

State of California

# Memorandum

To: Len Welsh, Acting Chief  
Department of Industrial Relations  
Division of Occupational Safety and Health

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Subject: Cal/OSHA Investigations of Heat Related Illnesses

At your request, we are writing to report on the preliminary findings of our research project surveying the information gathered by DOSH enforcement investigations of heat illness cases arising during the year 2005.

Twenty five Cal/OSHA heat-related enforcement investigations occurred during the time span of May through November 2005. In conducting this research project, we interviewed the field inspectors involved in these accident investigations and reviewed the case files and associated medical records. Our data are still in the process of analysis and refinement, but we are in a position to present some important basic findings now to inform the rulemaking process as California moves toward adoption of a permanent heat-illness prevention standard.

## GENERAL BACKGROUND ON THESE CASES:

- The cases involved 100% male workers and spanned several industries such as Construction (29%), Agriculture (38%), Public Safety (8%), Service (12.5%) and Transportation (12.5%).
- 68% of the workers involved in heat-illness-related incidents spoke Spanish as their primary language.
- 84% of these cases involved outdoor work exclusively, 12% involved indoor and outdoor work, and 4% involved indoor-only work. The work was described as moderate or strenuous in 92% of the cases, the majority of these being moderate.
- Death was the outcome in (54%) of the cases, and of the remaining cases, 38% required hospitalization greater than 24 hours, many for several days.

The mean age of the involved workers was 41-years-old, with the minimum age being 17 and the maximum being 76 years of age.

These results are summarized in attached Table 1

#### **ENVIRONMENTAL FACTORS PRESENT IN THE WORKPLACE AT TIME OF INCIDENT:**

- The average ambient temperature at the time of the incident was 96°F with a low of 75°F and a high of 116°F. The average humidity was 29% and the wind speed was 7 miles per hour.
- The average victim core body-temperature recorded was 104°F, with a low of 98°F and a high of 108°F.
- Two of the individuals involved were wearing impermeable clothing and a respirator.

These results are summarized in attached Table 2

#### **WORKPLACE CONDITIONS ON THE DAY OF THE EVENT:**

Some of the key workplace elements ascertained during our investigation included the following:

- Potable Water was present in 100% of the cases and was considered easily accessible in 96% of the cases. However, in 78% of the cases, the medical evidence supported inadequate fluid consumption (i.e. dehydration).
- The workplace was shaded in 24% of the cases. The remaining workplace operations were conducted in direct sunlight.
- Some type of shade was available during the employees' breaks in 77% of the workplaces.
- Most workplaces had scheduled breaks, and workers reported that breaks could be taken as needed.
- 80% of the employers involved had a written Injury and Illness Prevention Program (IIPP).

- Only 20% of all employers investigated had a written heat illness prevention program.
- None of these written programs included or documented training on acclimatization. However, for 46% of the employees involved, the incident occurred their first day on the job. Roughly 80% of involved employees had been on the job for fewer than 4 days.
- Only 36% of employers involved had a written emergency response plan

These results are summarized in attached Table 3

### **EVIDENCE FOR WORKER HEAT STRESS ILLNESS:**

The symptoms and signs of possible heat related illnesses that were reported in these investigations are presented in Table 4.

- Fainting or loss of consciousness was seen in almost 80% of the investigations.
- Over 20% of the cases had seizure activity.
- Many of the cases had some initial symptoms potentially suggestive of heat-related illness; however, in many of the cases, these symptoms were not reported to the employer.
- Findings such as fainting, seizures, hot body temperature, and rapid pulse are easier to observe because they are not dependent on employee reporting.

### **DISCUSSION:**

We feel that the data presented above provide important information about the experiences Cal/OSHA has had in investigating heat-related illness cases this past year. The data indicate that many employment sectors have experienced heat-related cases, suggesting the necessity for a heat illness prevention standard with broad application.

The consequences of heat-related illness are devastating as seen by the high number of deaths and serious illnesses encountered this past year. A high level of awareness and suspicion is imperative for timely management of these illnesses. Symptoms providing an early warning are not always apparent, and without an adequate IIPP and Heat Illness Prevention Training Program, symptoms may not be reported or recognized as related to heat. Preventative action is needed before employees reach the point of experiencing seizures, loss of consciousness, or core body temperatures averaging 104°F, yet in many of the above-described cases, necessity for action was not recognized until the employees involved had reached these late stages of heat illness onset.

This points to the need for a heavy emphasis on effective training and communication as well as the development of supporting materials, with due consideration being given to the culture and level of language of the target employee population, especially given the high prevalence of Spanish-speaking workers at risk and the potential for involvement of other employees who are non-native speakers of English.

Our research further indicates that environmental conditions were variable and do not suggest that there is a particular threshold for the occurrence of heat-related illness. Cases occurred across a temperature spectrum. While most of the cases occurred in weather at or above 100°F, cases also occurred at temperatures in the mid-seventies and eighties.

We have not yet attempted to calculate a heat index to account for the role of humidity or the heat effects of work in direct sunlight. Accounting for these factors would likely raise our estimate of the overall heat burden caused by the environment on the days and worksites in question and give a more accurate indication of the heat exposure actually experienced by each worker who fell ill. Exertion and workload also played a key role in producing heat-related illness in cases where temperature appeared less threatening.

As shown above, lack of acclimatization was a prevalent factor in the group of 25 cases investigated by DOSH last year. It was the first day on the job for almost half of the workers stricken, while 80% of them had been on the job for 4 or fewer days. Training on acclimatization and measures to address it were absent from all of the investigated workplaces. Very few of the employers involved had any program to address heat illness prevention.

In reviewing the investigations in relationship to the elements covered by the emergency heat illness prevention standard that took effect in August, we found that water was generally available and accessible. However, the employees who fell ill showed medical evidence of dehydration. Information about the quantity of water available or consumed was generally difficult to ascertain. Most of the work performed was in direct sunlight, though some form of shade was often available for scheduled breaks, although this was less true in agricultural settings. Emergency response timeliness was generally not an issue once the call for help was made. However, the employer's recognition of the need for emergency medical assistance was not always timely.

We have not completed our statistical analysis of the medical conditions associated with the heat-related illness cases. However, as can be seen above the vast majority of cases were fatalities. Those employees who survived generally experienced life-threatening health effects from their exposure, including rhabdomyolysis (a serious breakdown of muscle tissue), liver damage, blood-clotting disorders, electrolyte disorders, and neurological conditions.

In conclusion, the information generated by DOSH investigations of the 25 heat illness incidents that occurred during 2005 has provided valuable information to inform the standard setting process. Our research to date supports inclusion of the requirements present in the existing emergency heat illness prevention standard as a good starting point for heat illness prevention. However, we should strongly encourage all stakeholders to review these findings and consider the benefits of incorporating more explicit protections into the heat-illness standard, particularly in the areas of worker acclimatization and awareness of employers and employees of the need for recognition of and prompt response to early warning signs of heat illness.

JCP/AN/kb  
Attachment to follow

## Memorandum Attachments: Tables 1 through 4

**Table 1: General Information on Heat Stress Cases**

Primary Language Spoken:	Frequency	Percent
English	8	32%
Spanish	17	68%

Victim Outcome		
Death	10	42%
Emergency Room visit only	2	8%
Hospitalization > 24 hours	9	38%
Hospitalization then Death	3	12%

Industry Service sector:		
Agriculture	9	38%
Construction	7	29%
Public Safety	2	8%
Service	3	12.5%
Transportation	3	12.5%
Work conditions:		
Indoor	1	4%
Indoor and Outdoor	3	12%
Outdoor	21	84%
Nature of work:		
Light	2	8%
Moderate	15	
Strenuous		
Response time by ambulance once called to worksite:		
5 min or less	7	
10 min or less	7	
20 min or less	9	
90 minutes	1	

<b>Days on job for worker prior to incident:</b>		
First day on the job	11	46%
1-4 days on the job	8	34%
5 days-2 wks on the job	1	4%
Greater than 2 wks	4	16%
<b>Mode of transportation of victim from the work site?</b>		
ambulance	16	70%
helicopter	1	
other	4	
private vehicle	2	
<b>If Shade was provided (n=16), describe type:</b>		
building	7	42%
Indoors	2	12.5%
tree	5	31%
Vehicle	2	12.5%

**Table 2: Numerical data describing involved employees and environmental conditions**

<b>Variable</b>	<b>Mean</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>
Age (yrs)	41	41	17	76
Victim's Core Body Temp (°F)	104	105	98	108
Ambient Temperature (°F)	96	100	75	116
Relative Humidity (%)	29	29	12	55
Wind Speed (mph)	7	7	0	17

**Table 3: Evidence for Key Provisions Relating to T8 CCR §3395**

Key Elements Covered	n (%)	n (%)
	Yes	No
Potable Water	25 (100)	0
Accessible Water	23 (96)	1 (4)
Shade during Work	6 (24)	19 (76)
Any Shade during Breaks	17 (77)	5 (23)
Rest as Needed	13 (76)	4 (24)
IIPP	20 (80)	5 (20)
Heat Illness Prevention Program	5 (21)	19 (79)
Training on Acclimatization	0	25 (100)
Emergency Response Plan	9 (36)	16 (64)
Did the medical evidence support of adequate Fluid	5 (22)	18 (78)

**Table 4: Frequency of Reported Signs and/or Symptoms Experience by Victims**

Symptoms Reported	Yes	No or Unknown
Headache	1	24
Muscle Cramps	5	20
Weakness	11	14
Unusual Fatigue	6	19
Unusual Behavior	9	16
Nausea or Vomiting	5	20
Hot Dry Skin	12	13
Fainting	19	6
Seizures	6	19
Loss of Consciousness	19	6
Rapid Pulse	8	17