microenvironment of your placement. Keep in mind that wind velocity, relative humidity and ambient temperature can be different than forecasted based on the type and/or location of the slab. For example, wind speeds are likely to higher for suspended slabs than slabs poured inside or below grade. It is also known that hard troweling slabs (especially burning the finish) generates additional heat at the surface due to friction, thus increasing the concrete surface temperature.

The following are our recommendations to minimize the effects of ASR:

- Placing concrete during the cooler parts of the day.
- Avoid direct sunlight on the slab as solar radiation increases the potential.
- Do not use chemical hardeners that contain potassium silicate or sodium silicate.
- If a concrete slab placement must be completed during potentially hazardous conditions, Cemstone strongly recommends the use of Cemstone Cure & Seal Plus “ASR Sand Pop-Out MINIMIZER” to be applied as a curing compound immediately after final finishing. This product provides a reduction in ASR sand pop-out frequency.

For more information on hot weather concrete and ASR, please visit our website at http://www.cemstone.com/hot-weather-concrete.cfm. If you have further questions or concerns, do not hesitate to call your account representative.

Sincerely,

Lars Anderson
Cemstone Products Company
QA/QC Manager of Engineering Services
(651) 286-1292
landerson@cemstone.com
**HOT WEATHER CONCRETING**

**Rate of Evaporation**

Surface drying and plastic-shrinkage cracking is frequently associated with hot weather concreting. It occurs in exposed concrete, primarily in flatwork, when the evaporation rate is greater than the rate at which water rises to the surface of recently placed concrete, i.e. bleeding. One or a combination of the following factors can lead to this condition:

- High air temperature
- High concrete temperature
- High wind speed
- Low humidity

The probability for surface drying and plastic-shrinkage cracking may be increased if the setting time of the concrete is delayed.

ACI 305 states that caution should be taken when the evaporation rate is less than 0.2 lbs/ft²/h. This rate is dependent upon the air and concrete temperatures, wind speed and relative humidity. Knowing these four factors one can effectively estimate the rate of evaporation by using the following chart.

### RATE OF EVAPORATION CHART FOR HOT WEATHER

<table>
<thead>
<tr>
<th>RELATIVE HUMIDITY (%)</th>
<th>PLASTIC CONCRETE TEMPERATURE (° F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>90</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>90</td>
</tr>
</tbody>
</table>

**To use this chart:**
1. Enter with air temperature, move up to relative humidity.
2. Move right to concrete temperature.
3. Move down to wind velocity.
4. Move left, read approximate rate of evaporation.
THEORETICAL RATE OF EVAPORATION CHART

If the evaporation rate exceeds 0.1 lbs/ft²/hr but is less than 0.2 lbs/ft²/hr, provide the following concrete evaporation protection.

1. Take special precautions to ensure that the forms and subgrade are sufficiently moist or protected to avoid lowering the water content at the pavement/subgrade interface. In hot weather conditions, moisten the subgrade prior to placing the concrete.
2. Minimize solar heat by shading or wetting concrete chutes or other equipment that comes in contact with the plastic concrete.
3. Use a fog spray to increase the relative humidity of the ambient air if there is a delay in immediately starting the curing process.
4. Ensure that the time between placing and curing is minimized.
5. Immediately apply an approved evaporation retarder to the concrete or increase the surface cure application to 1.5 times the standard specified rate.
6. Use monofilament fibers to reduce the potential for plastic shrinkage.

If the evaporation rate is 0.2 lbs/ft²/hr or greater, take EXTREME CAUTION.

HYDRATION STABILIZER ADMIXTURE USE AT HIGH TEMPERATURES

Hydration stabilizers are an admixture which slows the hydration of cement that preserve workability. Hydration stabilizing admixtures are used for making more uniform and predictable high-performance concrete. Hydration stabilizing admixture retard set time by controlling the hydration of Portland cement and other cementitious materials while facilitating placing and finishing operations.

![Recommended Hydration Stabilizing Admixture Dosage Chart](chart.png)

<table>
<thead>
<tr>
<th>Concrete Temperatures</th>
<th>0.5 - 1 Hours</th>
<th>1 - 1.5 Hours</th>
<th>1.5 - 2 Hours</th>
<th>2 - 2.5 Hours</th>
<th>2.5 - 3 Hours</th>
<th>3 - 3.5 Hours</th>
<th>4 - 4.5 Hours</th>
<th>5 - 5.5 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°F - 109°F</td>
<td>5 oz./cwt</td>
<td>6 oz./cwt</td>
<td>7 oz./cwt</td>
<td>8 oz./cwt</td>
<td>9 oz./cwt</td>
<td>10 oz./cwt</td>
<td>11 oz./cwt</td>
<td>12 oz./cwt</td>
</tr>
<tr>
<td>90°F - 99°F</td>
<td>4 oz./cwt</td>
<td>5 oz./cwt</td>
<td>6 oz./cwt</td>
<td>7 oz./cwt</td>
<td>8 oz./cwt</td>
<td>9 oz./cwt</td>
<td>10 oz./cwt</td>
<td>11 oz./cwt</td>
</tr>
<tr>
<td>80°F - 89°F</td>
<td>3 oz./cwt</td>
<td>4 oz./cwt</td>
<td>5 oz./cwt</td>
<td>6 oz./cwt</td>
<td>7 oz./cwt</td>
<td>8 oz./cwt</td>
<td>9 oz./cwt</td>
<td>10 oz./cwt</td>
</tr>
<tr>
<td>70°F - 79°F</td>
<td>2 oz./cwt</td>
<td>3 oz./cwt</td>
<td>4 oz./cwt</td>
<td>5 oz./cwt</td>
<td>6 oz./cwt</td>
<td>7 oz./cwt</td>
<td>8 oz./cwt</td>
<td>9 oz./cwt</td>
</tr>
<tr>
<td>60°F - 69°F</td>
<td>1 oz./cwt</td>
<td>2 oz./cwt</td>
<td>3 oz./cwt</td>
<td>4 oz./cwt</td>
<td>5 oz./cwt</td>
<td>6 oz./cwt</td>
<td>7 oz./cwt</td>
<td>8 oz./cwt</td>
</tr>
</tbody>
</table>

cwt - 100 lb of Cementitious Material

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Curing and sealing is a critical process to increasing the surface durability and service life of concrete. In hot weather conditions, it is even more critical as the concrete is vulnerable to drying due to high evaporation which can lead to shrinkage cracking, scaling as well as other surface defects. This guideline will discuss the importance of curing in hot weather conditions, how to properly cure and the steps for sealing concrete.

**ALKALI SILICA REACTION (ASR) SAND POP-OUTS**

ASR occurs when alkalis (potassium and sodium) from Portland cement react with certain siliceous aggregates. When this reaction occurs, a gel is formed and in the presence of moisture, the gel expands causing internal pressure which often leads to cracking and/or surficial pop-outs. These pop-outs predominately occur in high evaporation rate conditions, often including higher ambient temperatures around the slab, i.e. hot weather conditions. To mitigate this, Cemstone has developed a curing compound, Cure and Seal Plus – ASR Sand Pop-Out Minimizer, that has been shown to minimize the effects of this reaction.

**CURING CONCRETE**

Curing should begin immediately after final finishing. Properly cured concrete retains the water added at the time of batching to maximize the hydration process of the cementitious materials within the concrete. This process increases strength, abrasion resistance, freeze/thaw resistance and resistance to surface scaling. Curing also decreases permeability thereby extending the service life of your concrete. See Figure 1 which shows the relationship between curing and concrete strength. There are numerous methods of curing concrete, the key is selecting the best method and the appropriate duration of curing for the application and intended use of the concrete member. Methods of curing include:

1. Moist curing (ponding, continuous sprinkling or fogging)
2. Wet coverings (wet burlap, burlene, etc.)
3. Impervious paper and plastic sheets (preferably light in color)
4. Membrane-forming curing compounds. It is Cemstone’s recommendation that Cure and Seal Plus – ASR Sand Pop-Out Minimizer be used or curing concrete in hot weather conditions in Minnesota and Iowa.

In hot weather conditions, Cemstone recommends using Cure and Seal Plus – ASR Sand Pop-Out Minimizer in accordance with the manufacturer's instructions.

When hot weather conditions exist in accordance with ACI 305, apply Cemstone Cure and Seal Plus – Sand Pop-Out Minimizer at a rate of 200-300 ft²/gal immediately after final finishing is completed. A second sealing application can then be applied at a rate of 400 - 600 ft²/gal.

Please see Cemstone Cure and Seal Plus – Sand Pop-Out Minimizer data sheet for coverage rates, technical data, application instructions and other pertinent information.

For information regarding curing of concrete in non-hot weather conditions, please refer to the latest version of Cemstone’s Concrete Guidelines.
SEALING CONCRETE

Properly sealing concrete helps maintain the appearance and durability of the concrete after it has had adequate time to cure; approximately 28 days following placement. Sealing is designed to keep moisture and contaminants like deicing chemicals from penetrating into the concrete. Since sealers eventually will degrade from wear and environmental exposure and thus no longer function as intended, concrete should be sealed on a regular basis in accordance with the sealer manufacturer’s instructions or as needed.

Prior to sealing/resealing, an aggressive power washing or power brooming may be required to remove any dirt or stains from the concrete surface. For deeper stains that are not easily removed by either power washing or power brooming, contact your Cemstone Sales Representative for a list of products and methods designed to remove tough stains. After power washing, the concrete surface must be allowed to dry for a period of 72 hours before applying any sealer material.

Sealing your concrete should be implemented by one of the following methods:

SEALING CONCRETE BEFORE OCTOBER 1ST

METHOD 1

Curing Compound – Cemstone Cure and Seal Plus – ASR Sand Pop-Out Minimizer

Option 1 –

Sealer - Cemstone Cure and Seal Plus – ASR Sand Pop-Out Minimizer

Regardless of the number of coats used for curing, Cemstone Cure and Seal Plus – Sand Pop-Out Minimizer must be reapplied a minimum of 28 days after initial concrete installation/curing. Apply the sealer at a coverage rate of 200-300 ft²/gal. Surface finish will determine the actual coverage rate.

Option 2 –


Approximately 28 days after initial concrete installation/curing, apply any of the listed sealers above sealer at the coverage rate specified within the current corresponding data sheet. Surface finish will determine the actual coverage rate.

METHOD 2

Curing Compound – Cemstone Cure and Seal (Solvent or WB)

Option 1 –


Approximately 28 days after initial concrete installation/curing, apply any of the listed sealers above sealer at the coverage rate specified within the current corresponding data sheet. Surface finish will determine the actual coverage rate.

SEALING CONCRETE AFTER OCTOBER 1ST

Special precautions must be taken when sealing exterior concrete after October 1st. Contact your Cemstone Sales Representative for more information.
CEMENT BURN WARNING!

EXPOSURE TO WET CONCRETE CAN LEAD TO SERIOUS INJURIES!
Working with concrete without proper use of the appropriate Personal Protective Equipment (PPE) can damage the skin. “Cement burns” range from minor redness or irritation to serious chemical burns.

ALKALI BURNS FROM WET CEMENT
When water is added Portland cement, calcium hydroxide is formed. This wet cement is caustic, i.e. a pH as high as 12.9 and can produce third-degree alkali burns after 2 hours of contact. Unlike professional cement workers, inexperienced finishers are usually not aware of the danger and may stand or kneel in the wet cement for long periods. As illustrated in a case report, general physicians may not recognize the seriousness of the injury in its early stages or the significance of a history of prolonged contact with wet cement. All people working with wet cement should be warned about its dangers and advised to immediately wash and dry their skin if contact does occur.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
The best way to prevent cement-related skin problems, is to minimize contact with wet Portland cement. Compliance with OSHA's requirements for provision of PPE, washing facilities, hazard communication and safety training, along with the good skin hygiene and work practices listed below, will aid in protecting against hazardous contact with wet cement.

- Anyone who may come into contact with wet Portland cement should wear proper gloves. Consult with the glove supplier or the cement manufacturer's SDS for help in choosing the proper gloves. Butyl or nitrile gloves, rather than cotton or leather gloves, are frequently recommended for caustic materials such as Portland cement.
- Use only well-fitting gloves. Loose-fitting gloves can let wet cement in. Often the use of improper gloves and clothing makes the exposure worse when wet cement gets inside or soaks through the garment. Use glove liners for added comfort.
- Wash and thoroughly dry hands before putting on gloves. Wash and dry your hands every time that you remove your gloves.
- Follow proper procedures for removing gloves, whether reusing or disposing.
- To prevent wet cement from coming in contact with your skin, protect your arms and hands by wearing rubber gloves duct taped to a long sleeved shirt and your legs by wearing rubber boots duct taped to long pants.
- Wear protective goggles or face shield, hardhat and protective over-boots.

SKIN CARE

- Wash areas of the skin that come in contact with wet cement in clean, cool water. Use a pH-neutral or slightly acidic soap. Check with the soap supplier or manufacturer for information on the acidity and alkalinity of the soap.
- Consider using a mildly acidic solution such as diluted vinegar or a buffering solution to neutralize caustic residues of cement on the skin.
- Do not wash with abrasives or waterless hand cleaners, such as alcohol-based gels or citrus cleaners.
- Avoid wearing watches and rings at work since wet cement can collect under such items.
- Do not use lanolin, petroleum jelly, or other skin softening products. These substances can seal cement residue to the skin, increase the skin’s ability to absorb contaminants, and irritate the skin. Skin softening products also should not be used to treat cement burns.

PPE Products are available at Cemstone Supply 651-905-1500

651-688-9292 / 800-CEMSTONE / cemstone.com
DANGER - CONCRETE MAY CAUSE BURNS TO EYES AND SKIN!

ROUTES OF ENTRY AND HEALTH EFFECTS: WARNING: INJURIOUS TO THE EYE, CAUSES SKIN IRRITATION. READ THIS WARNING BEFORE USING.

SKIN/EYE CONTACT: Fresh ready-mixed concrete has an alkalinity level (pH) between 12 and 13; therefore, it may cause irritation and alkali burns, particularly when exposure is an area of skin previously subjected to abrasion or irritation. Prolonged or repeated contact may cause allergic dermatitis in sensitive individuals. Skin contact may cause local irritation of the affected areas. Preexisting skin conditions may be aggravated by exposure.

INGESTION: Unlikely, may cause irritation.

INHALATION: Fresh ready-mixed concrete does not pose an inhalation hazard. However, sawing, grinding, cutting, drilling or otherwise disturbing hardened concrete may contribute to elevated airborne repairable silica dust, which may cause silicosis. Always use appropriate respiratory protection industry environments in accordance with OSHA Regulations.

EMERGENCY AND FIRST AID PROCEDURES: DANGER: MAY CAUSE BURNS TO EYES AND SKIN, READ BEFORE USING.

SKIN CONTACT: Wash skin with large amounts of soap and water. For minor irritation, apply a lanolin-containing cream to skin after washing. Contact a physician if persistent or severe irritation or discomfort occurs.

EYE CONTACT: Contact a physician immediately. Flush eyes with large amounts of water for at least 15 minutes.

INGESTION: Due to the nature of this material, it is unlikely that it will be ingested. If this does occur, remove individual from the area. If the individual is conscious, two or three glasses of milk or water should be provided to dilute stomach contents. Do not induce vomiting. Contact a physician or poison control center.

AVISOS: CONCRETO MEZCLADO FRESCO PUEDE CAUSAR IRRITACIÓN DE LA PIEL, GRAVES QUEMADAS QUÍMICAS O DAÑO PERJUDICIAL A LOS OJOS!!!

(vea el lado contrario para precauciones)

- Evite contacto con la piel y lárese pronto las partes expuestas con agua.
- Si él polvo del cemento o la mezcla fresca de concreto le cae eu los ojos, enjuáguese los ojos inmediatamente y repetidamente con agua y obtenga pronto atencio medica.
- Evite contracto indirecto a través de la ropa. Enjuangue la ropa que h estado en contacto, cemento con el contredo, cemento o mortero mojado.

- Las siguientes clases de ropa debieran ser usados para obteuer coutacto mínimo cou la piel cuando sé usau estos productos:
  - botas de caucho altas y ajustadas suficiente para impedir e/ contacto
  - guantes de caucho
  - pantalones largos metidos dentro de las botas
  - cojincillo impermeables para los rodillas
  - gafas ahumadas que la queden bien pegadas a los ojos

No Corra et Riesgo!

CEEB TOOM: COV XIS MAS UAS NYUAM QHUAV TOV TAU MUAJI PEEV XWM UA KOM YUS TEJ TAWV NQAIJ MOB KHAUS, MUJA TSHUAJ KUB, LOSSIS UA KOM QHOV MUAG PÚAS.

(xyuaas sap nrauv kom paub btxhuag)

- Ua knm cov tawv nqaij txhob muja Mob, muab dej ntxuav kom huv si.
- Yog cov hmooov lossiss cov xis mas uas nyuam qhuav tov tau nkag rau hauv qhov muag yyav tsum tau maub ntxuav tamsim ntawd thiab sij ntxuav ib lwm thiab yuav tau muab tschuaj rau.
- Tsis txhob pub kom cov hmooov xis mas paug rau cov khaub ncaws. Maub cov khaub nc0aws uas paug lossiss lo xis ntxhua.

- Yog yuav tov lossiss pua xis mas yuav tsum hnav cov khaub ncaws raws li nram no:
  - rau cov khau roj hmab siab, rau cov khau kom mws siab es cov xis mas thiaj li nkag tsis tau
  - rau hnb looj tes roj hmab
  - hnav ris ntew, maub ntswas rau hauv nkawm khau
  - rau cov looj hauv caug thaiw dej
  - rau cov iav taiv qhov muag

Tsis Txhob Kav Liam! © July 2017, Cemstone Companies, All Rights Reserved
**Why is heat a hazard to workers?**

When a person works in a hot environment, the body must get rid of excess heat to maintain a stable internal temperature. It does this mainly through circulating blood to the skin and through sweating.

When the air temperature is close to or warmer than normal body temperature, cooling of the body becomes more difficult. Blood circulated to the skin cannot lose its heat. Sweating then becomes the main way the body cools off. But sweating is effective only if the humidity level is low enough to allow evaporation, and if the fluids and salts that are lost are adequately replaced.

If the body cannot get rid of excess heat, it will store it. When this happens, the body’s core temperature rises and the heart rate increases. As the body continues to store heat, the person begins to lose concentration and has difficulty focusing on a task, may become irritable or sick, and often loses the desire to drink. The next stage is most often fainting and even death if the person is not cooled down.

Excessive exposure to heat can cause a range of heat-related illnesses, from heat rash and heat cramps to heat exhaustion and heat stroke. Heat stroke can result in death and requires immediate medical attention.

Exposure to heat can also increase the risk of injuries because of sweaty palms, fogged-up safety glasses, dizziness, and burns from hot surfaces or steam.

**How do I know if it's too hot?**

- The temperature rises
- Humidity increases
- The sun gets stronger
- There is no air movement
- No controls are in place to reduce the impacts of equipment that radiates heat
- Protective clothing or gear is worn
- Work is strenuous

The heat index, which takes both temperature and humidity into account, is a useful tool for outdoor workers and employers (see Heat Index chart right).

<table>
<thead>
<tr>
<th>Heat Index</th>
<th>Risk Level</th>
<th>Protective Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 91°F</td>
<td>Lower Caution</td>
<td>Basic heat safety and planning</td>
</tr>
<tr>
<td>91°F to 103°F</td>
<td>Moderate</td>
<td>Implement precautions and heighten awareness</td>
</tr>
<tr>
<td>103°F to 115°F</td>
<td>High</td>
<td>Additional precautions to protect workers</td>
</tr>
<tr>
<td>Greater than 115°F</td>
<td>Very High to Extreme</td>
<td>Triggers even more aggressive protective measures</td>
</tr>
</tbody>
</table>

**Prevention**

Most heat-related health problems can be prevented, or the risk of developing them can be reduced. For indoor environments, refer to the information below.

**Engineering Controls**

The best way to prevent heat-related illness is to make the work environment cooler. A variety of engineering controls can reduce workers’ exposure to heat:

- Air conditioning (such as air-conditioned crane or construction equipment cabs, air conditioning in break rooms).
- Increased general ventilation.
- Cooling fans.
- Local exhaust ventilation at points of high heat production or moisture (such as exhaust hoods in laundry rooms).
- Reflective shields to redirect radiant heat.
- Insulation of hot surfaces (such as furnace walls).
- Elimination of steam leaks.

**Work Practices**

- Employers should have an emergency plan in place that specifies what to do if a worker has signs of heat-related illness, and ensures that medical services are available if needed.
- Employers should take steps that help workers become acclimatized (gradually build up exposure to heat), especially workers who are new to working in the heat or have been away from work for a week or more. Gradually increase workloads and allow more frequent breaks during the first week of work.
- Workers must have adequate potable (safe for drinking) water close to the work area, and should drink small amounts frequently.
- Rather than being exposed to heat for extended periods of time, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work/rest cycles.
Work Practices

• If possible, physical demands should be reduced during hot weather, or heavier work scheduled for cooler times of the day.
• Rotating job functions among workers can help minimize overexertion and heat exposure.
• Workers should watch out for each other for symptoms of heat-related illness and administer appropriate first aid to anyone who is developing a heat-related illness.
• In some situations, employers may need to conduct physiological monitoring of workers - see Monitoring Workers at Risk of Heat-related Illness.

Personal Protective Equipment

Workers should be aware that use of certain personal protective equipment (e.g., certain types of respirators and impermeable clothing) can increase the risk of heat-related illness.

In some situations, special cooling devices can protect workers in hot environments:

• In some workplaces, insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields may be needed.
• Thermally conditioned clothing might be used for extremely hot conditions; for example:
  • A garment with a self-contained air conditioner in a backpack.
  • A garment with a compressed air source that feeds cool air through a vortex tube.
  • A plastic jacket whose pockets can be filled with dry ice or containers of ice.

Training

Workers and supervisors should be trained about the hazards of heat exposure and their prevention. Topics should include:

• Risk factors for heat-related illness.
• Different types of heat-related illness, including how to recognize common signs and symptoms.
• Heat-related illness prevention procedures.
• Importance of drinking small quantities of water often.
• Importance of acclimatization, how it is developed, and how your worksite procedures address it.
• Importance of immediately reporting signs or symptoms of heat-related illness to the supervisor.
• Procedures for responding to possible heat-related illness.
• Procedures to follow when contacting emergency medical services.
• Procedures to ensure that clear and precise directions to the work site will be provided to emergency medical services.

<table>
<thead>
<tr>
<th>HEAT RELATED ILLNESS AND FIRST AID</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILLNESS</td>
</tr>
<tr>
<td>---------</td>
</tr>
</tbody>
</table>
| HEAT STROKE | • Confusion  
• Fainting  
• Seizures  
• Excessive sweating or red, hot, dry skin  
• Very high body temperature | • Call 911  
While waiting for help:  
• Place worker in shady, cool area  
• Loosen clothing, remove outer clothing  
• Fan air on worker, cold packs in armpits  
• Wet worker with cool water, apply ice packs, cool compresses, or ice if available  
• Provide fluids (preferably water) as soon as possible  
• Stay with worker until help arrives |
| HEAT EXHAUSTION | • Cool, moist skin  
• Heavy sweating  
• Headache  
• Nausea  
• Dizziness  
• Light Headedness  
• Weakness  
• Thirst  
• Irritability  
• Fast heart beat | • Have worker sit or lie down in a cool, shady area  
• Give worker plenty of water or other beverages to drink  
• Cool worker with cold compresses/ice packs  
• Take worker to clinic or emergency room for medical evaluation or treatment if signs or symptoms worsen or do not improve within 60 minutes  
• Do not return to work that day |
| HEAT CRAMPS | • Muscle spasms  
• Pain  
• Usually in abdomen, arms, or legs | • Have worker rest in shady, cool area  
• Worker should drink water or other cool beverages  
• Wait a few hours before allowing worker to return to strenuous work  
• Have worker seek medical attention if cramps don’t go away |
| HEAT RASH | • Clusters of red bumps on skin  
• Often appears on neck, upper chest, folds of skin | • Try to work in a cooler, less humid environment when possible  
• Keep the affected area dry |

* Remember, if you are not a medical professional, use this information as a guide only to help workers in need.