



Energy for India

## HEAT STRESS PREVENTION AT MEGA CONSTRUCTION WORK SITE IN DESERT AREA OF INDIA

Shah, Dr. Divyang A. Hari Kumar, MacIntyre Colin  
*Cairn India Pty. Ltd., Gurgaon, India*  
[Divyang.Shah@cairnindia.com](mailto:Divyang.Shah@cairnindia.com)



# Introduction

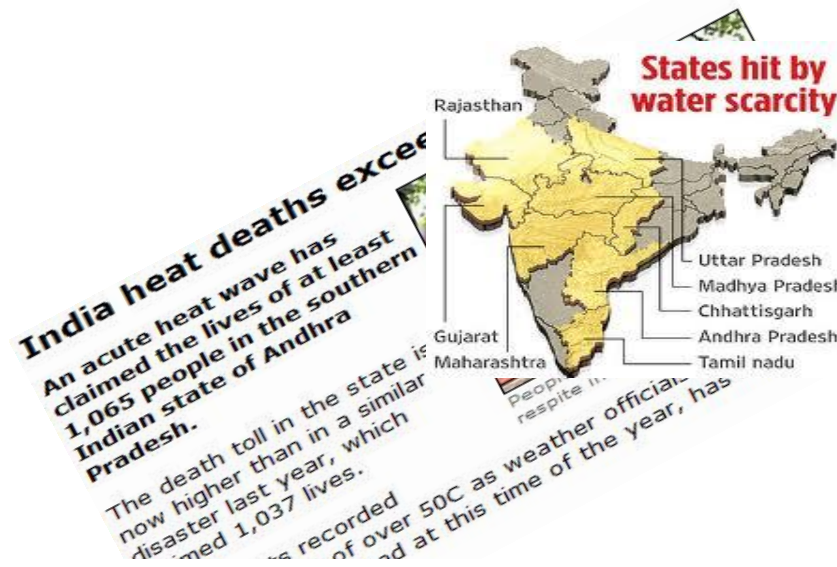


Rajasthan, situated in the western part of India is known for the largest desert in Indian subcontinent. A largest discovery of oil in Indian soil was made in 2006.





# Problem Statement

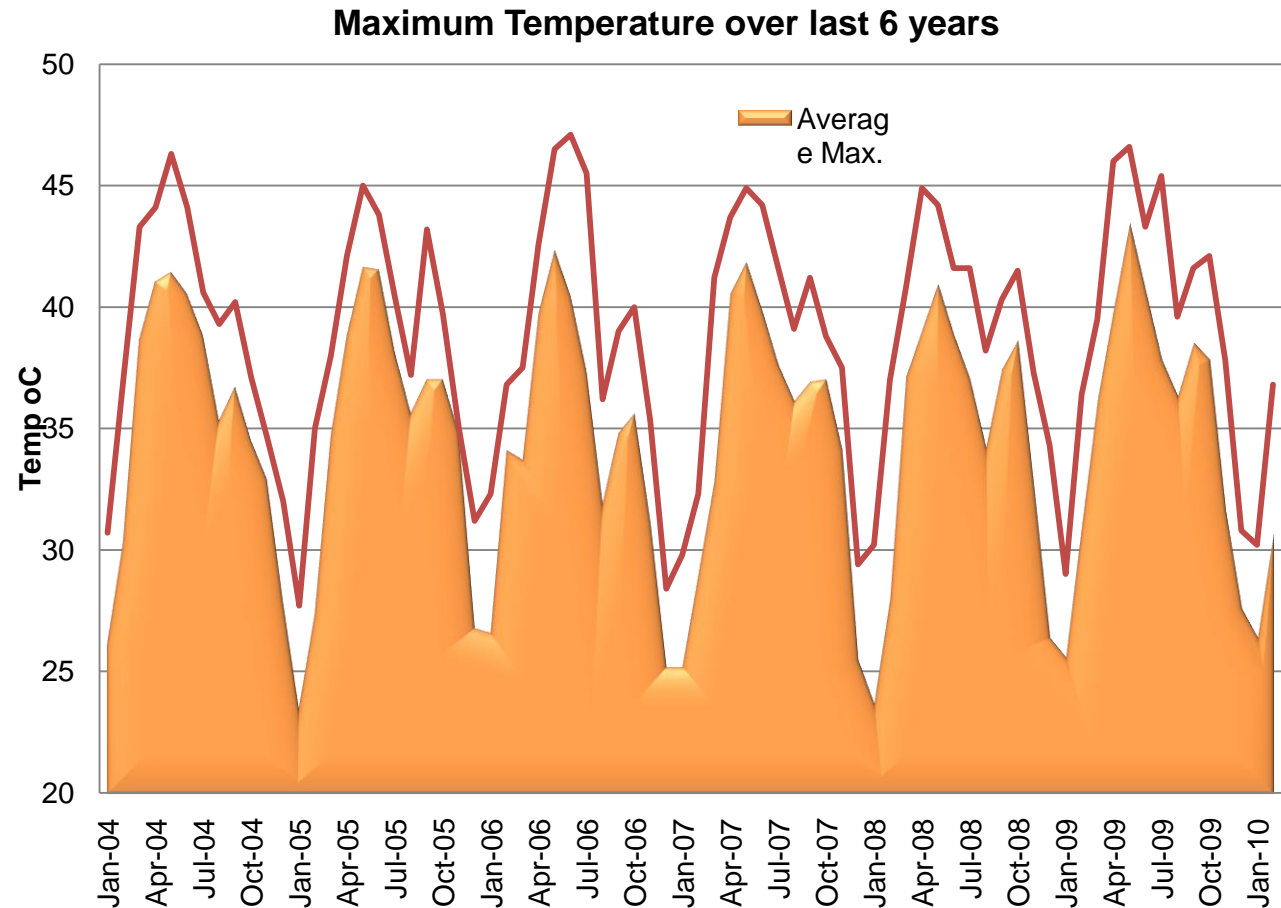


The death toll is expected to rise with experts forecasting temperatures approaching 50C (122F) in coming weeks. More than 100 people are reported to have died in the state of Gujarat where the mercury topped at 48.5C last week. At least 90 died in Maharashtra, 35 in Rajasthan and 34 in Bihar.

# Problem Statement



- 2009-10 The peak of construction activities
- More than 18000 workforce were involved in construction and commissioning activities
- The temperature in this area usually reaches up to 48°C (120°F) in summer,
- Being a mega construction project, all personnel were pressed against tight project execution schedule.



## Major Activities



# Major Activities

- **Work at Height**
- **Excavation**
- **Manual Material Handling**
- **Civil / Earthen work**
- **Travel**



# Interventions



## • Management commitment



Protecting People & Environment



Rahul Dhir, CEO & MD  
Executive Directors

# Interventions



## •Heat stress prevention Guidelines

CAIRN INDIA LIMITED PROCEDURE Heat Stress Prevention Guidelines			
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		Prepared by	Dr. David Smith

### •Table of Contents

#### •DOCUMENT CHANGE HISTORY

#### TABLE OF CONTENTS

1. [PURPOSE](#)
2. [SCOPE](#)
3. [DEFINITIONS](#)
4. [BASICS OF BODY TEMPERATURE](#)
5. [EVALUATION:](#)
6. [CONTROL:](#)
7. [ACCLIMATISATION](#)
8. [MONITORING REGIME](#)
9. [TRAINING AND SUPPORT](#)
10. [RESPONSIBILITIES](#)
11. [REFERENCES](#)

[Appendix - A Fitness for work in Heat Stress Environment](#)

[Appendix-B Heat Stress Indices](#)

[Appendix-C Flag Signs](#)

[Appendix-D WBGT and Recommended Work Rest Regime](#)

[Appendix-E Self Evaluation](#)

[Appendix-F Guidelines for acclimatisation and re-acclimatisation](#)

[Appendix-G Effects of heat stress](#)

**HEAT STRESS**

Keep out of the sun  
Take regular breaks  
Rest in cool place  
Wear loose clothing

**WATER** ✓  
 • Drink cool water (around 200ml) every 15-20 mins  
 • Keep water within easy reach  
 • Drink dehydrated zwitter drinks

**COFFEE** ✗  
 • Avoid drinking coffee

Line Colour	Interpretation and remedy
Dark Red	Drink water regularly
Red	Drink More Water
Orange	Mildly Dehydrated
Yellow	Extremely Dehydrated

## Interventions

- Awareness campaign





# Interventions



Self Evaluation	
Urine Colour	Interpretation and remedy
	Extremely Dehydrated
	Drink water immediately
	Mildly Dehydrated
	Drink More Water
	Not dehydrated
	Drink water regularly



# Interventions

- Administrative control
    - >700 earthen pots at worksite
    - Rest shelters
    - All workforce provided with insulated water bottle before entering the site
    - Hourly monitoring and broadcasting of heat index
    - Flag signs at work locations
-



# Heat index chart

## Old chart

Limitation: Requires WBGT meter, in absence of which interpretation is incorrect

Wet Bulb Globe Temperature (WBGT) from Temperature and Relative Humidity

		Temperature (°C)																													
		20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
0	15	16	16	17	18	18	19	19	20	20	21	22	22	23	23	24	24	25	25	26	27	27	28	28	29	29	30	31	31	32	32
5	16	16	17	18	18	19	19	20	21	21	22	22	23	24	24	25	26	26	27	27	28	29	29	30	31	31	32	33	33	34	35
10	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29	30	30	31	32	32	33	34	35	36	36	37
15	17	17	18	19	19	20	21	21	22	23	23	24	25	26	26	27	28	29	29	30	31	32	33	33	34	35	36	37	38	39	
20	17	18	18	19	20	21	21	22	23	24	24	25	26	27	27	28	29	30	31	32	32	33	34	35	36	37	38	39			
25	18	18	19	20	21	22	23	24	24	25	26	27	28	28	29	30	31	32	33	34	35	36	37	38	39						
30	18	19	20	21	22	23	23	24	25	26	27	28	29	29	30	31	32	33	34	35	36	37	38	39							
35	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39								
40	19	20	21	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39									
45	19	20	21	22	23	24	25	26	27	27	28	29	30	32	33	34	35	36	37	38											
50	20	21	22	23	23	24	25	26	27	28	29	30	31	33	34	35	36	37	39												
55	20	21	22	23	24	25	26	27	28	29	30	31	32	34	35	36	37	38													
60	21	22	23	24	25	26	27	28	29	30	31	32	33	35	36	37	38														
65	21	22	23	24	25	26	27	28	29	31	32	33	34	36	37	38															
70	22	23	24	25	26	27	28	29	30	31	33	34	35	36	38	39															
75	22	23	24	25	26	27	29	30	31	32	33	35	36	37	39																
80	23	24	25	26	27	28	29	30	32	33	34	36	37	38																	
85	23	24	25	26	28	29	30	31	32	34	35	37	38	39																	
90	24	25	26	27	28	29	31	32	33	35	36	37	39																		
95	24	25	26	27	29	30	31	33	34	35	37	38																			
100	24	26	27	28	29	31	32	33	35	36	38	39																			

WBGT > 40

Note: This table is compiled from an approximate formula which only depends on temperature and humidity. The formula is valid for full sunshine and a light wind

## New chart

Advantage: Based on recent research and publication, does not require special equipment, interpretation is based on air temperature and relative humidity only.

		Relative Humidity in %																			
		100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	
Air Temp (in °C)	49																			50	49
	48																			49	48
	47																		50	47	47
	46																		49	46	46
	45																		50	45	45
	44																		49	44	44
	43																	49	43	43	43
	42																	50	42	42	42
	41																	48	41	41	41
	40																	49	40	40	40
	39																	49	39	39	39
	38																	49	38	38	38
	37																	49	37	37	37
	36																	50	36	36	36
	35																	50	35	35	35
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	32																	50	32	32	32
	31																	50	31	31	31
	30																	48	30	30	30
	29																	46	29	29	29
28																	43	28	28	28	
27																	41	27	27	27	
26																	39	26	26	26	
25																	37	25	25	25	
24																	35	24	24	24	
23																	33	23	23	23	
22																	31	22	22	22	
21																	29	21	21	21	



# Flag signs

Danger Category/ Flag Colour	WBGT Index (based on temp. , humidity , radiant heat and air velocity)	Humidex (Based on temp. and humidity)		Heat related Health Risk	Water Requirement (1 cup = ½ litre)	Work: Rest Period (Minutes)	Controls
		Humidex -1 Moderate physical Work, unacclimatised worker, OR Heavy physical work, acclimatised worker	Humidex -2 Moderate physical work, acclimatised worker, OR Light physical work, unacclimatised worker				
IV. Extreme Danger	≥40	≥46	≥50	Heat stroke or sunstroke imminent	1 cup every 10 minutes	-	All work stopped
III. Danger	34-39	38-45	43-49	Sunstroke, Heat Exhaustion or Heat cramps likely. Heat Stroke possible with prolonged exposure and physical activity	1 cup every 15 minutes	30:10	Work under shade, Elevated work stopped
II. Extreme Caution	28-33	30-37	36-42	Heat stroke, Heat Exhaustion or Heat cramps possible with prolonged exposure and physical activity	1 cup every 20 minutes	45:15	No working alone, Self-pace
I. Caution	22-27	Up to 29	Up to 35	Fatigue possible with prolonged exposure and physical activity.	1 cup every 30 minutes	Continuous work	Continuous visual monitoring of workers in direct sun and heavy work



Success:  
Zero Incident of Heat Related Illness  
throughout the Project Period



Prime Minister of India  
with First oil from the  
facility