



**Delhi Disaster Management Authority**

**Govt. of NCT of Delhi**



## **Delhi Heat Action Plan 2024-25**



**(Guidelines U/S 18 (2) (h) of Disaster Management Act, 2005 for prevention, mitigation, capacity building and preparedness to combat the adverse impact of Heat Waves in Delhi)**

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## Executive Summary

Indian subcontinent is experiencing higher temperatures that arrive earlier and stay for longer, and will likely continue to experience more frequent heat waves in the coming decades. Extreme heat fuelled by human-caused climate change is adversely affecting the ecology, economy, and health of people from all walks of life and all of parts of the world. Extreme heat takes a substantial toll of lives in India. India's Ministry of Earth Sciences points out that the mortality rates per million for heat waves have increased by 62.2% during the last four decades. In addition to mortalities, extreme heat adds to the difficulties of many poor and marginalized communities— who are living in inadequately ventilated, hot, and crowded homes—to maintain thermal comfort due to the high costs of cooling.

Extreme heat threatens the health and livelihood of millions of occupationally exposed people in India. According to the World Bank, India may account for 34 million of the projected 80 million global job losses from extreme temperature/ Heat. Lost labour from rising heat and humidity could result in loss up to 4.5% of India's Gross Domestic Product (GDP) (equivalent to approximately US\$150-\$250 billion) by the end of this decade. Further, according to India Meteorological Department IMD observed in its Statement on "Climate of India in 2022", that "anomalously high temperatures and heat waves reduced crop yields, especially wheat". In these many ways, heat wave conditions are likely to have continuing, deadly consequences for human health, making the role of adaptation strategies and mitigating heat risks very critical. It is important to develop zero tolerance towards heat wave-related deaths.

Delhi Disaster Management Authority developed Heat Action Plan (HAP), as per NDMA Guideline. This aims to facilitate the stakeholders in preparing a Heat Management plan by providing insight into the heat related illness and the necessary mitigative and response actions to be undertaken. It would also help in mobilization and co- ordination of various departments, individuals and communities to focus on heat reduction aspects to help and protect their neighbours, friends, relatives and themselves against avoidable health problems during spell of very hot and dry weather.

To implement Heat Action plan in Delhi the following key strategies have been adopted

- Establish Early Warning System and Inter- Agency Coordination
- Capacity building/ training programme
- Public Awareness and community outreach
- Collaboration with Non-Governmental and Civil Society

## Abbreviation

IMD	India Meteorological Department
NDMA	National Disaster Management Authority
NOAA	National Oceanic and Atmospheric Administration
IPCC	Intergovernmental Panel on Climate Change
AR6	Sixth assessment report
MOES	Ministry of Earth Science
WMO	World Meteorological Organisation
SLCP	Short Lived Climate Pollutants
UHI	Urban Heat Island
IDSP	Integrated Disease Surveillance Programme
NCDC	National Centre for Disease Control
MoH&FW	Ministry of Health and Family welfare
PPE	Personal Protective Equipment
RH max	Relative humidity maximum
RH min	Relative humidity minimum
LST	Land Surface Temperature
IEC	Information, Education and Communication
TVCs	Television commercials
MCD	Municipal Corporation Department
NDMC	New Delhi Municipal Council
NGOs	Non-Governmental Organisation
PWD	Public Works Department
I&FC	Irrigation and Flood Control
DUSIB	Delhi Urban Shelter Improvement Board
DJB	Delhi Jal Board
IT	Information Technology
DFS	Delhi Fire Service
RWA	Resident Welfare Association
ASHA	Accredited Social Health Activist
DDA	Delhi Developmental Authority
PWD	Public Works
NTPC	National Thermal Power Corporation
DSIIDC	Delhi State Industrial and Infrastructure Development Corporation
BSES Rajdhani	Bombay Suburban Electric Supply
NDPL	North Delhi Power limited
I&PR	Information & Public Relation
SEOC	State Emergency Operation Centre

I&PR	Information and Public Relation
DCB	Delhi Cantonment Board
DDA	Delhi Development Authority
DPCC	Delhi Pollution Control Committee
NHAI	National Highway Authority Of India
DMRC	Delhi Metro Rail Corporation
ECBC	Energy Conservation Building Code
NCRTC	National Capital Region Transport Control
DISCOMS	Distribution Companies
DCMC	Dust Control Management Cell

# Chapter One

## Introduction

# 1

### 1.1 Profile

Delhi is the National Capital Territory and largest metropolitan city. It is bordered by Haryana on three sides and by Uttar Pradesh in the east. Geographically, Delhi is situated in Indo-Gangatic Plains, south of Himalayas and East of Aravallis and adjacent to Punhar (Punjab - Haryana) plain. It has a length of 51.9 km and breadth of 48.48 Km. Delhi has 11 districts with 33 Tehsils /Sub-Divisions. Eleven Revenue Districts named as North, North-West, West, South East, South-West, South, East, North-East, Shahdara, Central and New Delhi. Delhi is bounded by the Indo-Gangetic alluvial plains in the North and East, by Thar Desert in the West and by Aravalli hill ranges in the South. The terrain of Delhi is flat in general except for a low NNE-SSW trending ridge that is considered an extension of the Aravalli hills of Rajasthan.

The ridge may be said to enter Delhi from the South-West. The eastern part of the ridge extends up to Okhla in the South and disappears below Yamuna alluvium in the North-East on the right bank of the river.

Two prominent features of Delhi are the Yamuna Flood Plain and the Ridge. It is located in India's seismic zone-iv, an indication of its vulnerability to major earthquakes.

Characteristics of the City	
<b>Location</b>	85°44' E to 85°44' 'E longitude and 20° 12' to 20°25' N latitudes
<b>Height above main sea Level</b>	45 m above Mean Sea Level (MSL)
<b>Total area (sq. km)</b>	1486.5 sq.km (Census, 2011)
<b>Total Population</b>	16.78 million (Census, 2011)
<b>Population Density</b>	14698 per sq km
<b>Slum Population</b>	6343 slums

*Table 1: Delhi City Characteristics*

### 1.2 Weather

Delhi Weather varies with the different climatic conditions and city is characterized by extreme weather conditions. Delhi experiences tropical steppe type of climate and hence its seasons are marked with extreme temperatures. The summer season commences in the month



of April and continues till July. During this season, continental air blows over the city and makes the weather very dry and hot. Summer weather condition of Delhi is characterized by scorching heat and unbearable temperature. Temperature reaches almost 45degree C in the summer months. On the contrary, winter, which lasts from December to January, is extremely cold. Temperature falls to almost 5 °C during the winter months. The rainy season in Delhi begins in June and continues almost till October. Delhi receives most of its rain during this period from the Northwesterly winds. Most of the precipitation occurs in the month of July. The weather condition of Delhi remains pleasant during the rainy season, but humidity level remains high.

### 1.3 Green Cover

The Green Cover of Delhi varies with its varied topography and comprises small and medium sized plants and shrubs. Vegetation is widely scattered and do not form any shade as such over any part in the city.

The entire topography of Delhi is divided into ridge, Yamuna Flood Plain, the Plain. Each of these regions is marked by distinct type of vegetation. The ridge area of the city offers the right factors that favour the growth of acacias and other cacti. However, during the monsoon, herbaceous plants grow in abundance in the ridge. As far as the plain region of Delhi is concerned, it is characterized by shisham trees. And finally, riverine type of vegetation grows along the plain of Yamuna. Vegetation of Delhi mainly comprise of medium size trees and herbs. However, Delhi is known for its varied flowering plants. Weeds and grass grow on the banks of the Yamuna River.

### 1.4 Social & Demographic Profile of Delhi

Delhi is one of the fastest growing cities in the country. Due to rapid pace of urbanization, the landscape of Delhi has undergone a change from a rural majority to urban. The rural to urban area change during the last three censuses in Delhi is depicted in Statement.

#### 1.4.1 Area Rural and Urban

S. No	Classification of Area	1991		2001		2011	
		km2	%	km2	%	km2	%
1	Rural	797.66	53.79	558.32	37.65	369.35	24.90
2	Urban	685.34	46.21	924.68	62.35	1113.65	75.1
3	Total	1483.00	100.00	1483.00	100.00	1483.00	100.00

Table 2: Census of India



The growth in the urban area during 2001-2011 was observed at 20.44 percent. This pace of urbanization has reduced the number of villages in Delhi from 300 in 1961 to 165 in 2001 and 112 in 2011. The number of urbanized villages has increased from 20 in 1961 to 135 in 2011. The number of census towns has increased from 3 in 1971 to 29 in 1991 and 110 in 2011. Thus more and more rural villages of Delhi are being declared as census towns in each successive Census, resulting in decreasing rural population and rural areas in Delhi.

#### 1.4.2 District wise population of Delhi as per Census, 2011 is as follows;

The global urban population has multiplied more than ten times in the past century; from 224 million in 1900 to 2.9 billion in 1999. According to United Nations estimates, the population living in urban areas exceeded 50 percent of the world total in 2006 and approach 60 percent in 2020. While the world's urban population is expected to increase by almost 2 billion over the next 30 years, the world's rural population is actually expected to decline slightly falling from 3.3 billion in 2003 to 3.2 billion in 2030. Thus, all future population growth for the foreseeable future is expected to be absorbed in urban areas. Most, if not virtually all of this growth, is taking place in the developing countries.

Districts	Populations (2011)
North East	22,40,749
East	17,07,725
Central	14,27,910
West	25,31,583
North	8,87,978
North West	22,46,311
South	12,33,401
New Delhi	11,73,902
South West	17,49,492
South East	15,00,351
Shahdara	22,40,749

Table 3: District Wise Population

## 2.1 Heat Waves

The Indian Meteorological Department (IMD) has given the following criteria for Heat Waves:

- Heat Wave need not be considered till maximum temperature of a station reaches at least 40°C for Plains and at least 30°C for Hilly regions
- When normal maximum temperature of a station is less than or equal to 40°C Heat Wave Departure from normal is 5°C to 6°C Severe Heat Wave Departure from normal is 7°C or more
- When normal maximum temperature of a station is more than 40°C Heat Wave Departure from normal is 4°C to 5°C Severe Heat Wave Departure from normal is 6°C or more
- When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat waves should be declared. Higher daily peak temperatures and longer, more intense heat waves are becomingly increasingly frequent globally due to climate change. India too is feeling the impact of climate change in terms of increased instances of heat waves which are more intense in nature with each passing year, and have a devastating impact on human health thereby increasing the number of heat wave casualties.

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## 2.2 Health Impacts of Heat Waves

The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. The signs and symptoms are as follows:

- Heat Cramps: Edema (swelling) and Syncope (Fainting) generally accompanied by fever below 39°C i.e. 102°F.
- Heat Exhaustion: Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- Heat Stroke: Body temperatures of 40°C i.e. 104°F or more along with delirium, seizures or coma. This is a potential fatal condition

There will be no harm to the human body if the environmental temperature remains at 37° C. Whenever the environmental temperature increases above 37° C, the human body starts gaining heat from the atmosphere. If humidity is high, a person can suffer from heat wave disorders even with the temperature at 37°C or 38°C. To calculate the effect of humidity we can use Heat Index Values. The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. As an example, if the air temperature is 34°C and the relative humidity is 75%, the heat index--how hot it feels--is 49°C. The same effect is reached at just 31°C when the relative humidity is 100 %. The temperature vs humidity chart is placed and the temperature actually felt is placed below:

Relative Humidity %	Temperature °C																
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57	
50	27	28	30	31	33	35	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	54	58			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	56											

Caution	Extreme Caution	Danger	Extreme Danger
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Source: Calculated °F to °C from NOAA's National Weather Service

Table 4: Temperature/ Humidity Index

Green (No Action)	Normal Day	Maximum temperatures are nearnormal
Yellow(Be updated)	Hot day advisory	>= 40 °C
Orange Alert(Be prepared)	Heat alert day	>= 45°C
Red Alert (Take Action)	Extreme heat alert day	>= 45°C

Table 5: Heat Alert Thresholds for Delhi City (source: NDMA)

Last 50 years have witnessed a hike in the frequency of hot days, nights and heat waves all over world (IPCC, 2014). India has experienced a number of heat wave incidences, since 2006, and average temperature during 2018 was significantly above normal (+.41°C above). The year 2019 was the seventh warmest year on record since nation-wide records commenced in 1901. June and July 2019 have been the hottest month record globally, with National Oceanic and Atmospheric Administration (NOAA) confirming June 2019 being hottest on records, 0.95°C above normal average.

Under 2°C warming scenario, the frequency of heat waves in India is projected to increase by 30 times the current frequency by the end of the century. The duration of heat waves is also expected to increase 92 to 200-fold under 1.5 and 2°C scenarios. Coupled with poverty in South Asia, the impact can be severe. Future projections of temperature indicate a steady increase across the three periods (2030s, 2050s, 2080s), with anomalies reaching 4-5°C for high emission scenarios by 2080. Higher daily peak temperatures of longer duration and more intense heat waves are becoming increasingly frequent globally due to climate change. Extreme temperatures are among the most dangerous natural hazards but rarely received adequate attention.

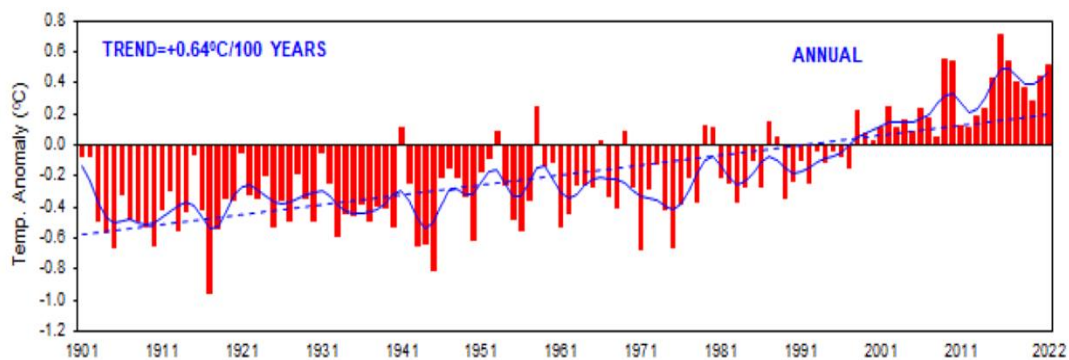


Figure 1: Annual mean land surface air temperatures anomalies 1901- 2022. IMD

**The IPCC AR6** states climate change is already affecting nearly every part of the planet, and human activities are unequivocally the cause. The report indicates that the earth is now around 2.0°F (1.1°C) warmer than in 1850-1900, warming at a rate without precedent in at least 2000 years, possibly longer. This report confirmed that the climate-driven changes occurring around the world are widespread, rapid, and intensifying. The report makes clear that until we reach global net zero emissions of greenhouse gases, we cannot limit warming to any temperature threshold, be it 1.5°C, 2.0°C or 3.0°C.<sup>1</sup>

### 2.3 Heat Waves in Delhi

Delhi is one of the hottest city in India and one of most vulnerable to impacts of heat wave due to its large population, high number of lower income groups. The summer season in Delhi begins in early April and continues till the mid of June, with the heat peaking in late May and early June. It is characterized by extreme heat, low humidity, very hot winds and thunderstorms.

The climatology of the summer season or the period between 1991-2020 is showcased below.

Months	March	April	May	June	July
Mean maximum temperature (°C)	35.3	41.3	43.7	43.8	39.7
Mean minimum temperature (°C)	10.7	16.0	20.8	22.3	24.0
Average Relative Humidity (%) at 1730 IST	35	23	26	39	62

**Climate data for New Delhi (Safdarjung) 1991–2020, Source: IMD (1971-2000)**

Table 6: Climatology of the summer season or the period between 1991-2020

March 2022 marked the hottest month ever in India (IMD), with Delhi recording its second hottest April in 72 years. With India recording 203 Heat wave days in 2022 (highest in the recent past), Delhi city recorded around 17 heat wave days (2022), with mere 3 days recorded in 2021. (IMD & MoES)<sup>2,3</sup>

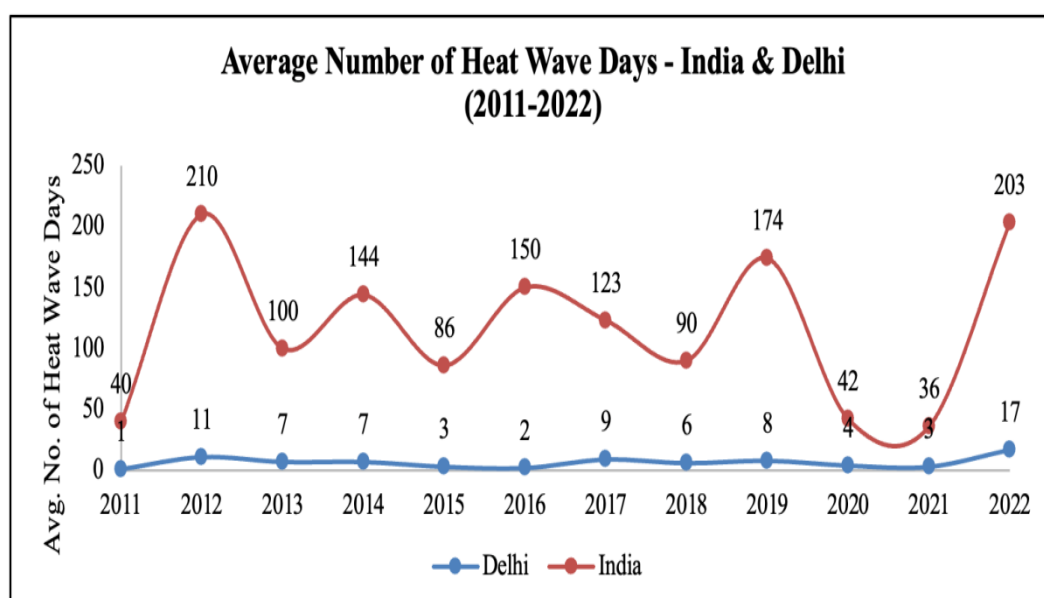


Figure 2: Average Heat Wave Days in India & Delhi (2011-22)

Heat waves have increased in intensity, frequency and duration, along with the increased temperature and Relative Humidity, the number of Heat Wave days have also increased. For instance, in case of Delhi the number of Heat wave days have increased by 35% from 90 days in 2018 to 174 days in 2019.

- **Highest heat wave days have been recorded in 2012 and 2019**
- **The number of heat wave days have increased from 49 days (2018) to 90 days (2019) in 3 months (April, May, June) – increased by 35%,**



Figure 3: Category wise No. of Days

## 2.4 Impacts of Heat Wave on Livelihood

Heat wave is a “silent disaster” and adversely affects the livelihood and productivity of people. Heat Wave has emerged as a major Health Hazard. WMO predicts Heat Wave related fatalities to double in less than 20 years. Heat waves often lead to poor air quality. The extreme heat and stagnant air during a heat wave increase the amount of ozone pollution and particulate pollution.

Air pollution, such as methane and black carbon, are powerful short lived climate pollutants (SLCPs) that contribute to climate change. Although SLCPs persist in the atmosphere for short lifetime, their global warming potential is often much greater than carbon di oxide (CO<sub>2</sub>). These pollutants are harmful to human health and also contribute to complex air quality problems such as the formation of ground level ozone (smog), fine particulate matter, and acid rain.

Health impacts of heat are more severe in urban areas, where residents are exposed to higher and nocturnally sustained temperatures, due to the Urban Heat Island (UHI) effect (Climate Council of Australia, 2016). Recent Study by Tata Centre of Development, University of Chicago warns that 1.5 million people may die by 2100 due to Extreme Heat due to Climate Change. The baseline death rate due to heat induced climate change in the early 2000s in India was 550 per 100,000 of the population. There has been a 10% increase upon current death rate (Climate Impact Lab, 2019). In 2010 May, the city of Ahmedabad had a major heat wave, registering 1,344 additional deaths in the city with an excess of 800 deaths recorded in the week of 20-27th May.



India has experienced a lot of heat wave incidences, since 2006. 2017 witnessed the 4<sup>th</sup> consecutive heat wave in India out of which the year 2016 had the deadliest heat wave. Heat waves in India took a large number of deaths in 4 years (2014-2017). India experienced a loss of 4,500 lives in 4 years' period alone.

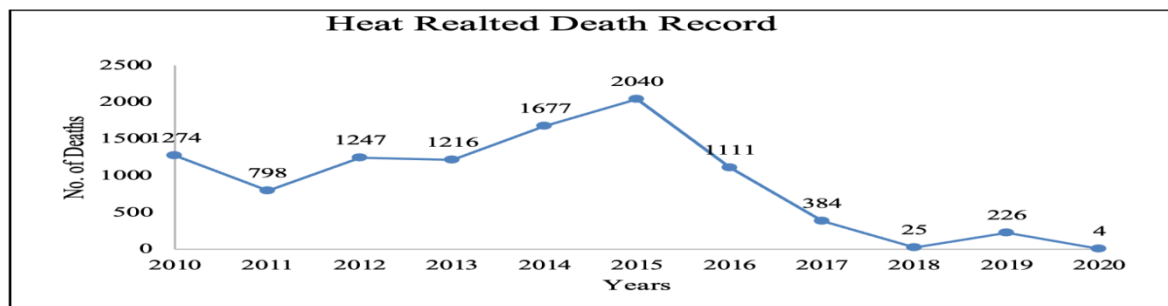


Figure 4: Heat Wave Mortality Records, India (2010-2020)

The Integrated Disease Surveillance Programme (IDSP) under the National Centre for Disease Control (NCDC) of the Ministry of Health and Family Welfare (MoH&FW) is responsible to collect and record data regarding the heat waves and related mortality and morbidity.

Heat wave often led to poor air quality. The extreme heat and stagnant air during a heat wave increase the amount of ozone pollution and particulate pollution.

Air pollutant such as methane and black carbon, are powerful short-lived climate pollutants (SLCPs) that contribute to climate change. Although SLCPs persist in the atmosphere for short lifetimes, their global warming potential is often much greater than carbon dioxide. These pollutants are harmful to human health and also contribute to complex air quality problems such as the formation of ground level ozone (smog), fine particulate matter, and acid rain.

The table below illustrates vulnerability mapping and its essential components.

<b>Vulnerability Mapping</b>	
<b>Vulnerable Area</b>	
Less urbanized	
Minimal access- Water and Sanitation	
Minimal Household amenities	
<b>Vulnerable Group</b>	
Economically Weaker Sections (EWS)	
Elderly, Children, Women	
Working Individual:- Construction workers, factory workers, transport, sweepers, laborers and vendors/ street hawkers.	



## 2.5 Vulnerable Areas

Hot temperatures during a heat wave often result in some parts getting much hotter than rest the city. The air, surface and soil temperatures influence the overall temperature. Hence, it is important to identify beforehand such areas to minimize any potential health impact.

The spatial documentation of heat related health risks in addition to the biophysical vulnerabilities will help policy, planners, medical stakeholder etc. in developing heat preparedness plans at local scale /ward level.

Vulnerable areas within the city are classified as under:

### 2.5.1 Slums Pockets & Squatter Settlements

The economically weaker section of people in these areas are affected much more due to their poor coping mechanisms and limited ability of the inhabitants especially women to respond to health challenges during hot temperatures. The night time outdoor microclimatic conditions along with poor housing structure and no access to services make it extremely difficult for people to cope with heat wave. Consequently, acutely affecting the health of people living in these areas. The women of these areas face its brunt the most as they not only have to deal with heat wave but also have to make arrangement for services such as water etc.

### 2.5.2 Low Income Group Areas

People living in these areas constantly suffer from heat wave due to poor built up environment, limited access to basic services and housing material that are good at absorbing and storing the sun's heat. It has been observed that people living in higher floors with poor ventilation and bad housing material are more vulnerable to heat related impacts. People with disabilities and chronic diseases are worst sufferers. Women cannot even leave their front door open for safety and security reasons.

### 2.5.3 Heat Wave Vulnerable Hotspots

The hotspots identified during the vulnerability assessment of heat waves undergo significant rise in temperatures as compared to rest of the city. These areas are most likely to have higher number of inhabitants being affected during heat waves and experiencing huge heat-health implications.

## 2.6 Vulnerable Groups During Heat wave

A heat wave has varied health outcomes, with specific group of people being more vulnerable to heat related mortality and morbidity. Among these are, infants, children, woman, elderly, construction workers, destitute and people from economically weaker sections. .

Identifying such groups is important as it allows medical professionals to prioritize actions to treat heat related illnesses effectively in order to minimize potential threats.

The vulnerable groups are as follows:



Figure 5: Vulnerable groups during heat wave

### 2.6.1 Infants (0-1years)

They are particularly sensitive to heat due to different metabolism and poor ability to adjust to changes in temperatures. The infants sweat less which considerably decreases their ability to cool their body. Infants are more susceptible to heat related deaths due to their high metabolism rate and inability to remove sheets or clothing.

### 2.6.2 Children (1-14 years)

They are physiologically more vulnerable to heat wave unlike adults. Heat related illnesses are associated with their physical activity, production of more metabolic heat/ kilogram, in comparison to their body weight, dehydration and lower cardiac output. Henceforth, strict vigilance is required during a heat wave to avoid any heat related sickness and overheating among them.

### 2.6.3 Woman

They are more at risk for heat related mortality. They are vulnerable to heat wave as their ability to thermo regulate is compromised. There are increasing evidences of still birth among

pregnant women due to Heat wave. Their heat related illnesses are further intensified due to social norms and gender discrimination.

#### **2.6.4 The Elderly**

They are at a great risk to morbidity and mortality during heat wave. With growing age there is considerable reduction in the cardiac output and capacity to circulate blood to skin, intestinal and renal circulatory beds. Aging compounds these problems which reduces the efficiency of heat dissipation in them.

#### **2.6.5 Working Individuals**

They perform activities both indoors and outdoors in farms, manufacturing and construction and hence are at greater risk to dehydration and heat wave. Their capacity to thermo regulate exceeds on a regular basis and exposure to heat for long duration leads to dehydration, compromises abilities to carry out normal activities, chronic kidney disease, cardiovascular and pulmonary illnesses. The cultural aspects such as clothing and use of Personal Protective Equipment (PPE) may also hinder a worker's ability to cool through sweat.

#### **2.6.6 Economically Weaker Sections of Society**

They often lack awareness and the means to undertake any measures for protecting themselves against heat related illnesses. Most suffer from chronic diseases which often get aggravated during heat wave. Poor quality housing, lack of access to basic services such as water, health services and sanitation, compounds their vulnerability during.

#### **2.6.7 Person with Disabilities**

They are highly vulnerable to heat waves as their ability to receive or respond to heat alerts is substantially reduced. In certain cases, such as spinal cord injury, the body does not sweat, inhibiting the body's ability to cool from overheating. Besides, any form of physical or mental disability adds to their vulnerability. In addition, high social risk factors, such as household pattern, poor health conditions, food insecurity and housing instability, likewise further adds to these challenges. It has been observed that heat wave messages are not always designed in a way that makes it easy for people with disabilities to comprehend. For example, people with hearing impairment, visually challenged or reduced mental health have to depend on their caregivers.

## 2.6.8 Chronic Disease Patients

They are most likely to face the heat wave. Their medication not only impacts their ability to gauge changes in temperatures but also can make effect of hot temperatures even worse. Patients with conditions of heart diseases, mental illnesses, poor blood circulation and obesity are more at the risk of heat related illnesses. Overweight people often tend to retain body heat which makes them vulnerable to heat wave and its associated impacts.

## 2.7 Heat season

The summer season covered months of March, April, May and June. Daily maximum temperature (T max) and daily minimum temperature (T min) from year 2001 to year 2022 was collected. The data was further analysed to determine monthly mean values of T Max and T Min. Mean values of T max and mean T Min for the summer season were also determined. The established mean values were further compared with long term climatological mean of T Max and T Min. Observed Climatological mean values established by IMD for the period 1905- 2022 were used to compare monthly and seasonal variability of T Max and T Min for the study period of 17 years.

Similarly, daily maximum humidity (RH max) and daily minimum humidity (RH min) for the years 2004-2022 were analysed to assess mean monthly RH Max, RH Min trends for months of April, May, June and July as well as for summer season. These values were further compared against long term climatological mean for corresponding months and the summer season.

Below gives the mean climatological values (based on IMD data from 1905 to 2022) for temperature and relative humidity for the summer months.

Month	Tmax (° C)	Tmin (° C)	RH (830) (%)	RH (1730) (%)
March	29.6	15	65	35
April	36	21.5	45.33	23.17
May	39.8	26.2	44.67	26
June	39.4	28.3	55.55	38.67

Table 7: Climatological Values, Delhi

## 2.8 Thermal Hotspot Maps for Delhi

The surface temperature maps of the city are developed using LANDSAT 8 satellite data and superimposed on the ward-boundaries map of the city to develop the city hot spot area. Wards with temperature above 42 degrees Celsius were delineated across the city.

Land Surface Temperature (LST) maps were prepared for 30 May 2019 (the day when Delhi recorded a maximum air temperature of 48 °C), and spatial variability of LST in different municipal zones of Delhi was analyzed. The zones Narela and Najafgarh recorded a maximum LST of 60.48 °C and 59.06 °C.

The LST Maps indicate higher temperatures recording across the wards Harkesh Nagar 092s, Harkesh Nagar 092s, Khyala 008s, Wazir Pur 072n, Bijwasan 048s, Vishwas Nagar 017e, Hari Nagar A 010s, Jahangir Puri 021n, Delhi Gate 088n, Shastri Park 025e

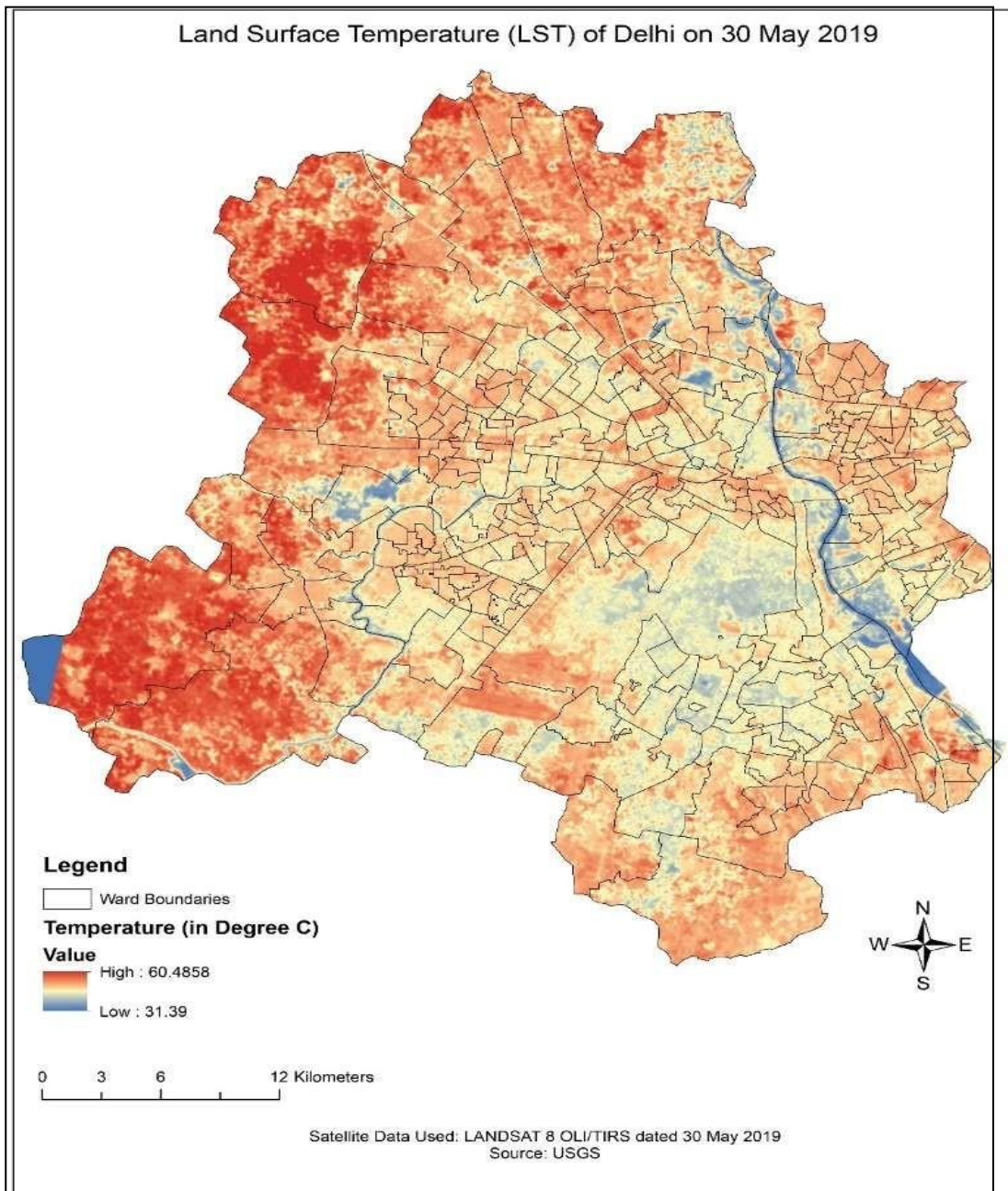


Figure 6: Thermal Hot Spot Map, Delhi, 2019



## 2.9 Identification of Ward- level vulnerability- Delhi

Heat wave vulnerability across the above identified wards in hot spot areas of Delhi were analysed using the comprehensive index, comprising of nine sectors - *Sanitation, Water, Electricity, Health, Transportation, Housing, Cooking, Awareness and Heat symptoms* and their respective sub sectors. A total of 10 hotspots have been identified in Delhi which includes overlap of vulnerable areas with vulnerable section. The cumulative ward wise heat wave vulnerability analysis indicates that nearly 6 wards in Delhi are highly vulnerable and lack minimum basic amenities to cope with heat wave.

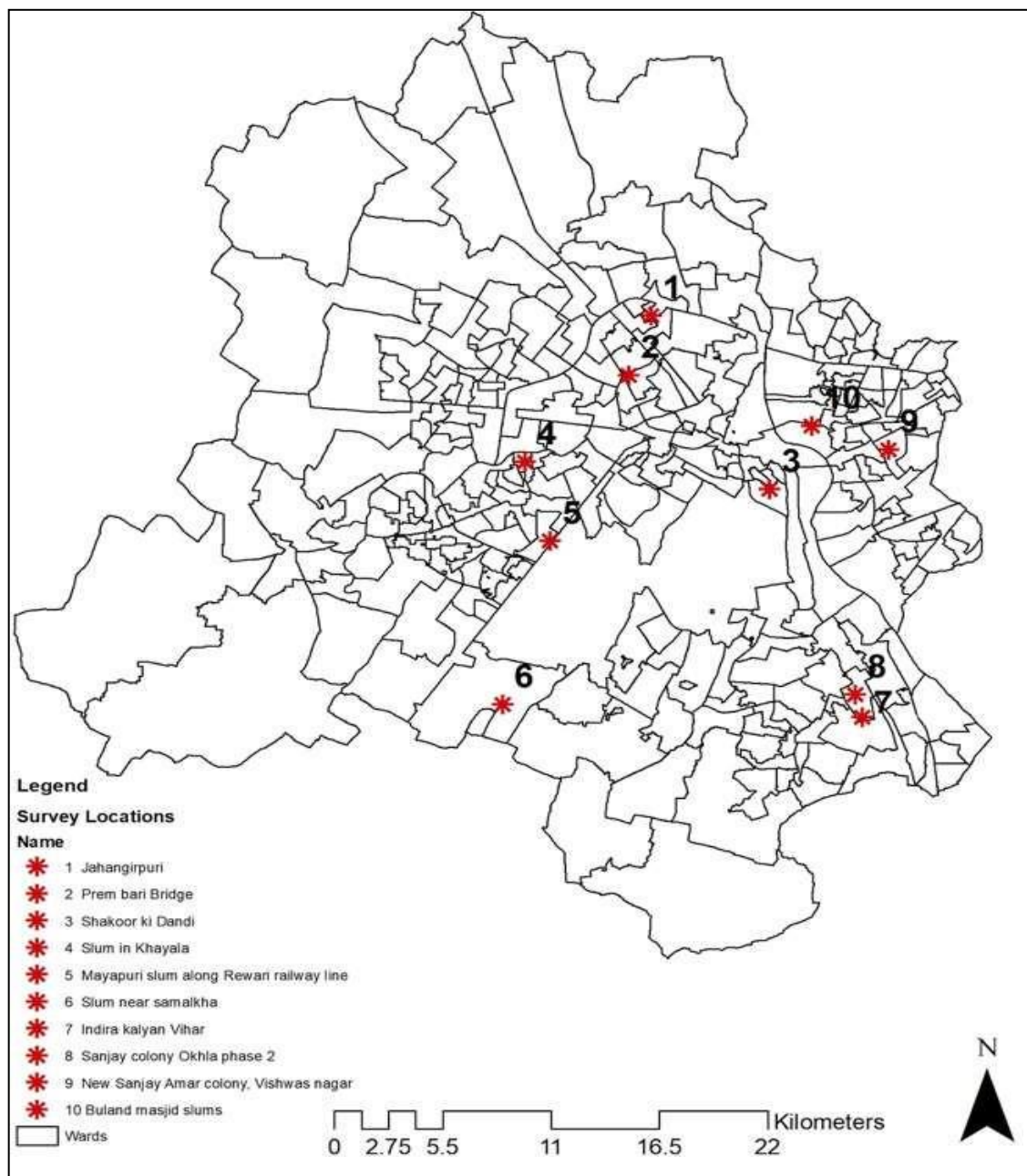


Figure 7: Survey Hotspots, Delhi

**Benefits of Heat wave Action Plan**

1. Prevents deaths associated with heat strokes.
2. Government commitment to protect the poor and vulnerable citizens.
3. Reduces chances of illness due to heat waves.
4. Making Indian cities future ready, Climate resilient cities.
5. Better preparedness of hospitals/health centres.
6. Economic losses- labour productivity, loss of job days, reduced labour and opportunity loss.

**This Heat Action Plan identifies**

1. Vulnerable populations and the health risks specific to each group (see section: Impact of Heat wave on Health, Livelihood and Productivity)
2. General heat-health risks (see section: Impact of Heat wave on Health, Livelihood and Productivity)
3. Effective strategies, agency coordination, and response planning
4. Process of activating heat alerts and the plan implementation
5. Evaluate and update the Heat Action Plan based on new learning

			
<b>EARLY WARNING SYSTEM &amp; INTER AGENCY EMERGENCY RESPONSE PLAN</b>	<b>PUBLIC AWARENESS &amp; COMMUNITY OUTREACH</b>	<b>CAPACITY BUILDING OF MEDICAL PROFESSIONALS</b>	<b>REDUCING HEAT EXPOSURE AND PROMOTING ADAPTIVE MEASURES</b>
Alert residents of predicted high and extreme temperatures & formally communication channels to alert governmental agencies	Communicate the risks of heat waves and implement practices to prevent heat-related deaths and illnesses	Training focus on primary medical officers and other paramedical staff, and community health staff	Access to potable drinking water and cooling spaces during extreme heat days & promote adaptive measures.

**3.1 Purpose**



This Heat Action Plan aims to provide a framework for the implementation, coordination, and evaluation of extreme heat response activities in Delhi that reduce the negative health impacts of extreme heat. The Plan's primary objective is to alert those populations most at risk of heat-related illness that extreme heat conditions either exist or are imminent, and to take appropriate precautions.

### 3.2 Extreme heat planning includes

- Identifying vulnerable populations and the health risks specific to each group;
- Developing effective strategies, agency coordination, and response planning to shape a Heat Action Plan that addresses heat-health risks;
- Switching off car ignition / at the red light
- Switching of the AC plant during unwanted time
- Increase greenery
- Implementing the Heat Action Plan and activating heat alerts;
- Evaluating and updating the Heat Action Plan regularly.

### 3.3 Causes

The heat wave was caused in large part by sparser pre-monsoon season showers, which brought less moisture than normal to the area, leaving large parts of India arid and dry. The sudden end of pre-monsoon rain showers, an uncommon trend in India has contributed to the heat waves. Additionally, the monsoon season is later and further south than the normal trend. This weather pattern, coupled with the EL Nino effect, which often increases temperatures in Asia, combined to create the record high temperatures. High humidity compounded the effects of the temperatures on residents. The Loo, a dry wind originating from Pakistan and northwest India, has contributed to increasing the temperature in India.

### 3.4 Key Strategy and Components of Heat Action Plan

The heat-wave action plan is intended to mobilize individuals and communities to help protect their neighbours, friends, relatives, and themselves against avoidable health problems during spells of very hot weather. Broadcast media and alerting agencies may also find this plan useful. Severe and extended heat-waves can also cause disruption to general, social and economic services. For this reason, Government agencies will have a critical role to play in preparing and responding to heat-waves at a local level, working closely with health and other related departments on long term strategic plan.

### 3.4.1 Establish Early Warning System and Inter-Agency Coordination to alert residents

On predicted high and extreme temperatures. Who will do what, when, and how is made clear to individuals and units of key departments, especially for health.

#### a-Effective early warning

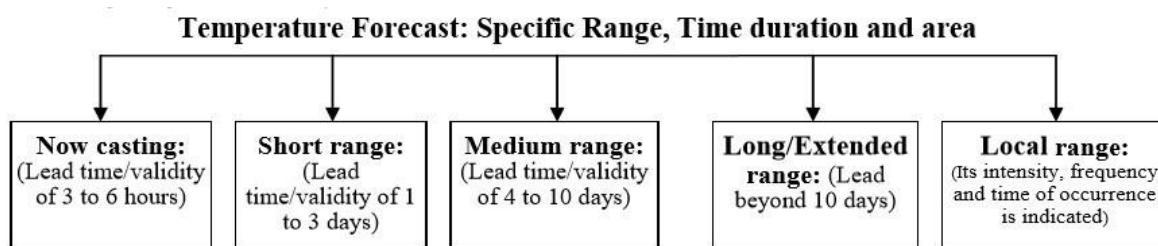
The primary objective of a warning system is to empower individuals and communities to respond timely and appropriately to the hazards in order to reduce the risk of death, injury, property loss and damage. Warnings need to get the message across and stimulate those at risk to take action.

#### b-Following measures needs to be ensure

- Extending the lead time of warnings;
- Improving the accuracy of warnings;
- Greater demand for probabilistic forecasts;
- Better communication and dissemination of warnings;
- Using new technologies to alert the public;
- Targeting of the warning services to relevant and specific users (right information to right people at right time at the right place);
- Warning messages are understood and the appropriate action taken in response
- Develop portal/dashboard/ application/ App related to awareness generation, quick information starting on the Heat Wave Risk reduction and dissemination the Heat Wave alerts.

#### c-Forecast and Issuance of Heat Alert or Heat Warning

**India Meteorological Department (IMD):** The IMD is mandated to meteorological observations and provides current and forecast meteorological information for optimum operation of weather-sensitive activities. It provides warning against severe weather phenomena like tropical cyclones, dust storms, heavy rains and snow, cold and heat waves etc. It also provides real time data and weather prediction of maximum temperature, Heat-wave warning, Heat-alert for the vulnerable cities/rural area of the severity and frequency. IMD provides following range and validity of time forecast:



### Identification of Color Signals for high Alerts

<b>Red Alert (Severe Condition)</b>	<b>Extreme Heat Alert for the Day</b>	<b>Normal Maximum Temp increase 6° C to more</b>
<b>Orange Alert (Moderate Condition)</b>	<b>Heat Alert Day</b>	<b>Normal Maximum Temp increase 4° C to 5° C</b>
<b>Yellow Alert (Heat-wave Warning)</b>	<b>Hot Day</b>	<b>Nearby Normal Maximum Temp.</b>
<b>White (Normal)</b>	<b>Normal Day</b>	<b>Below Normal Maximum Temp.</b>

### 3.4.2 Capacity Building / Training Programme

For health care professionals at local level to recognize and respond to heat-related illnesses, particularly during extreme heat events. These training programmes should focus on medical officers, paramedical staff and community health staff so that they can effectively prevent and manage heat-related medical issues to reduce mortality and morbidity.

### 3.4.3 Public Awareness and Community Outreach

Disseminating public awareness messages on how to protect against the extreme heat-wave through print, electronic and social media and Information, Education and Communication (IEC) materials such as pamphlets, posters and advertisements and Television Commercials (TVCs) on Do's and Don'ts and treatment measures for heat related illnesses.

### 3.4.4 Collaboration with Non-Government and Civil Society

Collaboration with non-governmental organizations and civil society organizations to improve bus stands, building temporary shelters, wherever necessary, improved water delivery systems in public areas and other innovative measures to tackle Heat wave conditions.

## **Chapter Four**

### **Roles & Responsibilities for Managing Heat Wave**

# **4**

There needs to be greater clarity around the roles and responsibilities in the management of Heat wave, for that matter any disaster. Preparation and response to Heat wave is to be managed in an integrated manner for which clear leadership to anchor the process is necessary. A control agency leads the response to a particular type of emergency. Support agencies provide resources, such as personnel, essential services and materials, to support or assist a control agency or affected person.

#### **4.1 Prevention, preparedness and Mitigation Measures**

##### **4.1.1 Phase 1 – Pre Heat Season (January to March)**

Pre-Heat Season is devoted to develop early warning systems, communication plan of alerts to the general public, health care professionals and voluntary groups (care givers) with emphasis on training and capacity building of these groups.

#### **Designated Department/ Nodal Officers**

1. Divisional Commissioner- Nodal Officer for State.
2. District Magistrate of respective District – Nodal Officer for District.
3. Deputy Commissioner – Nodal Officer for Municipal Corporation (MCD).
  1. To convene Meeting with Departments/ Organization/ NGOs involved in rehab/ agencies to review mechanism to respond extreme heat event.
  2. To Interact regularly with concerned departments for review the feedback.
  3. To identify High risk area of the State/Districts vulnerable to heat wave and focus on such area and initiate focused activities on prevention for heat related illness.
  4. To organize training for Health Workers, School Children and the local community with the Health Department in prevention measures and treatment protocol.
  5. To distribute IEC material (Pamphlets, Posters & Stickers) in Local Language with Tips to prevent heat wave to Hospitals, Schools, and professional associations.

## Roles and Responsibilities for managing Heat Wave – Pre Heat Season

S. No	Name of the activities	Name of the Agency	Responsibilities	Directions
1.	Early warning	India Meteorological Department (IMD)	<ul style="list-style-type: none"> <li>- Issue Heat wave alerts warnings</li> <li>- Weather forecasts on Short/ Medium/ Long range duration, Communicate Max. Temperatures district wise</li> </ul>	DDMA – <ul style="list-style-type: none"> <li>- To disseminate the information received from IMD to Line Departments and Public.</li> <li>- High Risk Area mapping and Identification of vulnerable groups</li> </ul>
2.	Measures of Mitigating effect of Heat Wave	MCD, PWD, I&FC, DUSIB, DJB, NDMC, Delhi Police & Traffic Police	<ul style="list-style-type: none"> <li>-To construct Shelters/ Sheds, Bus Stands with cool roof.</li> <li>-Identification of areas to provide shelters during heat alert period.</li> <li>-Ensuring Drinking Water at all identified major points in the sites &amp; worksite.</li> <li>-Ensure shade for on duty traffic police personnel as they are more exposed to heat waves and distribution of cool jackets for Traffic police personnel.</li> <li>- As a long-term solution all the line departments and the public at large should be asked to promote Cool Roof.</li> <li>-Maintaining water bodies also in forest area for wildlife animals and birds.</li> <li>-Augment use of public transport to reduce private vehicle use and for improving the frequency of transport.</li> <li>-Repair/ Maintenance of mechanical/ technical system with towing arrangement, on priority basis including fan and</li> </ul>	

			cooling system in buses. -Afforestation and plantation.	
3.		Labour Department	Organise training for employers, outdoor laborer's and workers. <ul style="list-style-type: none"> <li>• Change the shift of outdoor workers schedule change from peak hours.</li> <li>• Make emergency kit (Ice Packs, ORS, etc.) for the construction workers.</li> </ul>	- Training on Health Impact of extreme heat and suggestion to protect themselves during high temp.
4.		Transport Department	-Display Posters and distribute pamphlets on prevention of heat wave related illness -Ensure availability of adequate Bus Shelters with Drinking Facilities - Ensure that buses do not run during pick hours (12-4pm) when heat wave is declared. - Augment public transport to reduce private vehicle use and for improving the frequency of transport. -Promote car pooling -Repair/maintenance of mechanical/Technical system with towing arrangement, on priority basis including fan and cooling system in buses.	Transport Department to ensure necessary arrangements.
5.		Education Department	-Display Posters and distribute pamphlets on prevention of heat wave related illness - Ensure that schools do not run during pick hours (12-4pm) when heat wave is declared. -Identify the shelter space, drinking water, ORS facilities with signs. -No open-air classes to be conducted.	Director Education (Delhi Govt., MCD, NDMC) to take necessary action and implement in NCT of Delhi - to conduct Training of school teachers to equip them with knowledge of heat protection do's & don'ts and activities which they can disseminate in classrooms.

6.	Monitoring and response	Medical & Health Department and Medical Professional	<ul style="list-style-type: none"> <li>-Stockpiling of ORS in Hospitals and Dispensaries</li> <li>-Creating Medical Posts at vulnerable places</li> <li>-Dedicating the ward and the bed in the hospital.</li> <li>-Training of human resources and deploy additional staff to attend to the influx of patients during Heat Wave.</li> <li>-Display Heat- related illness prevention tips and how to stay cool around Hospitals and Dispensaries</li> <li>-Establish more clinical Education</li> <li>-Preparedness of heat health and social care system.</li> <li>-Enable better emergency support system/ ambulance for affected people to health care facilities with adequate equipments.</li> <li>-Preparedness of heat health, and social care system.</li> <li>-Enable better emergency transport system/ ambulance for affected people to healthcare facilities with adequate equipments.</li> </ul>	
7.	Emergency Services	1077 Emergency Helpline No.	<ul style="list-style-type: none"> <li>-Disseminate SMS text messages to advise local residents during a heat alert.</li> <li>-Identify risk area of vulnerable populations, in part by utilizing the list of high-risk area.</li> <li>-Create displays on ambulances to build public awareness during major local events.</li> <li>-To find out Hot spot of the city.</li> </ul>	<p>DDMA-</p> <ul style="list-style-type: none"> <li>- To make separate surveillance team during a heat wave.</li> <li>- To create single platform for all the line department</li> <li>- Identifying routes to high risk areas and to reach vulnerable sections of population in shortest time possible by utilizing the list of high-risk areas.</li> </ul>



				<ul style="list-style-type: none"> <li>- Collect all death data from MCD</li> <li>- collect all cases recorded in hospitals of Heat wave.</li> <li>- collect Ambulance call log of summers.</li> </ul>
8.	Media campaign and IEC activities	Information and Public Relation	<ul style="list-style-type: none"> <li>-Identification of areas to post warnings and information during heat season</li> <li>-Create awareness among the public through advertisement in local language</li> <li>-Display hoarding at important places</li> <li>-Creation of awareness through Print, Electronic and Outdoor media.</li> <li>-Increase the no. Of Installed LED screens with rolling updated temperature forecast.</li> <li>-Utilizing the local radio FM to alert public during Heat wave.</li> <li>-Send Heat wave warning through Text, WhatsApp Messages, Emails, Etc.</li> </ul>	
9.		Information Technology (IT) Department	<ul style="list-style-type: none"> <li>-Development of Disaster and Emergency Management System which includes Heat waves and prepare a Dash board to monitor heat wave scenario</li> <li>-Mapping of Risk areas and discrimination of warnings and alerts to all stakeholders automatically through web and mobile applications.</li> <li>-Prepare map on web interface with color coding system.</li> </ul>	
10.		Delhi Fire Services	<ul style="list-style-type: none"> <li>-To check the readiness of vehicles and firefighting equipments to face any emergency.</li> </ul>	

11	Communities and individuals	Community groups, Self-help groups, ward level committees, NGOs	<p>-Conduct training programmes, workshops and outreach sessions with community / Self- help groups and mobilizes such as RWAs, ASHA workers, Anganwadis, and Ward Committees in Municipalities to help inform and get vulnerable communities more actively involved.</p> <p>-Identification of NGOs, Voluntary Organizations in reaching out to the Public, especially vulnerable groups.</p> <p>-Encourage discussions for finding early signs of heat exhaustion with local doctors or Health Centres.</p> <p>-Inform community members about how to keep cool and protect oneself from Heat</p>	
12		Forest Department, DDA, MCD, NDMC, PWD, Education Department, Higher Education, NTPC, DSIIDC, DJB, BSES Rajdhani	-Increase plantation activity	Horticulture and Agricultural department to provide plants
13		Delhi Jal Board	To ensure proper arrangement of drinking water at various public places including residential, commercial, industrial areas.	Delhi Jal Board to arrange enough storage of water. Sprinkler of water
14		BSES Rajdhani, NDPL, Yamuna power ltd	<ul style="list-style-type: none"> <li>• To Provide uninterrupted power supply</li> <li>• Replace and upgrade all the damaged transformers and replace loose wires</li> <li>• Special care should be</li> </ul>	Instructions to all the staff to be ready for emergency

			<p>taken for power supply in Hospitals, Dispensaries and Clinics.</p> <ul style="list-style-type: none"> <li>• Awareness generation to run the AC at 25degree centigrade,</li> <li>• Proper use of AC in Government Department as well.</li> <li>• Cooperation of consumers</li> </ul>	
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#### 4.1.2 Phase 2 – During Heat Season (Annually from March to July)

High alert, continuous monitoring of the situation, coordination with all the departments /agencies concerned on one hand and general public & media on the other hand is the focus of this phase.

##### Designated Department/ Nodal Officers

- Issue a Heat alert State/District wide when extreme heat events are forecast. The key agencies, IMD, DDMA in accordance with the communication plan above may be notified.
- When necessary, monitor and increase the **heat alert** level to match the severity of the forecast and threshold established. Special meetings with key agencies may be convened.
- Activate cooling centres, such as temples, public buildings, malls etc. during a **heat alert** and / state government - run temporary night shelters without 32rgani to water and / or electricity.
- Provide access to shaded areas for outdoor workers, slum communities and other vulnerable population on a large scale. For example, confirm that night shelters stay open all day for migratory population during a **heat alert**.
- Hold regular (daily, if necessary) conference to discuss reports and fresh developments during a heat alert and ensure that communication channels are functional and operating.
- Monitor temperature data and forecast.
- Increase efforts to distribute fresh drinking water to the public by opening ‘‘Piaau’’.
- Inform power supply companies to prioritize maintaining power to critical facilities(such as Hospitals and dispensaries).
- Notify when the Heat alert is over.

## Roles and Responsibilities for managing Heat Wave – During Heat Season

S. No.	Name of the Activates	Name of the Agency	Responsibilities	Directions
1.	Alert Warning	India Meteorological Department (IMD)	<ul style="list-style-type: none"> <li>• Communicate Heat Wave alert/warning promptly</li> <li>• Communicate Max temperature district-wise periodically</li> </ul>	
2		Information & Public Relations (I & PR) Department	<ul style="list-style-type: none"> <li>• Creating awareness among public through advertisement in Hindi/ English.</li> <li>• Display hoardings at important places</li> <li>• Create awareness through TV and Radio and jingles</li> <li>• Conduct at regular press conference state or district level through concerned person</li> <li>• Circulate Heat Wave warning i.e text/voice alert</li> <li>• Develop SMS alert system</li> <li>• Explore other means of <b>communication like Facebook, Twitter, WhatsApp etc.</b></li> </ul>	
3	Monitoring and response	Medical & Health Department and Medical Professional	<ul style="list-style-type: none"> <li>• Display of heat-related illness prevention tips and how to stay cool around hospitals</li> <li>• Equip all hospitals/ Dispensaries with additional supplies of medicines and materials.</li> <li>• Ensure adoption of Heat illness treatment and prevention protocols.</li> <li>• Deploy additional staff at hospitals and Dispensaries to attend to the influx of patients during a heat alert, if feasible. Keep emergency wards ready</li> <li>• Deployment of Rapid Medical Response Team</li> <li>• Deployment of Rapid Medical Response Team</li> </ul>	
4.	Emergency Services	DDMA, (SEOC)	<ul style="list-style-type: none"> <li>• Activate dynamic strategic deployment plan for</li> </ul>	DDMA-collect information

			<p>ambulances.</p> <ul style="list-style-type: none"> <li>• Adequate supply of ice packs, I.V. fluids and medicines.</li> <li>• Keep accurate records of pre-hospital care.</li> <li>• Adequate staff on duty and restrict leave if necessary.</li> <li>• Disseminate SMS text messages to advise local residents during a heat alert.</li> </ul>	<p>regarding the Heat Wave from the Hospitals and Dispensaries and disseminate information to the concerned departments, officers.</p>
5.		Labour & Employment Department	<ul style="list-style-type: none"> <li>• Encourage employers to shift outdoor workers 'schedules away from peak afternoon hours (1pm-5pm) during Heat alert.</li> <li>• Provide emergency ice packs and heat illness prevention material to construction worker as pilot project.</li> <li>• Ensure provision of shelters/cooling areas, water and supply of emergency medicines like ORS, etc. at work sites by employers.</li> <li>• Re scheduling of working hours for employees in different sectors.</li> <li>• Ensure shed for resting and drinking water facilities for workers at all work places. Special care for vulnerable groups women and old ages.</li> <li>• Co-ordinate with health department and ensure regular health-checkup of the workers and provide emergency packets and heat illness prevention material for construction workers.</li> <li>• Rescheduling of working hours for employed in different sectors</li> <li>• Ensure shed for resting and drinking water facilities for workers at all work places. Special care for vulnerable groups women and old ages.</li> <li>• Co-ordinate with health department and ensure regular</li> </ul>	<p>Working Hours will be from 7:00am to 1:00pm , 4:00pm to 6:00pm</p>

			health checkup of the workers and provide and provide emergency packets and heat illness prevention materials for construction workers.	
6		Animal Husbandry Department	<ul style="list-style-type: none"> <li>• Display posters and distribute pamphlets on the precautionary measures to be taken to safeguard cattle and poultry birds during heat period in villages and important junctions.</li> <li>• Ensure adequate stock of medicine in all veterinary hospitals.</li> <li>• Ensure visit of field staff during heat wave to villages for follow up action in treatment of cattle / poultry birds.</li> <li>• Shelter for live stocks and animal husbandry should be maintained.</li> <li>• Update contingency plan regarding provision of drinking water for animals.</li> <li>• Shelter for livestock and animal husbandry should be maintained</li> <li>• Update contingency plan regarding provision of drinking water for animals.</li> </ul>	Department make arrangements for cool sheds and drinking waters.
7.		Transport Department	<ul style="list-style-type: none"> <li>• Display posters &amp; distribute pamphlets on prevention of heat related illness at bus stands, auto stands etc.</li> <li>• Ensure availability of shade / shelters, drinking water, ORS packets etc., at bus stands, auto stands etc.</li> <li>• Establish Health teams at major bus stands / Terminals and other public places</li> <li>• Ensure availability of water and ORS packets in long distance buses.</li> </ul>	
8		MCD	<ul style="list-style-type: none"> <li>• Shelter for stray Animals with provision of drinking water facilities.</li> <li>• Ensure visit of field health staff</li> </ul>	

			during heat wave for treatment of stray animals.	
9		Education Department	<ul style="list-style-type: none"> <li>• Ensure supply of water for students and teachers if school is functioning.</li> <li>• If school is not functioning, permit use of school premises as shelter during day time</li> <li>• Ensure that Schools do not function during peak hours (12noon-4pm) when Heat Wave is declared.</li> <li>• Display posters &amp; distribute pamphlets on prevention of Heat related illness in schools and colleges.</li> <li>• No open-air class to be conducted.</li> <li>• Rescheduling of school timing and vacation as per heat wave situation.</li> <li>• Ensuring that students avoid outdoor physical activities.</li> <li>• Re-scheduling of school timing and vacation as per heat waves situation.</li> <li>• Ensuring cool places at all education Institutes</li> <li>• Ensure that student avoid outdoor physical activities.</li> </ul>	
10		Information Technology (IT) Department	<ul style="list-style-type: none"> <li>• Send real time information through Dash board/ interface on all activities related to Heat wave.</li> <li>• Activity to be display on Dashboard / Interface/ on-line Monitoring Tool.</li> <li>• Activate Heat Wave APP</li> <li>• Generate reports encompassing all activities undertaken during heat wave alert to use for evaluation of systems and action plan.</li> </ul>	
11		NGOs, Community Groups and Individual	<ul style="list-style-type: none"> <li>• Take all precautions to avoid Heat related illness.</li> <li>• Keep cool and hydrated during the heat season by drinking water, staying out of the sun</li> </ul>	

			<p>and wearing light clothing.</p> <ul style="list-style-type: none"> <li>• Check on vulnerable neighbours, particularly during a heat alert.</li> <li>• Limit heavy work in direct sun or indoors, if poorly ventilated, especially during a heat alert.</li> </ul>	
12	Dust Pollution	PWD, MCD, DCB, NDMC, DDA, DPCC, DJB, Revenue, NHAI, DMRC, IFCD, NCRTC	<ul style="list-style-type: none"> <li>• Hotspots Monitoring</li> <li>• Deployment of Anti-Smog Guns (ASGs) at C &amp; D sites, On Roads and on top of High-Rise Buildings</li> <li>• Monitoring through C&amp;D web portal.</li> <li>• Institutional monitoring of Road dust management</li> <li>• Deployment of Mechanized Road Sweeping (MRS) machines</li> <li>• Deployment of water sprinklers.</li> <li>• Repair/ Greening &amp; Paving and maintenance of road and Central verges, road side etc.</li> </ul>	
13		Power Dept/ DISCOMS	<ul style="list-style-type: none"> <li>• Ensure repair/ maintenance work for uninterrupted water supply</li> <li>• Scheduling load shedding</li> </ul>	
14	Industrial Pollution	MCD, Revenue, DSIIDC, DPCC	<ul style="list-style-type: none"> <li>• All industries which are using fuel have to operate their industry on approved fuels as per CAQM amended Direction No 65.</li> <li>• Strict compliances on use of PNG by monitoring gas consumptions.</li> <li>• Flexible timing of weekly markets</li> <li>• Shelters for Stray Animals with provision of drinking water facilities</li> <li>• Ensure visit of field health staff during heat waves for treatment of stray animals.</li> <li>• Flexible timing of weekly markets.</li> </ul>	
15	Water Pollution	DJB, DDA, DPCC, I&FC, Drain Owning	Detailed Action Plan with timelines prepared and Order issued on 27.01.2023 to all	



		Agencies	stakeholders: <ul style="list-style-type: none"> <li>• Complete Treatment of Sewage</li> <li>• Trapping of all Drains</li> <li>• Sewerage Network in Unauthorized Colonies and JJ Clusters</li> <li>• Industrial Effluent Management by CETPs</li> <li>• Sludge (Septage) Management</li> <li>• Regulation of Floodplain</li> <li>• Utilization of Treated Wastewater</li> <li>• Other Issues (Land allotment, IEC, Monitoring etc.)</li> </ul>	
16	Open Burning	MCD, NDMC, DCB, DSIIDC, F&CD, DFS, DDA, Revenue	<ul style="list-style-type: none"> <li>• Enforcement: Municipal solid waste (MSW)/ Biomass Burning</li> <li>• Strict vigilance on Dumping of Waste</li> <li>• Strict vigilance on landfill fires</li> <li>• 100% Collection of Waste</li> </ul>	
17	Increasing Green Cover	Greening agencies, Department of Forest	<ul style="list-style-type: none"> <li>• Development of city forest, parks and gardens</li> <li>• Extensive plantation drive during pre-monsoon.</li> <li>• Development of green spaces at barren/ vacant lands</li> </ul>	
18	Increasing Blue cover	Wetland authority of Delhi, Water bodies owning agencies	<ul style="list-style-type: none"> <li>• Restoration of water bodies in Delhi</li> </ul>	

### 4.1.3 Phase-3 Role and responsibility of Post -Heat Season (Annually in July to September)

1. Divisional Commissioner- Nodal Officer for State.
2. District Magistrate of respective Districts – Nodal Officer for District.
3. Deputy Commissioner – Nodal Officer for Municipal Corporation (MCD).
  - Organise an annual meeting with key agencies and relevant stakeholders to review Heat Wave Action Plan.
  - Evaluate the reach and impact of the plan and update/ revise it based on review and evaluation.
  - Evaluate the plan process based on performance and revise accordingly.
  - Evaluate the reach and impact of the plan and revise accordingly.
  - Display the revised plan to the Disaster Management/ District website ahead of the next Heat season for stakeholders.
  - Discuss establishing cooling centers facilities in high- risk area around city.
  - Make important recommendations arising out of review and evaluation to Government.

### Roles and Responsibilities of Post Heat Season

S. No	Name of the activates	Name of the Agency	Responsibilities	Directions
1.		India Meteorological Department (IMD)	<ul style="list-style-type: none"> <li>• Provide season report containing duration of Heat Wave, maximum temperature location wise.</li> <li>• Obtain feedback on cases, plan and measures taken</li> <li>• Revise plan accordingly</li> <li>• Report to Government</li> </ul>	
2.		Information & Public Relation (I & PR) Department	<ul style="list-style-type: none"> <li>• Collect feedback on publicity, reach and implementation of plan from media and others sources.</li> <li>• Collect all news items/ reports on Heat wave plan published/ telecast.</li> <li>• Collect all news items/ reports on Heat wave.</li> </ul>	

3.		Medical & Health Department and Medical Professionals	<ul style="list-style-type: none"> <li>• Perform an epidemiological case review of heat- related mortality during the summer.</li> <li>• Conduct and gather Epidemiological outcome from the data on heat risk factor, illness and death, based on average daily temperature.</li> <li>• Incorporate data and finding into future versions of Heat Action Plan Measure</li> <li>• Mortality and morbidity rates based on data before and after the plan's interventions.</li> </ul>	
4.	Emergency Services	1077 Emergency Helpline No. Of Delhi	<ul style="list-style-type: none"> <li>• Review implementation of Heat wave Action Plan.</li> <li>• Obtain feedback on case, plan, and measures taken.</li> <li>• Revise plan accordingly</li> <li>• Report to Government</li> </ul>	
5.		Labour & Employment Department	<ul style="list-style-type: none"> <li>• Review implementation of Heat Wave Action plan.</li> <li>• Obtain feedback on case, plan and measure taken.</li> <li>• Revise Plan accordingly</li> <li>• Report to Government</li> </ul>	
6.		Transport Department	<ul style="list-style-type: none"> <li>• Review implementation and effectiveness of plan</li> <li>• Obtain and give feedback for further improvement of plan.</li> </ul>	
7.		Education Department	<ul style="list-style-type: none"> <li>- Review implementation and effectiveness of Plan.</li> <li>• Obtain and give feedback for further improvement of plan.</li> </ul>	
8.		Animal Husbandry Department	<ul style="list-style-type: none"> <li>• Review implementation of Heat wave Action Plan.</li> <li>• Obtain feed on cases, plan, and measures taken.</li> <li>• Revise Plan Accordingly</li> <li>• Report to Government</li> </ul>	
9.		Information Technology (IT) Department	<ul style="list-style-type: none"> <li>• Collect data of temperature.</li> <li>• Collect data on number of downloads of mobile app &amp; map accordingly.</li> </ul>	
10.		NGOs, CommunityGroup/ Individuals.	<ul style="list-style-type: none"> <li>• Educate community on regular basis.</li> </ul>	
11.	Increasing Green Cover	Greening agencies, viz.	<ul style="list-style-type: none"> <li>• Development of city forest</li> <li>• Extensive plantation drive</li> </ul>	

		Department of Forest, PWD, I&FC, MCD, NDMC, DUSIB, DDA, etc.	<ul style="list-style-type: none"> <li>• Development of green spaces at barren/vacant lands</li> <li>• Development parks and gardens</li> </ul>	
12.	Increasing blue Cover	Wetland Authority of Delhi, Water bodies owning agencies	<ul style="list-style-type: none"> <li>• Restoration of water bodies in Delhi</li> </ul>	

## 4.2 Health Impact of Heat Waves

- Identification of Heat-Wave illness and recordings of casualties: In the past, when the Government declared ex-gratia compensation for heat-wave affected families, it was observed that some people who were aware of the provision of direct cash relief reported natural deaths as the heat wave deaths. In the event of false reporting, the following procedures can be used for verifying and ascertaining the real cause of death.
- Recorded maximum temperature on the particular time periods and place.
- Recording incidents, panchnama or others witnesses, evidence or verbal autopsy.
- Postmortem/medical check-up report with causes.
- Local authority or Local body enquiry/verification report.
- Deployment of Rapid Medical Response Team.

### 4.2.1 Heat-related illnesses

Clinical Entity	Age Range	Cardinal Symptoms	Cardinal Signs	Pertinent Negatives	Prognosis Case	Definition
Heat Rash	All (mainly children)	Small, red, itchy papules with some times filled with clear or white fluid.	Diffuse maculopapular rash, occasionally pustular, at hair follicles; pruritic	Not focally distributed like a contact dermatitis; not confluent patchy; not petechial	Full recovery with elimination of exposure and supportive care	Diffuse, pruritic, maculopapular or vesicular rash in the setting of heat exposure, often with insulating clothing or swaddling.
Heat Cramps	All	Painful spasms of large and frequently used muscle groups	Uncomfortable appearance, may have difficulty fully extending affected limbs/joints	No contaminated wounds/tetanus exposure; no seizure activity	Full recovery with elimination of exposure and supportive care	Painful contractions of frequently used muscle groups in the setting of heat exposure, often with exertion

<b>Heat Exhaustion</b>	All	Feeling overheated, lightheaded, exhausted and weak unsteady nauseated, sweaty & thirsty, inability to continue activities.	Sweaty/diaphoretic; flushed skin; hot skin; normal core temperature; +/- dazed, +/- generalized weakness, slight disorientation	No coincidental signs and symptoms of infection; no focal weakness; no aphasia/; no overdose history	Full recovery with elimination of exposure and supportive care; progression if continued exposure	Syndrome of Generalized weakness & or exhaustion, often with light headedness, limiting functioning in a hot environment without history of recent infection. May or may not be exertional.
<b>Heat Syncope</b>	Adults	Feeling hot & weak; lightheadedness followed by brief loss of consciousness	Brief, generalized loss of consciousness and short period of disorientation,	No seizure activity, no loss of bowel or bladder continence, no focal weakness, no aphasia	Full recovery with elimination of exposure and supportive care;	Brief loss of consciousness in the setting of heat exposure without evidence of heat seizure activity, stroke or medication overdose
<b>Heat Stroke</b>	All	Severe overheating; profound weakness;	Flushed, dry skin (not always), core temperature $\geq$ mental status	No coincidental signs and symptoms of	25-50% mortality even with aggressive significant	Altered mental status (including disorientation, delirium, seizure,)

## Heat Illness – Treatment Protocol

General Treatment protocol applicable to all patients in any setting, where there is a potential concern for heat illness with slight variations according to the setting (EMS, health centre, clinic, hospital emergency department, etc.).

- i. Initial patient assessment — primary survey (airway, breathing, circulation, disability, and exposure), vital signs, including temperature.
- ii. Consider heat illness in differential diagnosis if:
  - a. Presenting with suggestive symptoms and signs
  - b. Patient has one or more of the following risk factors:
    - Extremes of age (infants, elderly)
    - Debilitation/physical de-conditioning, overweight or obese
    - Lack of acclimatization to environmental heat (recent arrival, early in summer season)
    - Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease.

- Taking one or more of the following:
  - Sympathomimetic drugs
  - Diuretics
  - Anticholinergic drugs
  - Alcohol
  - Barbiturates
  - Beta blockers
- iii. Remove from environmental heat exposure and stop physical activity.
- iv. Initiate passive cooling procedures:
  - a. Cool wet towels or ice packs to axillae, groin, and around neck; if patient is stable, may take a cool shower, but evaluate risk of such activity against gain and availability of other cooling measures.
  - b. Spray cool water or blot cool water onto skin.
  - c. Use fan to blow cool air onto moist skin.
- v. If temperature lower than 40°C, repeat assessment every 5 minutes; if improving, attempt to orally hydrate (clear liquids, ORS can be used but not necessary; cool liquids better than cold) and observe.
- vi. If temperature is 40°C or above, initiate IV rehydration and immediately transport to emergency department for stabilization.

### 4.3 Preparedness at community level- Do's and Don'ts

S. No.	Do's	Don'ts
1	Try to stay in cold places	Expose to direct sun light or hot breeze
2	Use umbrella during hot days	Move under hot sun without umbrella
3	Wear thin loose cotton garments, preferably of white color	Use of black and synthetic, thick clothes during summer season
4	Wear a hat of cotton or a turban	Move under the hot sun without a hat or turban
5	Avoid outdoor physical activity from 12 to 3 p.m. If unavoidable attend to only light physical activity under the hot sun.	Attend to strenuous physical activity under the hot sun
6	Take ample water along with salted butter milk or glucose water	Not stay hydrated
7	Take measures to reduce the room temperature like watering, using window shades, fanning and cross ventilation	Allow direct hot air into the living rooms
8	Shift the person with heat stroke symptoms to a cool dwelling	Delay in shifting the person suffering with heat stroke to a cool place
9	The person suffering with heat stroke should have minimum clothing	The person suffering with heat stroke do not have thick clothing
10	The person suffering with heat stroke has to be sponged with cold water, indirect application of ice packs.	The person suffering with heat stroke not to be sponged with hot water and not to be exposed to hot air.

11	The person suffering with heat stroke should be kept in between ice blocks	
12	If the persons affected with heat stroke and are not showing any improvement, he/she should be shifted to a hospital immediately, preferably with cooling facility.	Delay in shifting the person affected with heat stroke whenever there is no improvement in his condition



## Advisory issued by NDMA for Heat Wave Season- 2024

### 4.4 General Elections – 2024

The General Election – 2024 is scheduled during the month of March to May 2024 i.e. during the Heat wave periods in Delhi. To cater the seasonal outlook, following Heat Wave Mitigation Measures to be taken up.

S. No.	Name of Agency/ Department	Pre – Heat Season	During – Heat Season	Post – Heat Season
1.	District DMA	<ul style="list-style-type: none"> <li>To disseminate the advisory issued by NDMA for Heat Wave Season to the Line Departments.</li> <li>To create awareness amongst General Public regarding Heat Wave.</li> </ul>	<ul style="list-style-type: none"> <li>To disseminate the advisory issued by NDMA for Heat Wave Season to the Line Departments.</li> <li>To create awareness amongst General Public regarding Heat Wave.</li> <li>To ensure that all the basic facilities</li> </ul>	<ul style="list-style-type: none"> <li>Collect Feedback on action taken</li> <li>Conduct meeting to review implementation of Heat Wave Mitigation Measures.</li> </ul>
2.	Delhi Jal Board	<ul style="list-style-type: none"> <li>Preparation for arrangement of Drinking Water at all Polling Stations</li> </ul>	<ul style="list-style-type: none"> <li>Provision for Drinking Water in all Polling Stations</li> </ul>	<ul style="list-style-type: none"> <li>Collect Feedback on action taken</li> <li>Conduct meeting to review implementation of Heat Wave Mitigation Measures.</li> </ul>
3.	Department of Education	<ul style="list-style-type: none"> <li>Issue necessary directions on Heat Wave Mitigation Measures.</li> </ul>	<ul style="list-style-type: none"> <li>Rescheduling of the timing of schools/ educational institutions</li> </ul>	<ul style="list-style-type: none"> <li>Collect Feedback on action taken</li> <li>Conduct meeting to review implementation of Heat Wave Mitigation Measures.</li> </ul>
4.	Directorate of Health Services	<ul style="list-style-type: none"> <li>Preparation for deployment of Medical team at all Polling Stations</li> </ul>	<ul style="list-style-type: none"> <li>To provide all Emergency Medical Services at all Polling Stations</li> </ul>	<ul style="list-style-type: none"> <li>Collect Feedback on action taken</li> <li>Conduct meeting to review implementation of Heat Wave Mitigation Measures.</li> </ul>

## **(A) State Level**

- State Governments must update and customize their Heat Action Plans (HAPs) as per NDMA guidelines 2019.
- Heat Wave Action Plan of the State may be circulated to all Collectors & HODs of concerned line Departments with instructions for its implementation.
- Coordinate with all Stakeholder departments and NGOs involved in Heat Wave Management, local offices of IMD, Health and other sectors and disseminate warnings by using SMSs, Whatsapp and CAP Platform.
- States must appoint a Nodal Officer at each level (State, District and Block levels) for communicating early warning and coordinating the implementation of HAP.
- State Government must review and monitor the heat wave situation through video conferencing with concerned line departments/ districts/ blocks.
- Mass gathering events may be allowed only if no severe heat wave warning is issued for the concerned districts / cities.
- State Government must ensure shade and drinking water for traffic police personnel
- Coordinate with District Administration on all aspects of heat wave management on regular basis.
- State should make adequate provision in the popular tourist/ religious destinations.
- Coordinate with Election Commission for heat wave management during all phases of elections.

## **(I) Information and Public Relation Department**

- Put up display digital boards with colour coding for heat wave alert at different locations.
- Widely publicise Do's & Don'ts for general awareness, preferably in regional language
- Publish IEC print material (print material, radio jingles and TVs) in regional language.

## **(II) Health Department**

- Keep stock of ORS packets essential medicines, intravenous fluids, ice pack etc. at health centers and Aanganwadi.

- Special AC wards may be dedicated for addressing any heat wave related eventuality.
- Monitoring of early warning dissemination to the District hospitals, Primary Health Centre and Community health centers,
- Directions and training of health workers up to village level.
- Monitoring and reporting mortality and Morbidity of deaths due to heat wave may be followed rigorously.
- In case, of a mass gathering nearby health facilities may be alerted & activated.

### **(III) Urban Local Bodies/ Panchayati Raj Institutions**

- Setting up special shelters for MGNREGA workers, construction workers and rescheduling their working hours in association with Rural Development and Labour & Employment departments,
- Arranging drinking water facility in heat wave affected areas/localities
- Arrange shades in the parks, bus stands, tourist spots and open areas.
- Undisrupted supply of water in all the areas especially in informal settlements.

### **(IV) Labour Department**

- Trainings with Construction/ industries/ Commercial entities regarding heat wave related illnesses.
- Advisory on timing of work may be issued to avoid peak heat wave hours.
- Health camps in collaboration with the health departments especially in informal sectors & settlements,
- Drinking water facilities in all the work in premises for the labourers.

### **(V) Agriculture Sector and Animal Husbandry Department**

- Awareness to ensure minimum crop damage due to heat by ensuring cold storage facilities and prompt movement in the Mandis/ markets for public procurement.
- Awareness on the impacts of heat on animals and coping mechanisms
- Veterinary medicines and shelters with drinking water for animals

### **(VI) Education Sector**

- School timings should be re-scheduled to avoid peak heat/ midday. Schools may start early and close before noon.

- Setting up of drinking water stations kiosks/ shades at all schools & educational institutions
- Outdoor physical activities need to be avoided.

## **(B) District Level**

- Undertake awareness campaign to inform and educate the public on Heat wave Do's & Don'ts.
- Hold regular Press conferences on the risks and dangers of heat related illnesses
- Activate "cooling centers such as in public buildings, malls, religious places etc.,
- Urge NGOs, community groups and individuals to open drinking water/butter milk kiosks at public places during Heat Wave conditions.
- Urge power distribution / transmission companies to priorities maintaining power supply to critical facilities such as hospitals and UHCs.
- Coordinate with District Election Officer for timing of the election voting time and all other required measures.
- Enforce changed timings of schools, colleges, institutions etc. as and when required locally

The measures which have been taken by Delhi Municipal Corporation as part of Delhi, Heat Action Plan can be classified into short term, medium term and long-term measures.

## **5.1 Short- and Medium-Term Measures**

### **a- Awareness Campaigns**

- Hoardings, posters, to be displayed by city, at various locations, distribution of pamphlets.
- Awareness workshops for occupationally exposed – traffic police, hawkers, street vendors, construction workers and school children.

### **b- Capacity Building Workshop**

- For residential communities and other concerned stakeholders regarding roof cooling solutions.
- To promote green/ heat resilience infra structure, enhance natural shading, developing green spacing, encouraging energy efficient practices etc.

### **c- Mitigation measures**

- Keeping gardens, cooling shelters and other possible cooling centers open with water availability.
- Availability of water and sheds at open construction sites.
- Pilot project on roof painting with white colour – cool roof and or distribution of gunny bags for putting on the tin roofs/asbestos in slums.
- Provision of water points and ORS at Construction sites, Bus stands and other public places during processions and political and other rallies and processions during summer.
- Distribution of cool roof jackets to on-duty traffic police personnel.
- Water tanker campaign- Tankers to be made available on call in slums during orange/red alert days.

### **d- Early warning communication**

- SMS and WhatsApp messages for early warning to citizens, NGOs, Citizen welfare groups, construction contractors.

- Public announcement during orange and red alert days a day before and early on the forecasted day through various ways eg.by , SMS, CAP (Sachet), News, Social Media.
- Press Releases and campaigns on radio, TV and websites.

### **e- Medical Preparedness**

- Storage of ORS and cool packs at the various health centres & preparedness with cooling and rehydration as well as heat stroke management treatments.
- Medical camps during red alerts at hotspots.

### **f- Monitoring and Analysis**

- Recording ward wise heat stroke cases, proper cause of death and monitoring daily mortality as well as daily hospital admission due to heat-related causes.
- Monitoring and analysis of the morning temperatures

## **5.2 Long term Measures/ Strategies**

- Heat alerts, high risk area and emergency response plan needs to target vulnerable groups, and incorporate in the City Development Plan.
- Insulation and building standards required to be increased, with improving building bye-laws along with increasing heat tolerance for new infrastructure, retrofitting. Building bye-laws can have components of passive ventilation and cool roof technologies to increase thermal comfort and made mandatory in more vulnerable areas.
- Identifying locations for building shelters and shades in urban areas. Shelter locations for the urban poor and slum dwellers must be identified and constructed.
- Incorporation and documentation of indigenous knowledge to develop protective measures at regional and community level for sensitization and awareness generation. Local culture and physical exposure of population needs to be improvised to reduce the impact of heat on health and physical wellbeing.
- Capacity building at the community level, through awareness campaigns and outreach program's. Communicating risks associated with heat and its impact on health, livelihood and productivity and ways to mitigate.

- Initiating research on micro-climate and corroborating the need to monitor temperatures in urban areas. Policy level intervention to retrieve natural eco-systems and natural shelters.
- Greening infrastructure by vertical garden, roof garden can be an effective method to cope with heat.
- Initiating Early warning systems, advisories and alerts against extreme heat for the communities and Urban Local Bodies. Building communication networks through Localbodies, Health officers, Health care centres, hospitals, communities and media.
- Encourage investing in water bodies, fountains in areas of mass presence and promote greeneries in urban areas along with improving green transport and energy systems.
- Other strategies such as promoting green/heat resilient infrastructure, improving urban planning to enhance natural shading and developing green spacing, energy efficient practice etc will also be included to reduce heat impacts.
- Ensure capacity building of structural engineers, civil engineering ad architects for construction of green building, maintenance and fire safety of the structure.
- Increase forest coverage and green area
- Mass plantation and afforestation
- Ensure to construction of green building, Energy Conservation Building Code (ECBC) related to heat wave risk reduction.
- Coordinate with Dust Control Management Cell (DCMCs) for plantation of trees at road side and central verges.

### 5.2.1 Cool Roof Deployment

The term “cool roofs” applies to increase surface albedo (reflectance) of buildings to deflect a higher fraction of incoming solar radiation. Because of their relatively low cost and flexible application of reflecting materials (e.g., solar reflective paint or mosaic tiles), cool roofs are potential low-tech solutions to help keep indoor temperatures cooler and reduce cooling demand. Many cities in India for example, including Ahmedabad and Hyderabad) have adopted cool roof strategies because of their simplicity and low cost. Depending on the setting, cool roofs can help moderate indoor temperatures by 2-5°C (3.6-9°F) as compared to traditional roofs. In addition to that, they can help in reducing the cooling demand from the air conditioners and lead to reduction of air pollution through energy savings. Cool roof program needs to be targeted to the most vulnerable settlements with poor quality homes that trap heat and become dangerously hot. People living in slums and low-income communities are particularly heat vulnerable. Large percentage of their homes are far from optimal.

As a future recommendation for working around extreme heat in Delhi, selected household in wards that rank in high on the risk score can be selected based on factors such as the households electricity bill, having tin roof, direct sunlight exposure, and number of household

members sharing the space. These households can serve as controls for comparison with white painted roofs (cool roofs). Local community workers need to be trained the household to paint their own cool roof. This saves the labor costs and builds the household's capacity by learning the skill.

Through these community-led cool roof initiatives for long term implement programs and prepare vulnerable house for extreme heat with inter- agency coordination, save energy and combat climate change. Passive cooling technologies are an important strategy which when embedded within local heat action plans helps in protecting public health from heat risks.

Cool roofs programs can deliver great benefits citywide, and should be tailored to a city's needs and resources. Three emerging models for expanding cool roof implementation exits:

- Small- scale pilot programs-designing and implementation of cool roofs to showcase benefits;
- Municipal, voluntary, and corporate social responsibility (CSR) programs implementing cool roofs in municipal and government buildings;
- Building code programs that require cool roof installations enforcing cool roof provisions through building codes and partner with real estate developers and residents for wider adoption.

These models for cool roof programs enable cities to steadily make progress while building community awareness and support. These three models allow city cool roofs program to grow from a single neighborhood to at city-wide effort. Identifying and mobilizing funding sources for each phase is critical to the program's success. [Heat wave SEEDS-R9.cdr \(ndma.gov.in\)](https://www.ndma.gov.in/heat-wave-seeds-r9-cdr)

## 5.2.2 Threshold Estimation using Temperature and Mortality Data

IMD issues national seasonal forecasts in the form of Extended Range Forecasts and Short to Medium Range Forecasting services every year before the heat season begins and for every week also. This helps in issuing heat alerts to different cities and regions and should form the basis for developing an early warning system.

The heat wave definition by IMD is based on current climatic zones. Given India's heterogeneous climate and the dynamism observed during heat extremes, a one-size-fits-all approach of providing impact-based heat forecast alerts can lead to inaccurate estimates of mortality and heat related illness risks. Moving forward, inter-agency coordination is required where heat related mortality and morbidity data (encompassing all-cause mortality, cause-specific mortality and daily hospital admissions) needs to be examined along with region specific temperature thresholds.



### 5.2.3 Surveillance and Heat Alerts

Continuous improvement through sustained collection and review of information is an objective of this Heat Action Plan. Throughout the pre-heat (February onwards) and heat season (March to June) the vulnerable wards can be surveyed daily to implement appropriate targeted strategies. Two key steps include:

Heat wave Forecasts from IMD outlining the maximum and minimum temperatures for the next 7 days should form the basis for issuing alerts to the local population.

Reports on numbers of heat related illnesses and fatalities at all hospitals and health centers should be taken into account.

The temperature forecasts are an integral part of declaring heat days and heat wave emergencies. Records on heat-related illness and mortality give an additional measure of the ongoing impacts of heat, independent of the current weather conditions.

### 5.2.4 Leveraging culture and Heat Alerts

Delhi has to be well-equipped to manage heat risks in its own traditional ways. These measures serve the purpose of immediate response as well as are key steps to long-term adaptation actions.

One such measures are:

**Water harvesting** – there have been multiple water harvesting techniques, at different levels in the city, which needs to be harnessed to ensure mitigation and management of future risks due to extreme heat. The possibility of modifying the development plans of the city should also be explored to serve crucial purposes

## 5.3 Capacity Building

Training cum orientation workshop has to be organized for different professionals towards managing Heat-Related Illnesses in Delhi. The training aimed towards orienting professionals of Delhi city on Heat Action Plan, enhancing their capacities for proper and inclusive management of heat related illnesses and health impacts. Capacity building workshop for residential communities and other concerned stakeholders regarding roof cooling solutions will also be promoted by using “house Owners Guide to Alternate Roof Cooling Solutions” (Published in 2021)

## 5.4 Heat Wave Advisory

### Do's & don'ts during Heat Waves

Heat waves can result in fatal physiological strain. To minimize the health impacts of heat wave, the following measures are useful:

#### Do's

- Follow weather forecast and advisory on radio, TV, newspapers for appropriate cautions.
- Drink water often, even if not thirsty.
- Wear light weight, light-coloured, loose, and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in the sun.
- While travelling, carry water with you.
- If you work outdoors, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which re-hydrate the body and replace mineral loss.
- Recognize the signs of heat stroke, heat rash or heat cramps such as weakness, dizziness, headache, nausea, sweating and seizures. If you feel faint or ill, see a doctor immediately.
- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.
- Provide cool drinking water at workplace.
- Caution workers to avoid direct sunlight.
- Schedule strenuous jobs to cooler times of the day.
- Increase the frequency and length of rest breaks for outdoor activities.
- Pregnant women and workers with a medical condition should be given additional attention.

#### Don'ts

- Do not leave children or pets in parked vehicles.
- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Avoid wearing dark, heavy or tight clothing.
- When the outside temperature is high, avoid strenuous activities especially 12 noon and 3 p.m.
- Avoid cooking during peak hours. Open doors and windows to ventilate cooking area.
- Don't consume alcohol, tea, coffee and carbonated soft drinks as these drinks dehydrate the body.
- Avoid high-protein food and do not eat stale food.

## Chapter Six Implementation of Heat Action Plan

# 6

The Action Plan divides responsibilities into pre-, during- and post-event categories, detailing preparation for a heat wave (pre-event responsibilities), steps to be taken to reduce heat wave during a heat wave (during-event responsibilities) and measures to incorporate lessons learned and fill gaps found in the management of heat wave (post-event responsibilities).

### 6.1 Roles and Responsibilities in Phase (Pre-Heat Season January to March)

#### a-Nodal Officer

- Designate point of contact for each department. Convenes a meeting of key stakeholders (Delhi State Disaster Management Authority, Delhi State Surveillance Unit, local non-government organizations, community health groups, media, health department and hospitals, departments of labour, water and sanitation, transportation, power supply and distribution, private institutions, religious places, etc.) to respond to extreme heat events
- Engages state and local agencies to facilitate internal communications.
- Organizes training for health workers, link workers, health departments, school children, school staff and the local communities.
- Organizes outreach of health services to vulnerable communities.
- Undertakes publicity and awareness campaigns on health risks of heat wave through multi lingual pamphlets, posters at vantage locations in hospitals, schools, and public and private institutions.
- Creates a list of high-risk areas in the city where people are more vulnerable to heat waves for focused heat prevention measures

#### b-Media and Press Officer

- Execute campaign and awareness outreach through multi lingual pamphlet and advertisements on risks of exposure to high temperature, heat wave prevention, and tips for health protection during extreme heat events with greater focus on high-risk areas.
- Ensure wide visibility of information and heat communication materials to the public.

#### c-Health Department and Medical Professionals

- Enhance targeted training programmes, capacity building efforts and communication on heat illness for medical staff at local hospitals and Urban Health Centres (UHCs) based on the framework for Medical Professionals and Health Workers. These efforts should include nursing staff, paramedics, field staff and link workers.

- Ensure hospitals update their admissions and emergency case records to track heat-related morbidity and train them in recording heat stroke/ heat wave as the cause of death in certificates, if death is triggered by an illness from the exposure. This will give reliable data set to analyse epidemiology of illnesses associated with heat wave. The training components can include information, education and communication (IEC).
- Adopt heat-focused examination procedures at local hospitals and urban health centres, more so during the summer months.
- Equip Urban Health Centres, 108 emergency centres, ambulances and hospitals for the treatment of illnesses associated with exposure and heat wave.
- Explore creation of ice pack dispensaries for easy access by vulnerable communities.

#### **d-Urban Health Centres and Link workers**

- Advise community on treatment and prevention of heat related illness
- Sensitize and train link workers
- Develop and execute school health programs with support from Department of Education
- Create awareness campaigns in slum communities
- Coordinate community outreach efforts with non-profits

#### **e-Public Health Managers**

- Identify vulnerable areas
- Ensure adequate inventories of medical supplies in health centres.
- Ensure appropriate to health workers, para medics, clinicians, etc.
- Identify cooling centres and barriers to access cooling centres.

#### **f-108 Emergency Service**

- Create displays on ambulances to build public awareness.
- Identify vulnerable populations in at-risk areas and be in the state of preparedness to provide immediate relief in case of an illness reporting.
- Prepares handouts for paramedics on heat illness
- Uses informative visuals on ambulances to build public awareness
- Establishes Dynamic Strategic Deployment Plan for ambulances
- Ensures adequate supply of IV fluids
- Identifies at-risk areas
- Prepares SMS messages to disseminate during emergencies

## **g-Labour and Employment Department**

- Organize training for employers, outdoor laborer's and workers on the health impacts of extreme heat as well as on the mitigative and adaptive measures to prevent exposure, heat wave and associated debility.
- Identify high-risk outdoor workers and give them focused attention in outreach and advocacy. Use irradiance map from IMD or heat island map to identify vulnerable areas/pockets. During the high-risk days, conduct publicity campaigns to these specific areas.
- Organize orientation for factory medical officers and general practitioners on health effects of heat wave or exposure
- Compile list of factory medical officers and contractors for heat action communications from Nodal Officer
- Use maps of construction sites to identify high-risk outdoor workers

## **h-Civil Society and Individuals**

- Conduct training workshops and outreach sessions with community groups and mobilizers such as Mahila Arogya Samiti, Self-Employed Women's Association (SEWA), ASHA Workers, Aanganwadi Workers, Municipal Councils, etc., to help them organize community action. In such activities, Delhi Govt. must take lead and involve higher education, non-profits, and community.
- Provide child-relevant educative and preventative training at schools so that children avoid exposure and keep themselves adequately hydrated.
- Equip schools with materials for heat protection. Through "Teach the Teachers" workshop, give school administration training and material for insulation from heat.
- Encourage individuals to take heat wave preventive measures and seek medical care at hospital or Urban Health Centre at first experience of heat exhaustion.
- Inform fellow community members about how to keep cool and protect oneself from heat.

## **6.2 Roles and Responsibilities in Phase 2 (During March to July)**

### **a-Nodal Officer**

- Appoints Nodal officer in each department for coordination with the nodal office. Coordinate heat action plan activities through nodal offices in each department.

- Activates the citywide heat alert and response mechanism based, on the Department of Meteorology’s weather forecast, by notifying the key stakeholders, Deputy Municipal Commissioners and the Delhi state agencies in accordance with the Communication Plan.
- Monitors the heat alert level based on the weather temperature severity forecast (see section Heat Alert Severity). Increase in severity level necessitates the Municipal Commissioner to convene a special meeting of key agencies.
- Activates “cooling centres,” such as temples, public buildings, malls, temporary night shelters, etc., during a heat alert.
- Expands access to shaded areas for outdoor workers, slum communities, and other vulnerable populations. During heat alerts, orders night shelters be kept open through the day.
- Holds frequent, possibly daily, meetings to assess developments during a heat alert, and ensures that communication channels stay alert.
- Identifies key spots to set up large LED display boards to share temperature forecasts with general public.
- Ensures continuous surveillance of temperature data and forecasts for appropriate action.
- Communicates suspension of all non-essential uses of water (other than drinking, keeping cool) via the Water Project’s protocol procedures in cases of water shortage.
- Increases efforts to ensure adequate drinking water supply to the public. Besides, expands potable water access during a heat alert at religious places, BRTS transit stations, organizes water pouch handouts to the poor and high-risk areas (identified by irradiance maps).
- Communicates local utility protocol to prioritize uninterrupted power to critical facilities (such as hospitals and UHCs).
- Notifies the Steering Committee and relevant agencies when the heat alert is over.
- Monitor severity of heat alert based on forecast.

## **b-Press Officer**

- Issues heat alerts through WhatsApp and SMS platforms utilizing the centralized mobile databases of private sector telecom companies.
- Issues heat alerts to the public via centralized email databases.
- Sends direct heat alert messages to private medical practitioners, public hospitals and UHCs.
- Utilizes local radio FM broadcasts to disseminate heat protection tips and high temperature warnings to the city’s at-risk populations.
- Explores other means of communications for outreach to vulnerable population.

### **c-Health Department and Medical Professionals:**

- Establish treatment and prevention protocols of heat related illness and prevention of further exposure.
- Equipped hospitals with Ensure adequate medical supplies, medical staff and emergency ward in the state of readiness.
- During a heat alert, produce weekly report of public health impact of heatwave for the Nodal Officer.
- If required, increase the number of healthcare staff and doctors at hospitals and UHCs to attend to the influx of patients during a heat alert.
- Monitor incidence of water borne diseases, malaria and dengue
- Keep stock of small reusable ice packs to apply to PULSE areas
- Report heat stroke patients to daily. In case of death from heat stroke/ exposure, mention it as the cause of mortality in death certificates

### **d-Urban Health Centres and Link workers**

- Recheck management stock
- Ensure UHCs preparedness to respond to emergency
- Visit at-risk populations for monitoring and prevention
- Communicate information on tertiary care and 108 service

### **e-Public Health Managers**

- Prepare rapid response team
- Distribute pamphlets with “Dos and Don’ts” instructions among vulnerable community
- Effectively send a “Take Care but Don’t Panic!” message to community
- Ensure access to Medical Mobile Van in the Red Zone
- Ensure additional medical vans are available during red alerts

### **f-108 Emergency Service:**

- Ensure adequate supply of ice packs and IV fluids.
- During a heat alert, disseminate SMS text messages to warn residents in the vulnerable areas.
- Ensures adequate staff and stock of required medicine and equipment
- Keeps accurate record of pre-hospital care
- Sends messages to 108 Emergency Service employees on Heat Action Plan and heat alerts
- Activates Dynamic Strategic Deployment Plan for the ambulance service

## **g-Labour and Employment Department:**

- Encourages employers to shift outdoor workers' schedules away from the peak afternoon hours (1pm – 5pm) during a heat alert.
- Provides emergency ice packs and heat-illness prevention materials to traffic police, BRTS transit staff and construction workers.
- Ensure Water supply at work sites.
- Extend work hours of occupational Health Centre
- Consider emergency afternoon break or change the working hours to avoid heat exposure.

## **h-Community Groups and Individuals:**

- Keep cool and hydrated during the heat season by drinking water, staying out of the sun, and wearing light clothing.
- Check on vulnerable neighbours, particularly during a heat alert.
- Limit heavy physical work under the sun and even indoors if poorly ventilated, especially during a heat alert.

## **6.3 Roles and Responsibilities in Post-Heat Season July to September**

### **a-Nodal Officer**

- Organizes annual Heat Action Plan evaluation meetings with nodal officers and relevant stakeholders.
- Evaluates the Plan process based on performance and revise accordingly.
- Evaluates the reach and impact of the Plan and revise accordingly.
- Posts the revised Plan on the govt. website ahead of the next heat season for stakeholders' feedback and opinion.
- Undertakes tree-plantation in heat hotspot areas. Encourages builders to plant trees.
- Establishing cool resting centers in high-risk areas around the city.
- Review quantitative and qualitative data for process evaluation and improvements.

### **b-Health Department and Medical Professionals**

- Perform an epidemiological case review of heat-related mortalities during the summer.
- Based on average daily temperatures, gather epidemiological data on heat risk factors, illness and death.
- Incorporate data and findings into future versions of the Heat Action Plan.



- Measure mortality and morbidity rates based on data before and after the Plan's interventions.
- Participate in annual evaluation of heat action plan. Review revised Heat action plan and recommend amendment.

### **c-Urban Health Centres and Link Workers**

- Participate in annual evaluation of heat action plan. Review revised Heat action plan and recommend amendment.

### **d-Urban Health Centres and Link Workers**

- Participate in annual evaluation of heat action plan. Review revised Heat action plan and recommend amendment.

### **e-108 Emergency Service**

- Provides data to key agencies
- Participates in annual evaluation of Heat Action Plan
- Review revised Heat Action Plan and recommend amends

### **f-Press Officer**

- Evaluate efficacy of advocacy and campaign outreach and other communication.
- Participate in annual evaluation of Heat Action Plan.

### **g-Labour Department**

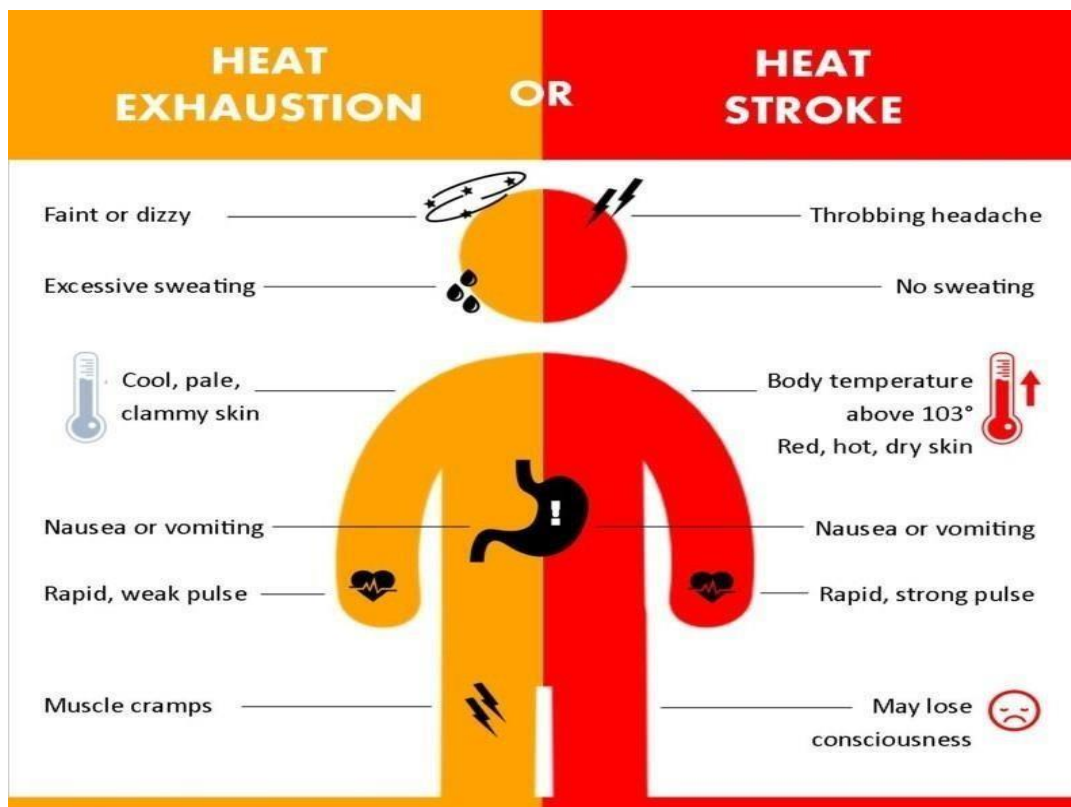
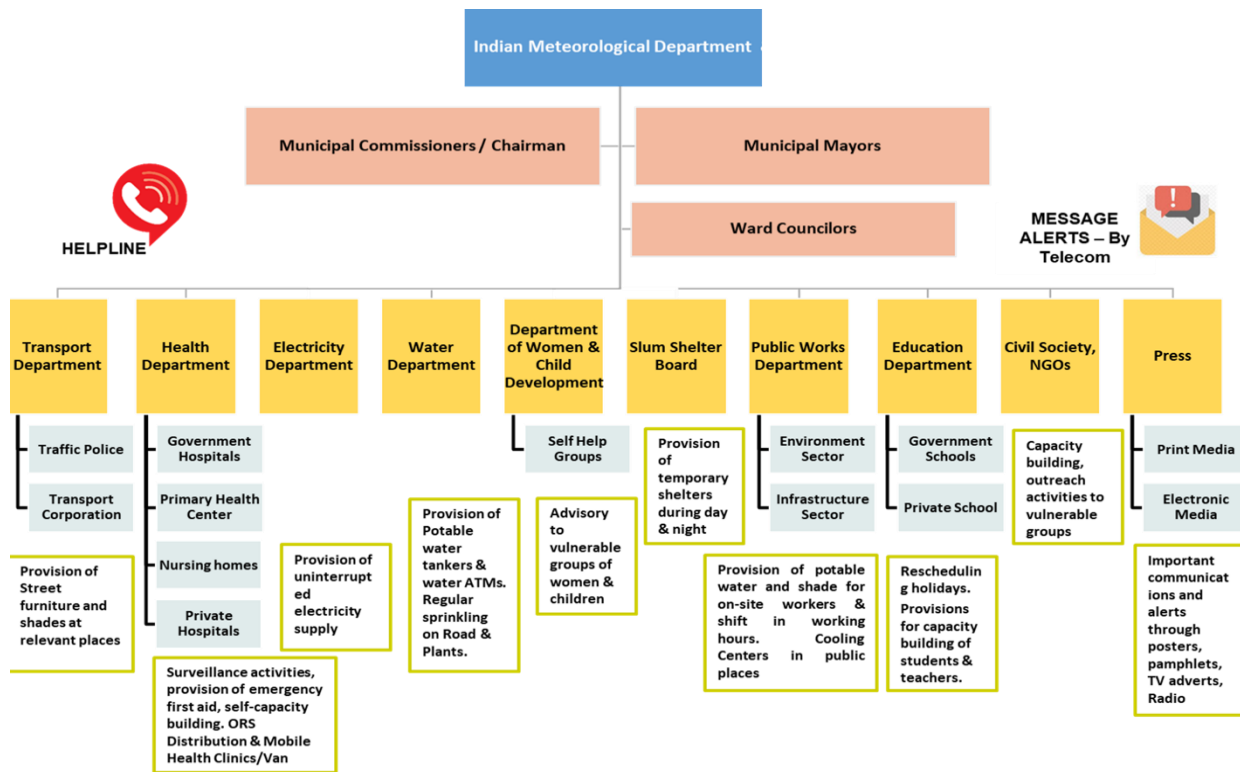
- Participate in annual evaluation of Heat Action Plan

## **6.4 Conclusion:**

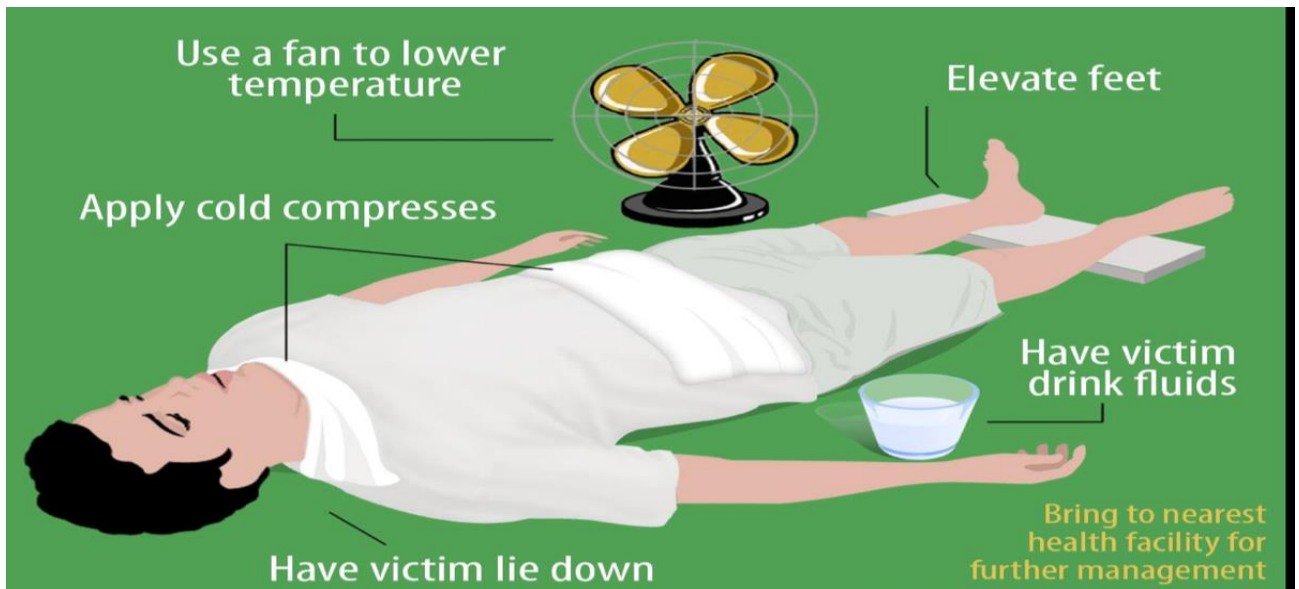
Heat wave action plans are key to city adaptation strategies. With the forecast of increased frequency and intensity of heat waves in the future, a climate adaptive heat wave action plan will enable Delhi to efficiently prepare, mitigate and adapt to the heat wave induced by climate change.

The action plan short-, medium- and long-term strategies to counter the impact of heat wave. The spatially differentiated Heat wave Action Plans (HSAPs) will serve to support Delhi's

medium-term development planning especially in prioritizing and integrating adaptive resilience within the agenda of climate-resilient smart cities.

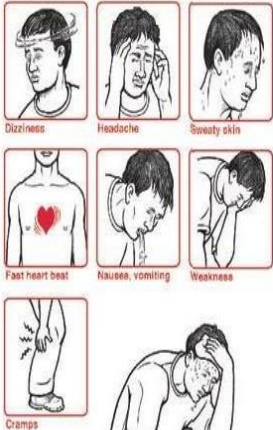


# Heat Stroke

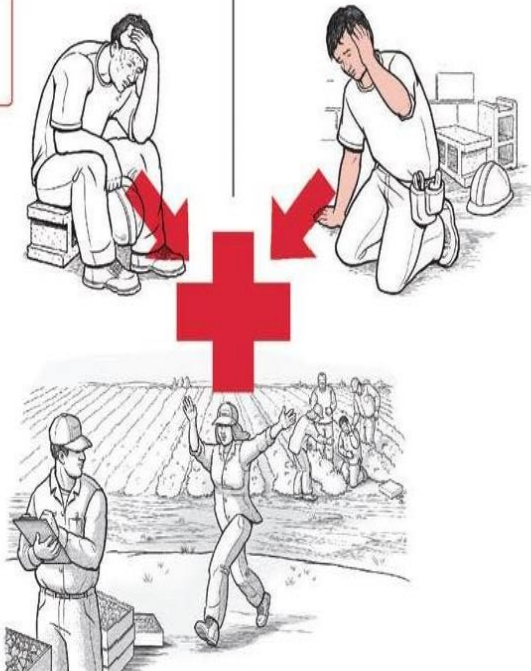
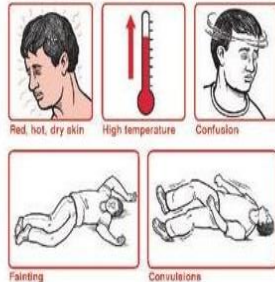


## Two types of heat illness:

### Heat Exhaustion



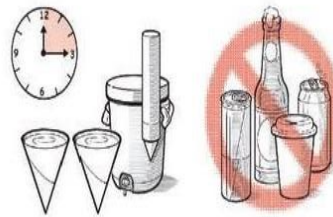
### Heat Stroke



**Heat kills – get help right away!**

## Stay safe and healthy!

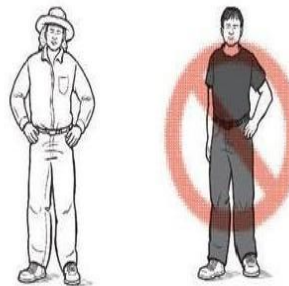
Drink water even if you aren't thirsty – every 15 minutes



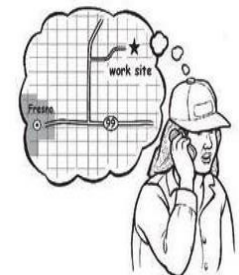
Watch out for each other



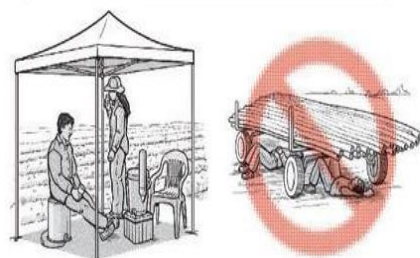
Wear a hat and light-colored clothing



Know where you are working in case you need to call 911



Rest in the shade



### **List of All District Contact Numbers**

S. No	District Name	District EOC Number	Office address
1.	DDMA HQ	011-23831077, 011-23839077	O/o Divisional Commissioner, Sham Nath Marg Civil Lines
2.	CENTRAL	011-23270151	O/o DM Central, Darya Ganj
3.	EAST	011-22051234, 011-21210852	O/o DM East, Geeta Colony
4.	WEST	011-25195529	O/o DM West, Rajouri Garden
5.	NORTH	011-27708768, 011-27708713	O/o DM North, Alipur
6.	SOUTH	011-23533222, 011-23831277	O/o DM South, Saket
7.	NEW DELHI	011-23385743, 011-23075083	O/o DM New Delhi, Jaam Nagar House
8.	SHAHDARA	011-22111077	O/o DM Shahdara, Shahdara
9.	NORTH EAST	011-22115289	O/o DM North East, Nand Nagri
10.	NORTH WEST	011-25951182	O/o DM North West, Kanjhawala
11.	SOUTH EAST	011-26476410	O/o DM South East, Amar Colony
12.	SOUTH WEST	011-25066674	O/o DM South West, Kapashera

*Table 8: List of All District (Delhi) Contact Numbers*

<b>EMERGENCY TOLL FREE NUMBER</b>		
1.	DISASTER MANAGEMENT	1077, 1070
2.	DELHI POLICE	112, 100
3.	PCR COMMAND ROOM DELHI POLICE	011-27491103, 011-27491104
4.	DELHI POLICE HOTLINE	011-23490313
5.	FIRE DEPARTMENT	101
6.	MEDICAL EMERGENCY NO.	108
7.	CATS AMBUANCES	102 / 1099
8.	TERROR HELP	1090
9.	SENIOR CITIZEN HELPLINE	109
10.	WOMEN HELPLINE	1098
11.	DELHI METRO	155370, 011-22185555
12.	DELHI JAL BOARD	1916, 011-23538495, 011-23527679
13.	BSES POWER	19123
14.	TPDDL / NDPL	19124, 18002089124
15.	IGI GAS LTD.	155216, 18001111817
16.	MCD CENTRALIZED HQ	155304, 011-23230700
17.	PWD	011-23490323
18.	FLOOD CONTROL	011-22428773 / 74
19.	FOREST DEPARTMENT	011-23378514 / 0679 / 0964 / 7838598567
20.	DTC	011-23370209 / 10 / 23327600
21.	NDRF	011-26107953, 23438091
22.	MTNL	011-25722198
23.	NDMC	011-26701820
24.	DUSIB	011-23378789 / 0559 / 0560
25.	BOAT CLUB INCHARGE {ECO-6}	HARISH 9868235938, 9650437938

*Table 9: Emergency Toll Free Numbers*

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