A Critical Study on Heat Stress in Textile Industry

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Abstract

The principal objective of the present investigation is to study the existing hot environment of various textile industries in Pandesara industrial Area, Pandesara Dist. Surat and it broadly deals with the determination of various parameters affecting the heat stress viz. measurement of relative humidity , dry bulb temperature, wet bulb temperature , air temperature and then derive the heat stress indices for the hot environment generated by various textile machines like Jet, Stenters, Agers, Jigger & Drum, Drier & Printing machine and Boiler .The Heat Stress Indices have been observed to be high in all the three industries for all the six work places both during day and night hours. The average value of Heat Stress Index is found to be 84.81 while during night hours H.S.I is found to be 83.07 It has been found to decrease during night hours. The results indicate that there is a likelihood of heat cramps or heat exhaustion. There are more chances of heat cramp if the workers are exposed to heat stress continuously for eight hours.

Keywords: OSHA, Heat Stress, Textile Industry

I. INTRODUCTION

The Occupational Safety and Heat Administration (OSHA) define heat stress as "Aggregate of environmental and physical factor that constitute the total heat load impose on the body." [1] Heat stress occurs when a person's environment clothing and activity interact to produce a tendency for body temperature to rise. The thermoregulatory system of the body responds in order to increase the heat loss. This response can be effective but it can produce strain in the body which leads to discomfort and eventually heat illness and even death. [2]

There are two sources of heat which are important to men working or living in a warm or hot environment. These are given as under:

- The internally generated metabolic heat and
- The externally imposed environmental heat

Metabolic heat is a by product of chemical processes occurring within the cells, tissues and organs. Under resting condition the metabolic heat production is quite low. Muscular activity is the major source of the increase heat production during the very hard physical work the production may reach to 600 to 750 kgCal. Thus under the conditions of physical work large quantity of heat must be removed from the body if an increase in body temperature is to be prevented.

Environmental heat is important because it has an effect on the rate at which body heat can be exchange with the environment and consequently the ease which the body can regulate and maintain normal temperature.

An internal body temperature of 98.6 ^{0} F is consider to be normal however body temperature is varies from time to time during the day and it is changes with the physical activity. Body temperature of 102 ^{0} F in otherwise healthy individual must be viewed with some concern and temperature above 105 ^{0} F is critically serious thus the regulation of the body temperature is important physiological function. [3]

II. EXPERIMENTAL

In the present investigation the most important part of the determination of WBGT & H.S.I requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of relative humidity, dry wet bulb temperature, wet bulb temperature and natural wet bulb temperature was carried out using WBGT apparatus provided by M/s de Tox Corporation, Surat. (Gujarat). All the experiments were carried out in the selected industries of Pandesara Industrial Complex near Surat city which is famous for textile and silk industries. This industrial estate is situated adjacent to Surat-Navsari highway. This selection was made after extensive survey of existing industries, more than 140 textile processing houses, the criteria considered for selection included following aspects:

- Type and number of textile machineries
- Schedule of production in such industries and
- Willingness of the industries for granting permission for conducting the work place measurement for heat stress.

Based on the results obtained, H S I have been computed and reported in Comparison Table-1 both for day time and night hours for three industries each having six workplaces. Comparison study has also been made to understand the trend of the heat stress development.

III. RESULTS & DISCUSSION ON H.S.I. OF DIFFERENT WORKPLACES [4]

It is clear from the computation of H.S.I that the H.S.I is found to be higher for all three industries at all six work places during the day time. For example, in the Industry - I at the jet machine work area, the H.S.I is found to be between 79-88 during the night hour and is found to be between 106 -122 during the day time. Compared with day time the average value of H.S.I observed in Industry - I is 115.03 and for the same industry during night hours the H.S.I is found to be 82.24.

Comparison Table - 1

Comparison of H.S.I of different workplaces

Industry	*Jet*	*Stenter*	*Agers*	*Jigger*	*Drier*	*Boiler*
I - d	*115.03*	*84.81*	*85.07*	*90.76*	*80.87*	*98.46*
I - n	*82.24*	*83.07*	*81.29*	*85.97*	*78.8*	*96.2*
II - d	*92.82*	*97.46*	*95.18*	*85.98*	*82.83*	*85.52*
II - n	*86.45*	*94.98*	*90.89*	*82*	*80.29*	*83.75*
III - d	*93.79*	*92.13*	*84.93*	*84.97*	*83.3*	*99.76*
III - n	*89.56*	*88.45*	*93.19*	*82.66*	*80.69*	*98.96*

- For the value of the H.S.I = 79-88 the heat stress is said to be severe and the personnel should be selected by medical examination. It is necessary to ensure adequate water and salt intake. The continuous exposure of eight hours should be avoided.
- For day time the values of the H.S.I = 115.03, it is obvious that exposure time limited by rise in deep body temperature.
- Measures that can be taken for Stenters machine, Agers machine, Jigger & Drum machine, drier and printing machine and boiler have been decided based on the value of average H.S.I from the heat stress index table given by OSHA.
- Similar conclusions can be drawn for other two industries.

IV. SUMMARY OF CONCLUSIONS

Based on the H S I reported in Comparison Table -1, following control measures have been suggested:
CONTROL MEASURES

A. Administrative Control

1) Number and Duration Of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

2) Rest Areas

Provide cool rest areas in hot work environments to reduce the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76^0Fappears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

3) Drinking Water

Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body.

4) Protective Clothing

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, protective clothing could be an advantage to the worker.

V. ENGINEERING CONTROL

Engineering controls can be used to modify the rate of convective, radiative and evaporative heat exchange between workers and their surrounding environment.

Covering the body with increased clothing can help reduce the rate of heat gain by convection. When feasible, reducing the air temperature by air conditioning is very effective.

Reducing heat and humidity by:

- Opening windows in hot work areas,

- Using fans, or
- Using other methods of creating airflow such as exhaust ventilation or air blowers. Use air conditioning to cool the entire workplace if possible or
- Use spot cooling for hot areas and work sites.
- Use local exhaust to remove heat from hot work processes.
- Insulate hot equipment and surfaces to contain radiant heat.
- Ensure that maintenance program quickly and effectively fixes problems that create hot conditions—such as steam leaks and
- Cover or contain heat sources—such as steaming tanks, vats and drains.
- Fans can increase the air flow and reduce humidity. Improving the air flow increases the cooling effect of sweating. However, if the air temperature is at or above body temperature, fans will simply expose the body to more hot air. This increases the heat load and the risk of heat stress disorders.

REFERENCES

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