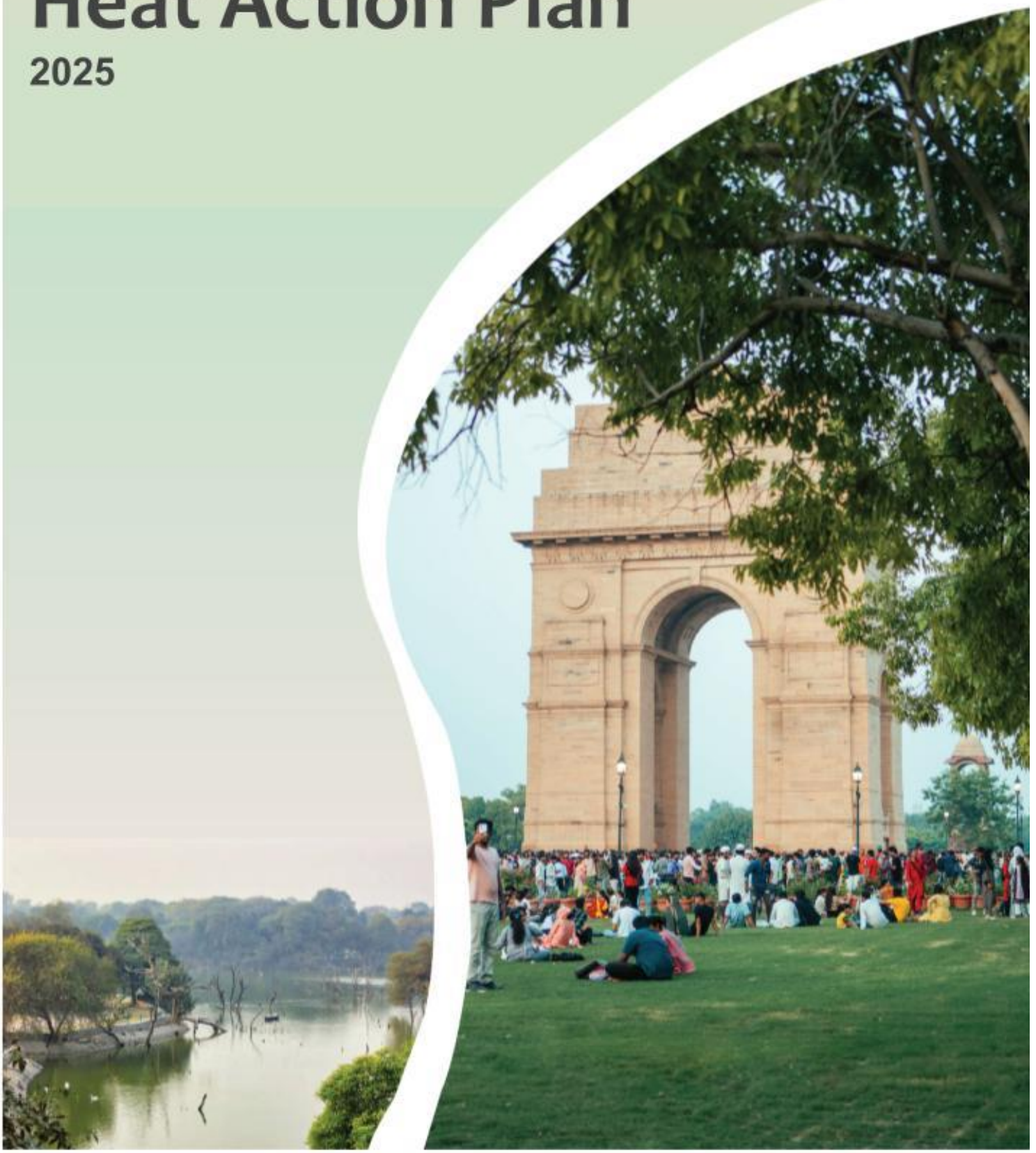
Delhi

Heat Action Plan

2025



Acknowledgement

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Technical partner:

- **National Disaster Management Authority (NDMA),** Ministry of Home Affairs, Government of India

Implementing Knowledge Partners:

- **ADRA - Adventist Development and Relief Agency**
- **CEEW – Council on Energy, Environment and Water**
- **CDRI - Coalition for Disaster Resilient Infrastructure**
- **IIHS – Indian Institute for Human Settlements**
- **IRADe – Integrated Research and Action for Development**
- **MHT – Mahila Housing Trust**
- **The Nand & Jeet Khemka Foundation**
- **NRDC – Natural Resources Defence Council**
- **Resilience AI**
- **RMI – Rocky Mountain Institute**
- **SEEDS – Sustainable Environment and Ecological Development Society**
- **SFC – Sustainable Futures Collaborative**
- **UC Berkeley – University of California, Berkeley**
- **UN Women – United Nations Entity for Gender Equality and the Empowerment of Women**
- **UNDP – United Nations Development Programme**
- **UNEP – United Nations Environment Programme**
- **UNICEF – United Nations Children's Fund**
- **Yuva Manthan**

Disclaimer:

Delhi HAP is prepared using data and information collected from multiple sources and global best practices, which is subject to periodic updates based on evolving data, stakeholder feedback, and emerging scientific understanding.

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Executive Summary

The 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 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, 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 (DDMA) developed the Heat Action Plan (HAP), as per NDMA Guidelines. This plan 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	
Location	76.50°44' E to 77°20' 'E longitude and 28° 24' to 28˚53' N latitudes
Height above main sea Level	Average 230 m above Mean Sea Level (MSL)
Total area (sq. km)	1483 sq.km
Total Population	16.78 million (Census, 2011)
Population Density	11320 per sq km

Table 1: Delhi City Characteristics (delhiplanning.delhi.gov.in)

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 45 degree C in the summer months. On the contrary, winter, which lasts from December to January, is extremely cold. Temperature falls to almost 5 ºC 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

North-westerly 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 does not form any shade as such over any part of the city.

The entire topography of Delhi is divided into ridge, Yamuna Flood Plain, the Plain. Each of these regions is marked by a 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. Finally, riverine vegetation grows along the plain of Yamuna. Vegetation of Delhi mainly comprises 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 the 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

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. Population data for nine district of Delhi as per census2011 and two district s form after 2011 south east districts and Shahdara,(Table 3).

Districts	Populations (2011)
North East	2,241,624
East	1,709,346
Central	582,320
West	2,543,243
North	8,87,978
North West	3,656,539
South	2,731,929
New Delhi	142,004
South West	2,292,958
South East	15,00,351 (District created after census)
Shahdara	22,40,749

Chapter Two
Heat Waves in Delhi & Need for Heat Action Plan

2

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: Ederna (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 Stoke: 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:

Table: Temperature/ Humidity Index

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

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

Green (No Action)	Normal Day	Maximum temperatures are near normal
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

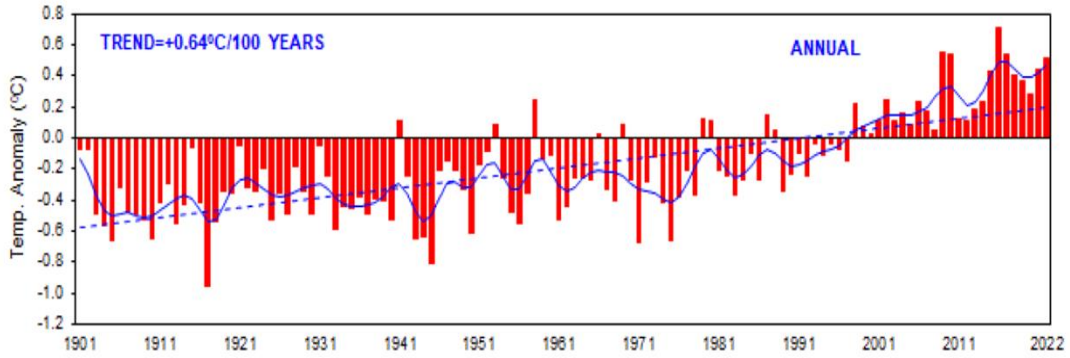
Table: Heat Alert Thresholds for Delhi City (source: NDMA)

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 (+.41ºC 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, 0.95ºC above normal average.

Under 2ºC 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 2ºC 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: 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.[1]

2.3 Heat Waves in Delhi

Delhi is one of the most vulnerable to impacts of heat wave due to it 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 thunder storms.

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

Month	March	April	May	June	July
Mean maximum temperature (°c)	29.9	36.5	39.9	39.0	35.6
Mean minimum temperature (°c)	15.6	21.3	25.8	27.7	27.5

Source:- http://mausam.imd.gov.in/newdelhi/mcdata/safdarjung.pdf

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

2023 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),

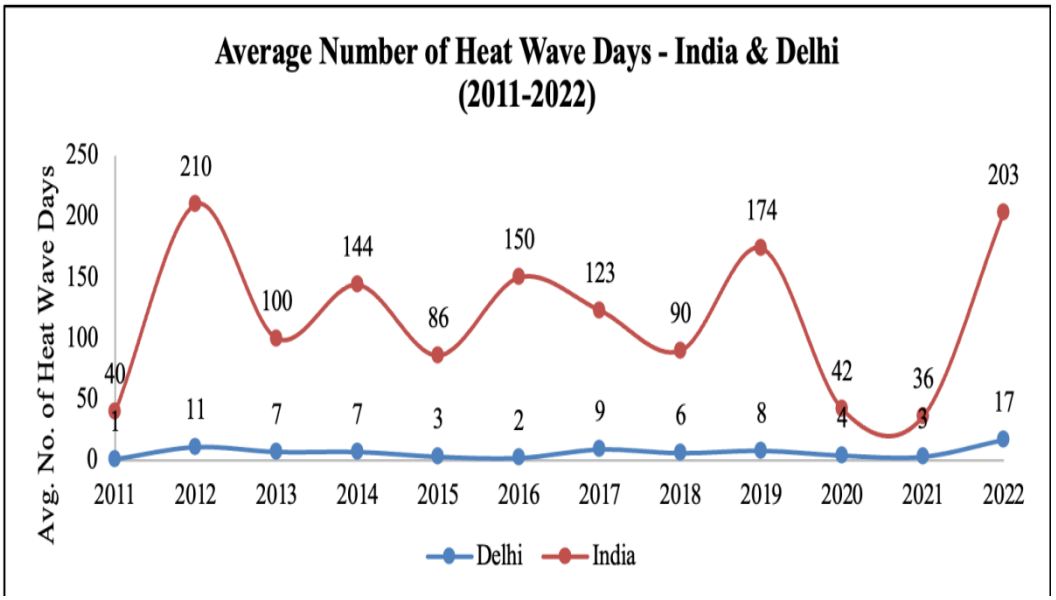


Figure: Average Heat Wave Days in India & Delhi (2011-22)

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.

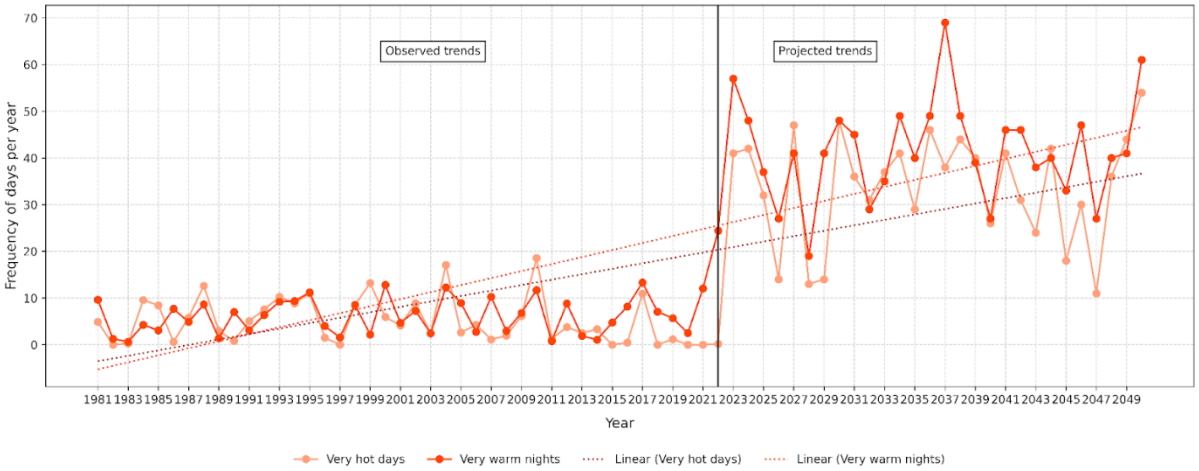


Figure: Over the years the number of warm days is increasing along with the number of warm nights, the change in increase in number of warm nights is significant and has severe impact on human body.

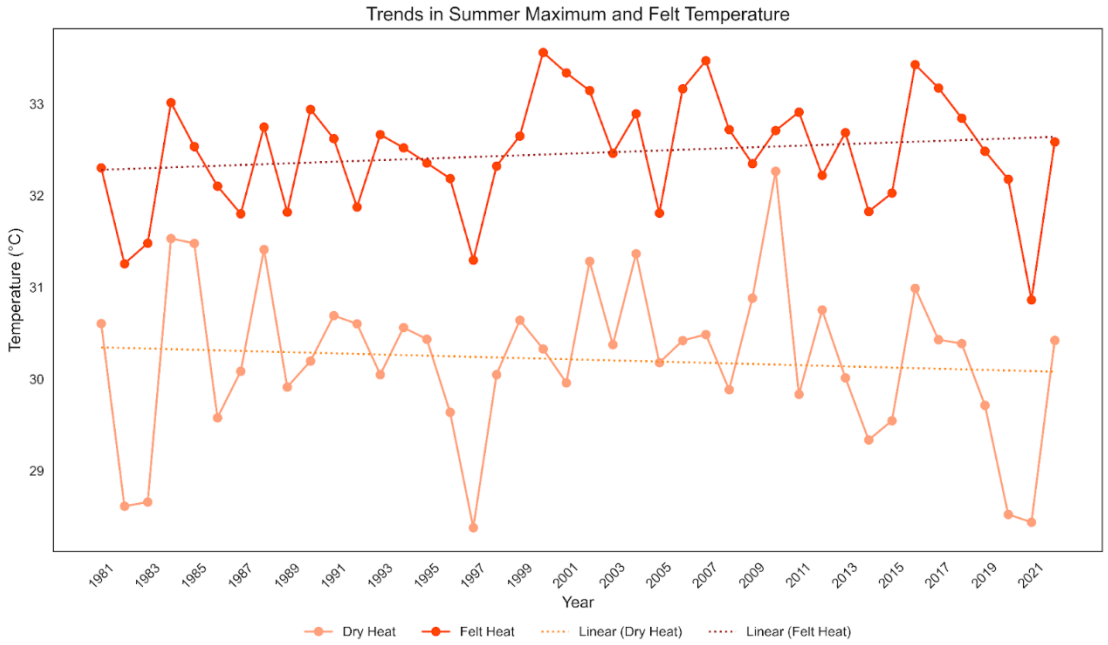


Figure: The graph represents the increase in dry and felt heat as well. Felt heat is dry heat when combined with humidity and has a significant role in how human body perceives heat. Added humidity makes it tough for human body to evaporate sweat and can negatively affect people with chronic disease

2.4 Impacts of Heat Wave on Livelihood

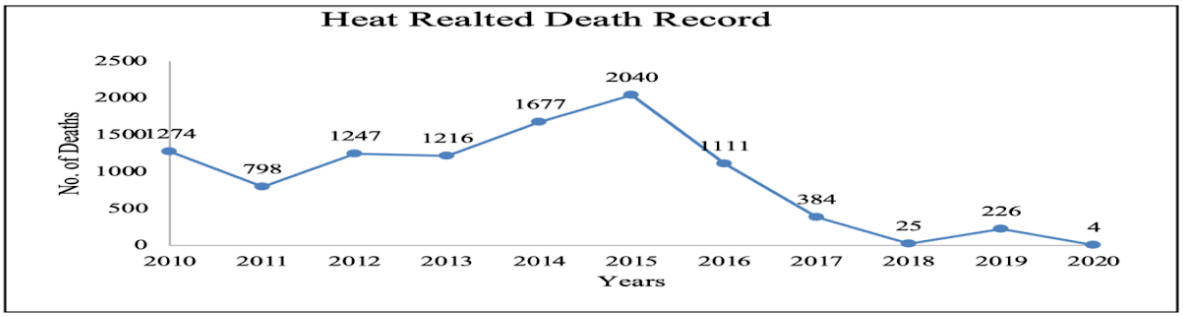
Heat wave is a “silent disaster” and adversely affects the livelihood and productivity of people. Heat Wave has emerged as a major Health Hazard. WMO predicts Heat Wave related fatalities to double in less than 20 years. Heat waves often lead to poor air quality. The extreme heat and stagnant air during 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 warning potential is often much greater than carbon dioxide (CO2). 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 4th 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.

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The table below illustrates vulnerability mapping and its essential components.

Vulnerability Mapping
Vulnerable Area
Less urbanized
Minimal access- Water and Sanitation
Minimal Household amenities
Vulnerable Group
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 it 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: 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: Climatological Values, Delhi

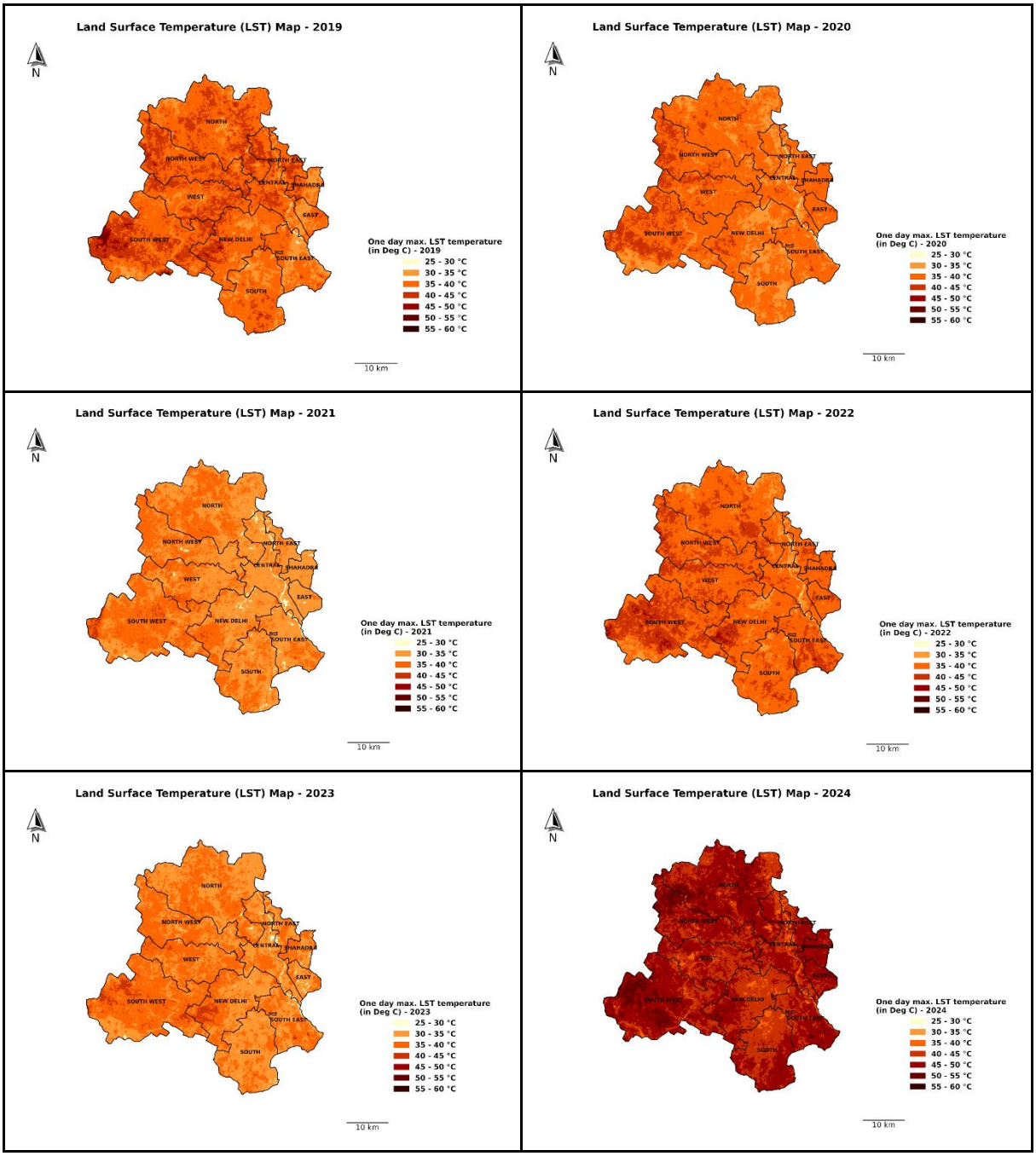
2.8 Thermal Hotspot Maps for Delhi

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

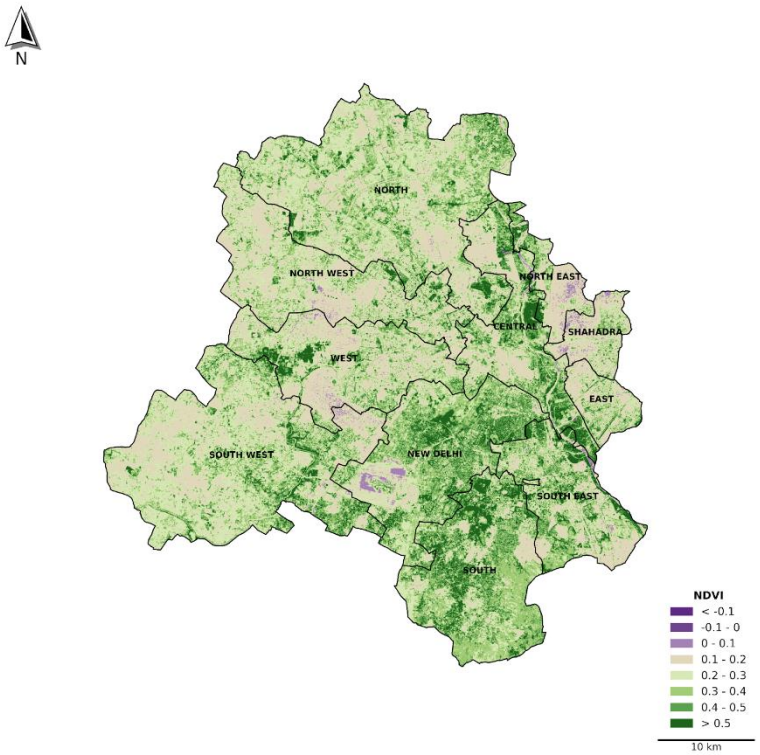
Yearly one-day maximum land surface temperature (LST) from 2019- 2024 during the months of March-June



Source: Authors' analysis using Landsat 8 for summer

Figure: The maps show increase in Land surface temperature from 2019 to 2024.

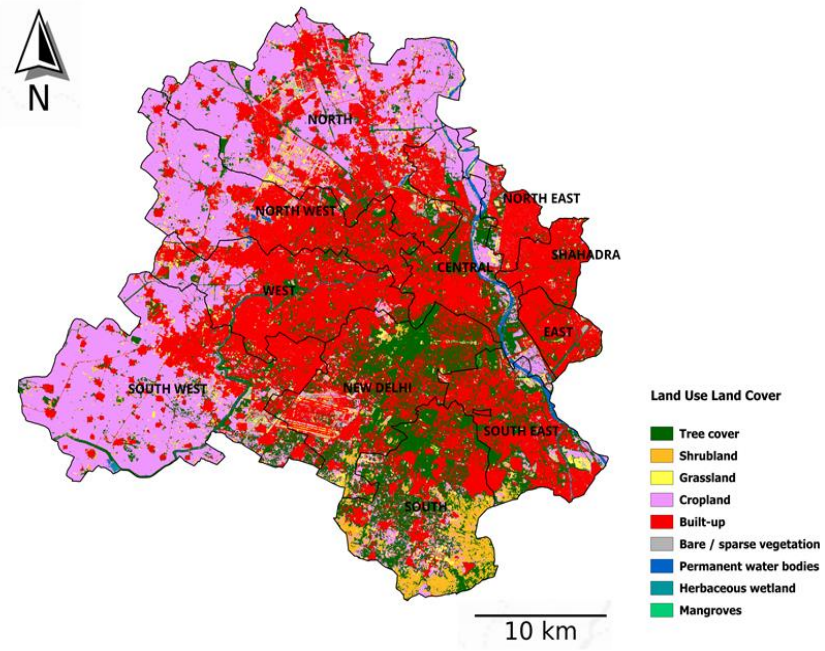
Normalized Difference Vegetation Index (NDVI) map for Delhi



Source: Authors' Analysis using Landsat 8

NDVI Range	Interpretation
< -0.1	Water bodies, snow, clouds
-0.1 – 0	Built-up areas, bare soil, or rocks
0 – 0.1	Very sparse or dry vegetation
0.1 – 0.2	Sparse vegetation, stressed crops
0.2 – 0.3	Low vegetation, grasslands
0.3 – 0.4	Moderate vegetation, cropland
0.4 – 0.5	Dense and healthy vegetation
> 0.5	Very dense vegetation

Land use land cover (LULC) map of Delhi



Source: Authors' analysis using ESA Worldcover v200

The Urban Heat Island (UHI) effect refers to the phenomenon where urban areas experience significantly higher temperatures than their rural surroundings, primarily due to human activities and land use changes. A key driver and indicator of this effect is the increase in Land Surface Temperature (LST) — the temperature of the Earth's surface as measured from satellite or ground-based sensors.

Urban areas, dominated by impervious surfaces such as asphalt, concrete, and buildings, tend to absorb and retain more heat compared to vegetated or water-covered rural areas. These materials have high thermal mass and low albedo, meaning they store more solar radiation during the day and release it slowly at night, leading to sustained higher temperatures. This process elevates the LST in cities, thereby intensifying the UHI effect.

Moreover, reduced green cover, limited water bodies, and anthropogenic heat from vehicles, industries, and buildings further exacerbate surface temperatures in urban environments. As LST increases, the intensity and spatial extent of UHI also grow, particularly during summer months or heatwave events.

In essence, elevated land surface temperatures are both a cause and consequence of the UHI effect, forming a feedback loop that can worsen urban heat stress, increase energy demand for cooling, and amplify health risks for urban populations.

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.

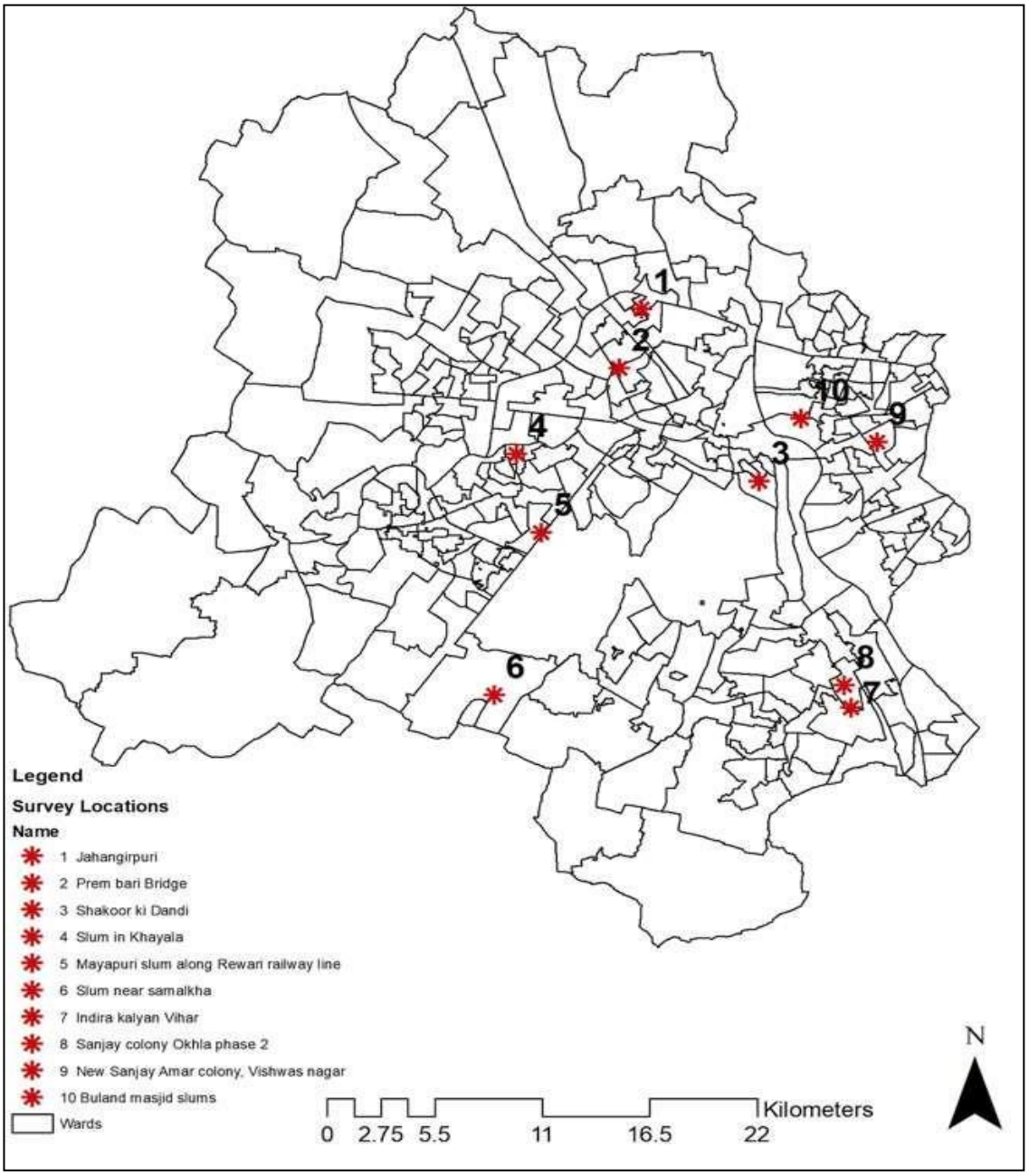


Figure: Survey Hotspots, Delhi

Chapter Three
Heat Action Plan — Strategy, Roles and Responsibilities

3

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

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.

Health sector has to play one of the most crucial roles in advancing heat resilience. Effective health sector preparedness, timely response, and long-term planning for risk reduction are crucial for minimizing the adverse impacts of extreme heat, particularly on vulnerable populations. This includes understanding the clinical manifestations of heat-related illnesses (HRIs), establishing protocols for their timely management, and ensuring that health facilities are equipped with dedicated heatwave wards and robust response mechanisms. Integrating Heat Health Early Warning Systems is also a key component, allowing for timely alerts and coordinated interventions when extreme heat conditions are anticipated.

As part of a comprehensive Heat Action Plan (HAP), these measures form the foundation for a resilient public health response—one that can anticipate, manage, and mitigate the health impacts of extreme heat through both preventive and reactive strategies. This chapter, based on the guiding documents provided by India's National Programme on Climate Change and Human Health, NCDC, MoHFW, outlines measures for health sector resilience.

1. Understanding and managing heat-related illnesses

One of the most direct outcomes of extreme heat is Heat-related illnesses (HRI), which have now emerged as a significant public health concern, notably contributing to fatalities associated with extreme heat events (Savioli et al., 2022). In India alone,

reports presented in the Lok Sabha in 2024 revealed that there were more than 67,637 suspected cases of heatstroke between March and July due to severe heat waves in the same year (Vasudha Mukherjee, 2024). A global systematic review indicates that for every degree rise in temperature from the baseline, there is an associated increase of 18 per cent in morbidity and a staggering 35 per cent in mortality related to heat illnesses (Faurie et al., 2022).

1.1 Pathophysiology

Human beings maintain a core body temperature of 37°C through four primary heat dissipation mechanisms :

- Conduction: transfer of heat through direct contact with a cooler object or air.
- Convection: heat transfer through direct contact with cooler air.
- Evaporation: loss of heat through sweat or water on the skin.
- Radiation: Heat is transferred from the skin tissue to the surrounding air.

It's important to note that, except for evaporation, the effectiveness of the other three pathways diminishes at temperatures above 35°C. Additionally, when relative humidity exceeds 75 per cent, evaporation becomes inefficient too (NPCCHH, 2024). As the thermoregulatory system becomes overwhelmed due to the inability to dissipate body heat, individuals may experience a range of heat-related illnesses (HRI). These can range from non-fatal conditions such as heat cramps, exhaustion, rashes, and edema to the more severe and potentially fatal heat stroke. If non-threatening conditions are not addressed on time, they can progress into heat strokes.

Table: The range of heat-related illnesses

Heat- Related Illnesses	Description	Treatment
Severe illness		
Heat stroke	A multisystem, life-threatening illness characterised by elevation of the core body temperature (>40°C) and CNS dysfunction	Move the patient to a cool environment; manage airway, breathing, and circulation; administer rapid cooling with cold-water or ice water immersion or other means; administer intravenous rehydration; and evacuate to the emergency department after on-site cooling is performed. ICU

		admission is warranted for the management of end-organ sequelae.
Moderate illness		
Heat exhaustion	Profound fatigue, weakness, nausea, headache or dizziness or a combination of these symptoms resulting from a decrease in body water content or blood volume due to water or salt depletion from heat exposure; mild elevation (<40°C) in body temperature may be present, but not altered mental status	Remove patient from the hot environment; treat with rest in supine position, evaporative cooling, and intravenous or oral rehydration; monitor mental status. A delayed response to treatment warrants further evaluation
Mild illness		
Heat syncope	Brief loss of consciousness due to vasodilation and pooling of blood in the limbs as a result of physiological compensation to heat exposure	Remove patient from the hot environment; treat with rest in supine position, passive cooling, and intravenous or oral rehydration. Prolonged recovery or a medical history or physical examination arousing concern for a cardiac cause, if the patient has cardiac risk factors, should prompt further evaluation
Heat edema	Swelling of limbs caused by peripheral vasodilation and interstitial pooling resulting from physiological compensation in response to heat exposure	Remove the patient from the hot environment and elevate the legs. Diuretic agents are not indicated

Heat cramps	Painful muscle spasms in the abdomen, arms, or legs during or after activity in the heat, which often occur when excessive amounts of salt are lost during sweating from physical exertion	Remove patient from the hot environment, treat with rest, oral electrolytes, and fluid repletion
Heat rash	An inflammatory disorder of the epidermis that results from blockage of sweat glands; may be followed by superimposed bacterial soft-tissue infection	Remove patient's clothing; treat with evaporative cooling and glucocorticoid and antibacterial cream as needed, but avoid topical emollients; monitor for cellulitis. Advise the patient to avoid hot environments and to wear loose clothing.

Source: Sorensen et al., 2022

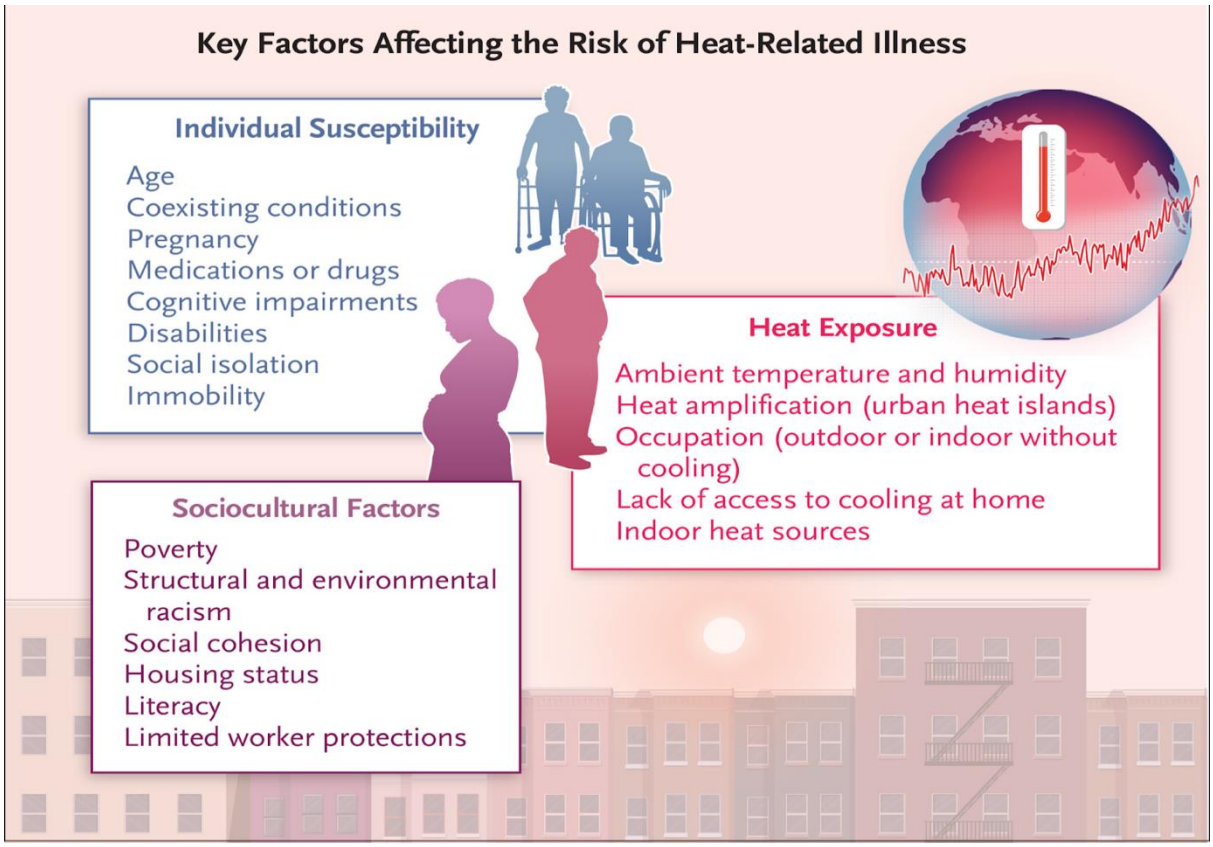
1.2 Risk factors for HRI

Increasing frequency and intensity of extreme heat events predispose certain groups to HRI. This risk is an amalgamation of 3 factors (Sorensen et al., 2022):-

- Heat exposure: a combination of ambient temperature, humidity, and bodily metabolic heat generated
- Individual vulnerability: age, sex, gestational status, and preexisting illnesses
- Socio-cultural factors: income status, healthcare access, working and living conditions

The risk factors have been quantified in chapter four of this heat action plan, where a ward-level heat risk map has been developed.

Figure 33: Risk Factors of Heat-Related Illness



Source: [Sorensen et al., 2022]

1.3 Heat stroke

On the spectrum of HRI, Heat strokes are considered a catastrophic emergency requiring immediate medical assistance. It is characterised by an increased core body temperature of 40°C and above associated with neurological dysfunction such as convulsions, delirium, and, in severe cases, coma. There are two types of heat strokes:

- Classical Heat Stroke (CHS): Occurs periodically in vulnerable groups at increased risk to HRI in extreme heat and humid environments
- Exertional Heat Stroke (EHS): Individuals engaged in high physical activity levels in extreme heat and humid conditions are predominantly at risk. Occupations such as athletes, outdoor manual workers, and military personnel are particularly vulnerable to these environmental stresses.

The primary distinction between EHS and CHS is the inability to dissipate excess internal heat stored from increased skeletal muscle activity. However, the clinical manifestations of both conditions remain the same, irrespective of the cause.

Table: Features of EHS and CHS

Feature	**Exertional Heat Stroke**	**Classic Heat Stroke**
Occurrence	Sporadic (any time of year)	Epidemic (heat waves)
Exposure	A. Athletic event B. Working in high heat stress conditions	A. High environmental heat with/ without high humidity
Acute risk factors	• Dehydration • Concurrent Illness • Obesity • Wearing too much clothing • Poor cardiovascular fitness	• Lack of adequate ventilation/ cooling • Confined places • Physical exertion not a pre-requisite
Heat equilibrium	Overwhelmed: heat gain> heat loss • Heat gain from environment with/ without an increase in internal heat production	Impaired: reduced heat loss capacity • Internal heat loss mechanism impaired • Restricted/ inadequate ventilation
Heat injury development	Quick rise in core body temperature (over minutes/hours)	Slow rise in core body temperature (over hours or days)
Sweating	Usually present (wet skin)	May be absent (dry skin)
CNS dysfunction	Common	Common
Pathophysiological changes	• Metabolic acidosis • Hypoglycaemia • Rhabdomyolysis: Frequent • Liver dysfunction: Severe • Renal failure: Common • DIC: Severe • Hypocalcaemia, Hyperkalemia	• Respiratory alkalosis • Liver dysfunction: mild • DIC: Mild • Volume and electrolyte abnormality is common
Risk factors		
Physiological	• Healthy, active adult	• Elderly • Children • Pregnancy • Obesity

		• Chronic illness • Poor physical or psychological health
Medication/ drug use	Amphetamines and amphetamine like agents, MDMA, cocaine, PCP and LSD, synthetic stimulants of the cathinone class, alcohol	Antihypertensives, laxatives, anticholinergic drugs, salicylates, thyroid agonists, benztropine, trifluoperazine, butyrophenones, tricyclic antidepressants, SSRIs
Socio-economic (individual/ institutional)	Occupation/ physical exertion linked: work time, duration, adequate time to rest, lack of cooling and hydration facilities	• Social isolation • Living on higher floors • Unventilated and non-air conditioned living space • Inability to care for oneself

Source: NPCCHH, 2024

1.4 Clinical manifestation

The signs and symptoms of heat stroke are:

- Warm skin with or without sweating
- Hypotension
- Tachycardia
- Tachypnea
- Anhidrosis is the last presentation

The liver and brain are particularly vulnerable to the effects of hyperthermia, and the prognosis is influenced by both the severity and duration of the hyperthermic episode. However, if cooling measures are implemented promptly and completed within 30 minutes of the onset of symptoms, the chances of death can be reduced to zero. This emphasises the critical importance of rapid intervention in preventing severe health outcomes in hyperthermic patients (Savioli et al., 2022).

1.5 Severe Heat-related Illness Management

Heat-related illnesses are largely preventable, but if not promptly identified and managed, they can lead to severe health complications and, in critical cases, even death. The clinical manifestations of heat stroke can closely resemble those of various other conditions, including sepsis, metabolic disorders, cerebrovascular events, neuropathic emergencies, and potential toxicological exposures. Therefore, it is always essential to record the core body temperature and rule out other causes of

hyperthermia. Simultaneously, prompt initiation of heat stroke treatment is critical to avoid adverse health outcomes. A comprehensive set of routine investigations should be conducted for patients suspected of heat stroke. These include:

- Complete blood count (CBC)
- Arterial blood gas (ABG) analysis
- Liver function tests (LFTs)
- Kidney function tests (KFTs)
- Blood glucose levels
- Electrolyte panel
- Toxicological screening
- Urinalysis
- Additionally, a chest X-ray should be performed if the patient exhibits respiratory symptoms. This thorough assessment helps guide appropriate treatment and management of heat stroke.

The foundation for effectively treating HRI lies in quickly recognising heat as a causative factor, implementing rapid cooling techniques, and relocating the patient to a cooler environment. Rapid cooling is the most effective treatment for suspected HRI cases, reducing the risk of mortality from more than 50 per cent to as low as 5 per cent (U.S. Customs and Border Protection). The technique adopted should be completed within 30 minutes of the onset of symptoms, ultimately maintaining a core body temperature between 38 to 39°C.

2. Rapid cooling

Heat-related illnesses, particularly heatstroke, require immediate cooling to prevent severe organ damage or fatal outcomes. Rapid cooling treatments help lower the body temperature as quickly as possible to prevent complications like brain swelling, kidney failure, and cardiovascular stress.

2.1 Managing principles when considering Rapid Cooling in heat stroke suspected cases

- Assess competency of airway, breathing, circulation, disability, and exposure before treatment initiation and monitor them throughout the procedure, particularly in CHS patients.
- A temperature gradient must be created between the skin and the surroundings, leveraging the body's thermoregulatory mechanisms.
- Cooling rates between 0.784 to 0.154 Deg C/min are efficient in preventing further organ dysfunction complications.
- The primary aim of managing heat stroke patients in emergencies is to *"Cool first, Transport second "* (NPCCHH, 2024)
- Depending on the scene of the collapse, appropriate cooling techniques should be undertaken to complete cooling within 30 minutes of clinical presentation.
- It is not required to differentiate a case between EHS and CHS, as the treatment line remains the same.

- Cooling is not advised when the body temperature is normal or low.
- Avoid prescribing antipyretics such as Paracetamol, Aspirin, Ibuprofen, etc.
- The use of Dantrolene, a skeletal muscle relaxant, is also not recommended in EHS.

2.2 Challenges

- Shivering may be triggered by rapid cooling even after persistent hyperthermia and is more commonly seen in the elderly and children. In such cases, wet bedsheets, water spray, and fans are used to cool the patient down. If shivering persists, seek pharmacological support.
- Monitoring of vital signs is crucial through electrodes, especially for severely ill patients presenting with CHS, as they are at an increased risk of cardiovascular decompensation. In cases of rapid cooling methods such as cold water immersion, it is not possible.

2.3 Appropriate rapid cooling techniques for heat strokes

2.3.1 For Exertional Heat Stroke

i. Ice/ Cold water immersion

The use of cold water immersion is widely recognized as the gold standard for cooling patients with exertional heat stress (EHS) who are otherwise physically healthy. Due to its high thermal conductivity, cold water facilitates efficient and rapid cooling compared to alternative methods.

Resources required: Tub/ Portable pool/ Tarp, cold water, ice buckets with ice, rectal thermometer, lubricating gel, 3-4 towels, tarp for shade, if outdoors, 3 to 4 trained personnel for stirring the water, recording vitals, managing patient vitals, and monitoring rectal temperature.

Mechanism: In this technique, a vessel filled with ice slurry or cold water is maintained at a temperature between 2 to 10°C. The patient should be exposed as much as possible to the cool medium and immersed up to the torso with hands outside the vessel. A cold cloth should also be placed on the head for additional cooling. The patient should be securely positioned with a cloth under the axilla and stabilised by personnel to prevent any risk of drowning. The immersion should last between 15 to 20 minutes, with the water being vigorously stirred to enhance heat transfer. This process should continue until shivering occurs or the patient reaches a target temperature of 38°C to 39°C. Following successful cooling, the patient should be transported to the nearest emergency department for further monitoring and evaluation. Continue cooling in the best possible way if temperatures are not met during transportation.

Cooling time: 15 minutes

Challenges: Effective pre-planning is essential for managing heat stroke incidents in the field, necessitating the allocation of appropriate resources, both material and personnel. This requires thorough preparation and coordination to ensure a timely and effective response.

Figure: Cold Water Immersion

Source: RML Delhi

ii. Tarpaulin-Assisted Cooling with Oscillation (TACO)

This method is designed for use in resource-limited settings.

Resources required: Instead of a traditional tub or pool for cold water immersion, a tarpaulin is utilized.

Mechanism: First, the tarpaulin is filled with ice, and the patient lies on their back in the centre of the tarp. The corners of the tarp are then lifted, allowing cold water to be added until the patient's chest is fully submerged. To enhance the cooling effect, the tarp is gently moved back and forth to mix the ice and water, facilitating effective cooling.

Challenges: It requires dedicated staff just for lifting patients. For obese patients, more people may be needed.

Cooling time: 10 to 15 minutes

Figure: TACO in the field

Source: National Health Mission

iii. Cold water dousing with ice massage

Also known as Water Ice Therapy.

Resources required: Utilizes same resources as cold water immersion; additionally, a porous stretcher is used.

Mechanism: The patient is placed on the porous stretcher inside the tub/ portable pool, and multiple personnel drench the patient entirely except the head in the ice-cold water from the tub. Simultaneously massage muscles of the chest, abdomen, thighs, and legs with icepacks.

Cooling time: 12 to 24 minutes

2.3.2 For Classical Heat Stroke

i. Body bag immersion

The technique has similar cooling rates as that of cold water immersion but allows for continuous monitoring of the patient as the chest is exposed. Hence, it is the ideal treatment mode in CHS patients. This technique can be used in the field, in an ambulance, or the emergency room of a hospital.

Resources required: Utilizes same resources as cold water immersion, except for a tub, a waterproof, leakproof body bag is used, and other medical equipment such as monitor, chest and limb leads.

Mechanism: Place the patient into the body bag filled with ice and cold water, baring the chest. Attach the monitor to assess ABCDE. Once the initial assessment is completed, close the body bag until the rectal temperature reaches 38 to 39°C.

Cooling time: 15 mins

Figure: Cold water immersion using a body bag in the emergency department

Source: Handtevy

ii. Water spray and Directed Fan

This technique effectively utilizes the body's evaporative and convective thermoregulatory pathways, making it particularly beneficial in cases of CHS, especially for children and older adults.

Resources required: Spray bottle, fan

Mechanism: Once the initial assessment is complete, carefully expose the patient and lightly spray them with cold water while turning on the fan to enhance the cooling effect. If the patient begins to shiver, switch to using room temperature water to ensure their comfort.

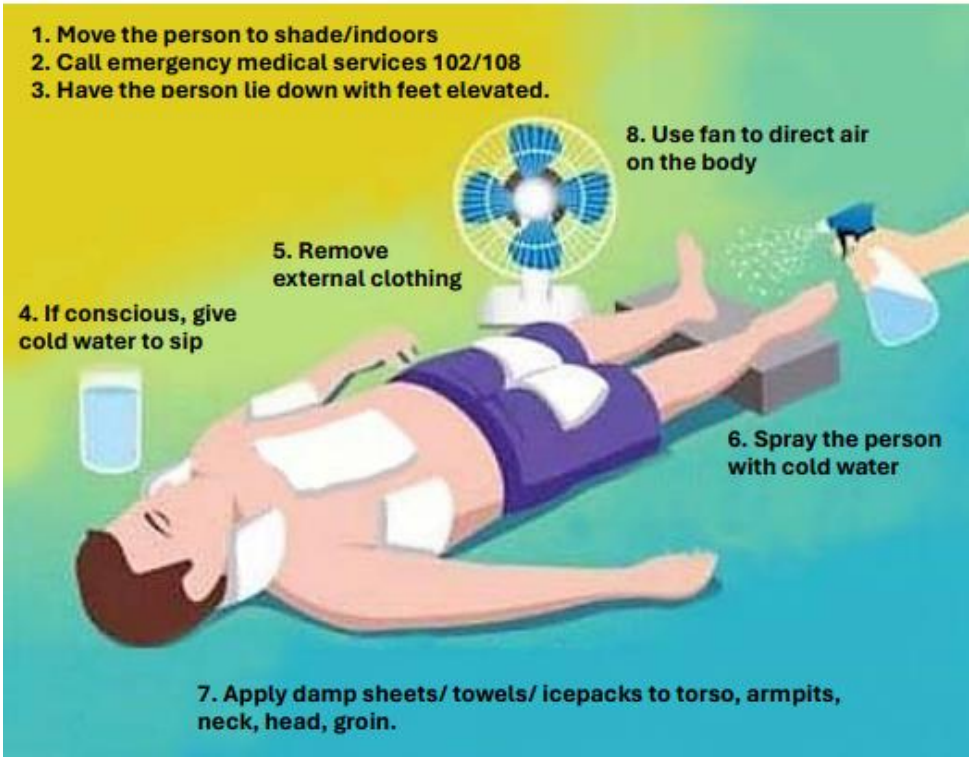
Challenges: It requires access to ample amounts of water and takes longer to cool down when utilizing water at room temperature.

iii. Water-soaked bedsheets and Directed Fan

Soak bed sheets in cool water and apply them over the patient's exposed skin while positioning a fan to blow air at a high speed. This method is particularly effective for children and elderly patients, as it helps to lower body temperature quickly and safely.

iv. Ice pack/ Crushed Ice, Water spray, and directed fan

Figure: Multiple methods implemented at a time for rapid cooling



Source: NPCCHH, 2024

3. Hospital initiatives towards heat wave preparedness

Heatwave Ward: Specialised Hospital Care for Heat-Related Illnesses (Anumeha Yadav, 2024)

A heatwave ward is a dedicated hospital space designated for the treatment of patients suffering from mild and severe heat-related illnesses. These wards are especially crucial in regions experiencing extreme heat conditions due to climate change and rising global temperatures, leading to an increased frequency of hot days and nights.

Owing to the sudden rise in heat-related mortality in 2024, hospitals like Safdarjung, AIIMS (All India Institute of Medical Sciences), and RML (Dr. Ram Manohar Lohia Hospital) in Delhi have established specialised heatwave units to provide dedicated care for patients affected by extreme heat. These wards feature well-ventilated, air-conditioned rooms equipped with life-saving drugs, expert HRI-skilled medical staff, ORS, IV fluids, ice and cold water, along with advanced cooling technologies to stabilize patients and prevent life-threatening complications. (Ankita Upadhyay, 2024)

Benefits of Heatwave Wards

- Prevents Fatal Heatstroke Cases: Rapid cooling interventions reduce mortality rates drastically, using evidence-based rapid cooling techniques to lower core body temperature.
- Reduces Heatwave-Related Hospital Admissions: Early intervention prevents complications and shortens hospital stays.
- Enhances Climate Resilience in Healthcare: These wards facilitate hospital preparedness for the rise in climate change-associated heat waves.
- Protects Vulnerable Populations: This is critical for elderly patients, outdoor workers, pregnant women, and those with chronic illnesses.

Figure: Inflated pools and Ceramic Tubs for Heat Wards

Source: Upadhyay, Ankita. 2024. "Battling 107°F fever with ice and water: Inside RML Hospital's heat stroke unit".

4. Hospital Preparedness Measures for Managing Heat-related Illness

The hospital preparedness plan developed under the NPCCHH serves as a foundational guide for states to design, implement, coordinate, and assess heatwave response measures within health facilities.

It outlines planned activities across three seasonal phases: pre-heat season, heat season, and post-heat season. These activities are categorized into three main areas: infrastructure and logistics, capacity building and information, and education and communication (IEC)/awareness. The plan is tailored for three tiers of healthcare institutions: Primary Health Centres (PHCs), Community Health Centres (CHCs), and District Hospitals (DHs)//medical colleges (MCs).

Table: Hospital Preparedness Chart- Pre-heat, during, and post-heat Season

<table>
<tr><th>PHC</th><th>CHC</th><th>DH/MC</th></tr>
<tr><td colspan="3">A. Pre-heat Season</td></tr>
<tr><td colspan="3">INFRASTRUCTURE AND LOGISTICS</td></tr>
<tr><td colspan="3">1. Check inventories for basic equipment and medicines required.
2. Ensure adequate arrangement of staff
3. Explore the creation of ice pack dispensaries to increase access to vulnerable communities
4. Adopt long-term measures such as cool roofs and improving the green coverage of health facility
5. Identify a Rapid Response Team (RRT) to respond to any exigency call outside the hospitals
6. Try to establish outreach clinics at various locations easily accessible to the vulnerable population</td></tr>
<tr><td colspan="3">CAPACITY BUILDING</td></tr>
<tr><td colspan="3">1. Prepare a detailed action plan to tackle HRI (updated annually).
2. Organize fresher/refresher targeted training course maintaining hospital records, improve expedience of recording of cause of death, heat illness examination procedures
3. Community involvement of trained staff to create awareness.</td></tr>
<tr><td>• Map susceptible villages (identify areas/populations that are vulnerable)</td><td>• Map susceptible PHCs (identify areas/populations that are vulnerable)</td><td>• Map susceptible blocks (identify areas/ populations that are vulnerable)</td></tr>
</table>

<table>
<tr><th colspan="3">IEC/AWARENESS</th></tr>
<tr><td colspan="3">1. Prepare targeted IEC hoardings, banners, posters, leaflets, factsheets, information cards, media, mic announcements, rallies, song/drama activities, and street plays.
2. Plan for dissemination as per assessment of vulnerable area/ communities.
3. Conduct sensitisation meetings.
4. Prepare handouts for health staff about heat illness
5. Ensure the availability of funds for the above activities</td></tr>
<tr><th colspan="3">B. Heat Season</th></tr>
<tr><th colspan="3">INFRASTRUCTURE AND LOGISTICS</th></tr>
<tr><td colspan="3">1. Ensure adequate medical supplies are available
2. Identify surge capacities and mark the beds dedicated to treating heatstroke victims and enhance emergency department preparedness to handle more patients</td></tr>
<tr><td>• Increase ASHA/ANM/ MPHW outreach in at-risk villages during a heat alert, if feasible.</td><td>• Increase ASHA/ ANM/MPHW outreach in at-risk PHC during a heat alert, if feasible.
• Ensure dedicated bed availability
• Ensure ambulance availability</td><td>• Increase MPHW outreach in at-risk blocks during a heat alert, if feasible.
• Ensure dedicated bed availability • Ensure ambulance availability
• Dedicated heat corners
• Increase staffing at DH/MCs to attend to the influx of patients during a heat alert, if feasible.
• Organize DNO-CC/ SNO-CC visits to CHCs to confirm proper preparation has been made for HRI and conduct case audits during the heat season.</td></tr>
<tr><th colspan="3">CAPACITY BUILDING</th></tr>
<tr><td colspan="3">1. Ensure reporting of HRI cases daily
2. Adopt HRI treatment and prevention protocols
3. Expedite recording of cause of death due to HRI</td></tr>
</table>

• Referral of patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration)	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season
IEC/AWARENESS		
1. Ensure IEC dissemination 2. Target the vulnerable area/communities followed by other areas. 3. Plan activities as per the Heatwave alert issued by IMD		
C. Post-heat Season		
A. INFRASTRUCTURE AND LOGISTICS		
• Review to assess/identify gaps, if any, e.g., ► Any shortage of equipment, medicine, staff. ► Any long-term measures adopted and maintained • Enlist/document the lessons learnt for the next season		
CAPACITY BUILDING		
Review to assess/identify gaps, if any, e.g., ► Any flaw/fault in reporting channel/format/ efficiency ► Number of deaths reviewed • Enlist/document the lessons learnt for the next season		
IEC/AWARENESS		
•Review to assess/identify gaps, if any, e.g., ► IEC messages ► Dissemination area/community ► Efficient use of resources • Enlist/document the lessons learnt for the next season		

Source: National action plan on heat-related illnesses (HRIs) by NPCCHH, 2024

4.1. Basic equipment and medicines required as a part of Hospital preparedness for heat season

Primary Health Centre (PHC), Community Health Centre (CHC), District Hospital (DH) and Medical Colleges should ensure the following requirements before the start of heat season:

- Dedicated bed for HRI patients in cooler area of hospital
- Thermometer, ORS packets, ice packs, BP apparatus
- Silver sulphadiazine cream, Calamine lotion, Chlorhexidine in a light cream or lotion base
- Cold IV normal saline (0.9%), dextrose 50% in water solution (D50W)
- Glucometer and testing strips
- ECG equipment: ECG machine, Gel, electrodes, ECG paper
- Cooling equipment: AC, cooler, fan as per requirement
- Water cooler
- Medicines: Lorazepam, diazepam
- Ambulance with ice packs and cold water.

The director/In-charge of Hospitals CHCS and PHCS in all States/Districts should ensure that the following measures are in place:

- A detailed action plan to tackle heat-related illnesses well in advance of hotter months.
- Operational framework - preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases (CSD).
- Need to update heat health action plan and issue advisories for hospital preparedness, surveillance, and weekly monitoring, including capacity building.
- Promoting strategic media coverage of climate and health linkages at the State level in regional languages to increase support for climate mitigation and adaptation responses.
- Long-term measures such as adopting cool roofs, improving green/forest coverage and analysing health impacts in urban planning.
- Standard Operating procedures should be established to tackle all levels of heat-related illnesses. Capacity-building measures for doctors, nurses, and other staff should also be undertaken.
- Cases with suspected heat stroke should be rapidly assessed using standard Treatment Protocols.
- Identify surge capacities and mark the beds dedicated to treat heat stroke victims and enhance emergency department preparedness to handle more patients.
- Identify RRTs (Rapid Response Teams) to respond to any exigency call outside the hospitals.
- Ensure adequate arrangements of Staff, Beds, IV fluids, ORS, essential medicines, and equipment to cater to the management of volume depletion and electrolyte imbalance.
- May try to establish outreach clinics at various locations easily accessible to the vulnerable population to reduce the number of cases affected. Health Centers

must undertake awareness campaigns for neighborhood communities using different means of information dissemination.

- Primary health centres must refer the patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration).
- Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load that exceeds their surge capacities.

All cases of heat-related illnesses (suspected or confirmed) should be reported to the IDSP (Integrated Disease Surveillance Programme) unit of the district.

5. Heat Health Early Warning Systems (EWS)

Heat Health Early Warning Systems (EWS) utilize climate and weather forecasts, along with predefined heat stress thresholds, to issue public advisories and activate health interventions aimed at minimizing heat-related health risks before, during, and after extreme heat events. These systems are essential decision-support tools, typically developed and maintained through collaboration between public health experts and meteorological agencies. As a core element of broader Heat Action Plans (HAPs), Heat Health EWS plays a vital role in informing health and social service protocols, ensuring timely and appropriate preparedness, prevention, and response measures during heatwaves.

Local heat thresholds for early warning systems can be developed using the following methods:

A. Biostatistical methods: The thresholds for temperature are prepared by IMD in India and can be coupled with impact indicators of health. These two can be used in combination to send out alerts and can be used to plan for preparedness as well.

To establish a correlation between temperature and health impact (outcome) variable, which may include-

- All cause daily mortality count data
- Cause-specific daily mortality count data
- Hospital daily admissions count data
- Emergency ambulance (108) services daily call count data

B. Meteorological (Bio-meteorological) method: The 2015 WMO WHO Heatwaves and Health: Guidance on Warning-System Development suggests that “In situations where there is basic meteorological information but no health data, a percentile-based threshold (90th, 95th) could be contemplated as a warning trigger value.”

Establishing of percentile thresholds based on thermal and bio-meteorological variables-

- Tmax, Tmin, and Tmean
- Humidex
- Wet bulb globe temperature
- Universal thermal climate index
- Heat index

NDMA recommends using the 75th, 85th and 95th percentile for Indian context

Extreme heat goes beyond just high daytime temperatures—it also involves factors like humidity and how well people are acclimatised. For early warning systems to be effective, they must account for these variables. This means combining weather forecasts with historical health and climate data to better anticipate the actual health impacts. Without this integrated approach, the true danger of extreme heat events can be missed. For example, many heat-related illnesses are triggered by persistently high nighttime temperatures, even when daytime highs don't seem extreme.

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

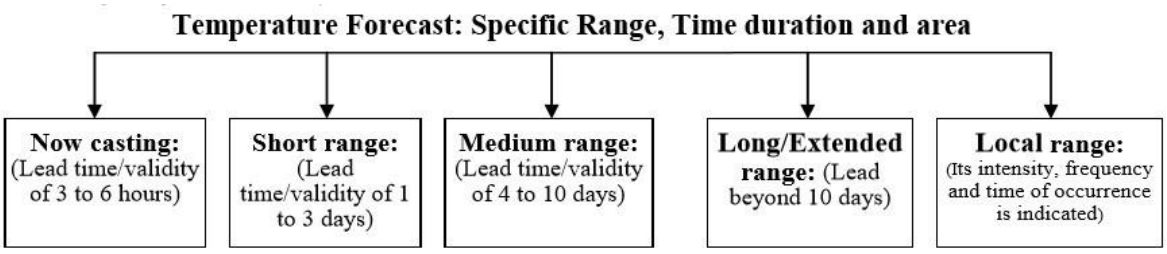
The primary objective of a warning system is to empower individuals and communities to respond timely and appropriately to the hazards in order to reduce the risk of death, injury, property loss and damage. Warnings need to get the message across and stimulate those at risk to take action.

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

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

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

4

Roles & Responsibilities for Managing Heat Wave

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. Special CEO (DM)- Nodal Officer for State.
2. Sub-divisional 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)	- Issue Heat wave alerts warnings - Weather forecasts on Short/ Medium/ Long range duration, Communicate Max. Temperatures district wise	DDMA – - To disseminate the information received from IMD to Line Departments and Public. - High Risk Area mapping and Identification of vulnerable groups
2.	Measures of Mitigating effect of Heat Wave	MCD, PWD, I&FC, DUSIB, DJB, NDMC, Delhi Police & Traffic Police	-To construct Shelters/ Sheds, Bus Stands with cool roof. -Identification of areas to provide shelters during heat alert period. -Ensuring Drinking Water at all identified major points in the sites & worksite. -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. - As a long-term solution all the line departments and the public at large should be asked to promote Cool Roof. -Maintaining water bodies also in forest area for wildlife animals and birds. -Augment use of public transport to reduce private vehicle	

			use and for improving the frequency of transport. -Repair/ Maintenance of mechanical/ technical system with towing arrangement, on priority basis including fan and cooling system in buses. -Afforestation and plantation.	
3.		Labour Department	Organise training for employers, outdoor laborer's and workers. ● Change the shift of outdoor workers schedule change from peak hours. ● Make emergency kit (Ice Packs, ORS, etc.) for the construction workers.	- 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	Transport Department to ensure necessary arrangements.

			priority basis including fan and cooling system in buses.	
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	-Stockpiling of ORS in Hospitals a nd Dispensaries -Creating Medical Posts at vulnerable places -Dedicating the ward and the bed in the hospital. -Training of human resources and deploy additional staff to attend to the influx of patients during Heat Wave. -Display Heat- related illness prevention tips and how to stay cool around Hospitals and Dispensaries -Establish more clinical Education	

			-Preparedness of heat health and social care system. -Enable better emergency support system/ ambulance for affected people to health care facilities with adequate equipments. -Preparedness of heat health, and social care system. -Enable better emergency transport system/ ambulance for affected people to healthcare facilities with adequate equipments.	
7.	Emergency Services	1077 Emergency Helpline No.	-Disseminate SMS text messages to advise local residents during a heat alert. -Identify risk area of vulnerable populations, in part by utilizing the list of high-risk area. -Create displays on ambulances to build public awareness during major local events. -To find out Hot spot of the city.	DDMA- - To make separate surveillance team during a heat wave. - To create single platform for all the line department - 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. - Collect all death data from MCD - collect all cases recorded in hospitals of Heat wave. - collect Ambulance call log of summers.

8.	Media campaign and IEC activities	Information and Public Relation	-Identification of areas to post warnings and information during heat season -Create awareness among the public through advertisement in local language -Display hoarding at important places -Creation of awareness through Print, Electronic and Outdoor media. -Increase the no. Of Installed LED screens with rolling updated temperature forecast. -Utilizing the local radio FM to alert public during Heat wave. -Send Heat wave warning through Text, WhatsApp Massages, Emails, Etc.	
9.		Information Technology (IT) Department	-Development of Disaster and Emergency Management System which includes Heat waves and prepare a Dash board to monitor heat wave scenario -Mapping of Risk areas and discrimination of warnings and alerts to all stakeholders automatically through web and mobile applications. -Prepare map on web interface with color coding system.	
10.		Delhi Fire Services	-To check the readiness of vehicles and firefighting	

			equipments to face any emergency.	
11	Communities and individuals	Community groups, Self-help groups, ward level committees, NGOs	-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. -Identification of NGOs, Voluntary Organizations in reaching out to the Public, especially vulnerable groups. -Encourage discussions for finding early signs of heat exhaustion with local doctors or Health Centres. -Inform community members about how to keep cool and protect oneself from Heat	
12		Forest Department, DDA, MCD, NDMC, PWD, Education Department, NTPC, Higher Education, 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	● To Provide uninterrupted power supply ● Replace and upgrade all the damaged transformers and replace loose wires ● Special care should be taken for power supply in Hospitals, Dispensaries and Clinics. ● Awareness generation to run the AC at 25degree centigrade, ● Proper use of AC in Government Department as well. ● Cooperation of consumers	Instructions to all the staff to be ready for emergency

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

1. Special CEO (DM)- Nodal Officer for State.
2. Sub-divisional Magistrate of respective District – Nodal Officer for District.
3. Deputy Commissioner – Nodal Officer for Municipal Corporation (MCD).

- 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 rgani 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)	● Communicate Heat Wave alert/ warning promptly ● Communicate Max temperature district-wise periodically	
2		Information & Public Relations (I & PR) Department	● Creating awareness among public through advertisement in Hindi/ English. ● Display hoardings at important places ● Create awareness through TV and Radio and jingles ● Conduct at regular press conference state or district level through concerned person ● Circulate Heat Wave warning i.e text/voice alert ● Develop SMS alert system ● Explore other means of **communication like Facebook, Twitter, WhatsApp etc.**	

3	Monitoring and response	Medical & Health Department and Medical Professional	● Display of heat-related illness prevention tips and how to stay cool around hospitals ● Equip all hospitals/ Dispensaries with additional supplies of medicines and materials. ● Ensure adoption of Heat illness treatment and prevention protocols. ● Deploy additional staff at hospitals and Dispensaries to attend to the influx of patients during a heat alert, if feasible. Keep emergency wards ready ● Deployment of Rapid Medical Response Team ● Deployment of Rapid Medical Response Team	
4.	Emergency Services	DDMA, (SEOC)	● Activate dynamic strategic deployment plan for ambulances. ● Adequate supply of ice packs, I.V. fluids and medicines. ● Keep accurate records of pre-hospital care. ● Adequate staff on duty and restrict leave if necessary. ● Disseminate SMS text messages to advise local residents during a heat alert.	DDMA-collect information regarding the Heat Wave from the Hospitals and Dispensaries and disseminate information to the concerned departments, officers.

5.		Labour & Employment Department	● Encourage employers to shift outdoor workers 'schedules away from peak afternoon hours (1pm-5pm) during Heat alert. ● Provide emergency ice packs and heat illness prevention material to construction worker as pilot project. ● Ensure provision of shelters/ cooling areas, water and supply of emergency medicines like ORS, etc. at work sites by employers. ● Re scheduling of working hours for employees in different sectors. ● Ensure shed for resting and drinking water facilities for workers at all work places. Special care for vulnerable groups women and old ages. ● 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. ● Rescheduling of working hours for employed in different sectors ● Ensure shed for resting and drinking water facilities for workers at all work places. Special care for vulnerable groups women and old ages. ● Co-ordinate with health department and ensure regular health checkup of the workers and provide and provide emergency packets and heat illness prevention materials for construction workers.	Working Hours will be from 7:00am to 1:00pm , 4:00pm to 6:00pm

6		Animal Husbandry Department	● 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. ● Ensure adequate stock of medicine in all veterinary hospitals. ● Ensure visit of field staff during heat wave to villages for follow up action in treatment of cattle / poultry birds. ● Shelter for live stocks and animal husbandry should be maintained. ● Update contingency plan regarding provision of drinking water for animals. ● Shelter for livestock and animal husbandry should be maintained ● Update contingency plan regarding provision of drinking water for animals.	Department make arrangements for cool sheds and drinking waters.
7.		Transport Department	● Display posters & distribute pamphlets on prevention of heat related illness at bus stands, auto stands etc. ● Ensure availability of shade / shelters, drinking water, ORS packets etc., at bus stands, auto stands etc. ● Establish Health teams at major bus stands / Terminals and other public places ● Ensure availability of water and ORS packets in long distance buses.	
8		MCD	● Shelter for stray Animals with provision of drinking water facilities. ● Ensure visit of field health staff during heat wave for treatment of stray animals.	

9 8.		Education Department	● Ensure supply of water for students and teachers if school is functioning. ● If school is not functioning, permit use of school premises as shelter during day time ● Ensure that Schools do not function during peak hours (12noon-4pm) when Heat Wave is declared. ● Display posters & distribute pamphlets on prevention of Heat related illness in schools and colleges. ● No open-air class to be conducted. ● Rescheduling of school timing and vacation as per heat wave situation. ● Ensuring that students avoid outdoor physical activities. ● Re-scheduling of school timing and vacation as per heat waves situation. ● Ensuring cool places at all education Institutes ● Ensure that student avoid outdoor physical activities.	
10		Information Technology (IT) Department	● Send real time information through Dash board/ interface on all activities related to Heat wave. ● Activity to be display on Dashboard / Interface/ on-line Monitoring Tool. ● Activate Heat Wave APP ● Generate reports encompassing all activities undertaken during heat wave alert to use for evaluation of systems and action plan.	

11		NGOs, Community Groups and Individual	● Take all precautions to avoid Heat related illness. ● 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 work in direct sun or indoors, if poorly ventilated, especially during a heat alert**.**	
12	Dust Pollution	PWD, MCD, DCB, NDMC, DDA, DPCC, DJB, Revenue, NHAI, DMRC, IFCD, NCRTC	Hotspots Monitoring Deployment of Anti-Smog Guns (ASGs) at C & D sites, On Roads and on top of High-Rise Buildings Monitoring through C&D web portal. Institutional monitoring of Road dust management Deployment of Mechanized Road Sweeping (MRS) machines Deployment of water sprinklers. Repair/ Greening & Paving and maintenance of road and Central verges, road side etc.	
13		Power Dept/ DISCOMS	Ensure repair/ maintenance work for uninterrupted water supply Scheduling load shedding	

14	Industrial Pollution	MCD, Revenue, DSIIDC, DPCC	● All industries which are using fuel have to operate their industry on approved fuels as per CAQM amended Direction No 65. ● Strict compliances on use of PNG by monitoring gas consumptions. ● Flexible timing of weekly markets ● Shelters for Stray Animals with provision of drinking water facilities ● Ensure visit of field health staff during heat waves for treatment of stray animals. ● Flexible timing of weekly markets.	
15	Water Pollution	DJB, DDA, DPCC, I&FC, Drain Owning Agencies	Detailed Action Plan with timelines prepared and Order issued on 27.01.2023 to all stakeholders: ● Complete Treatment of Sewage ● Trapping of all Drains ● Sewerage Network in Unauthorized Colonies and JJ Clusters ● Industrial Effluent Management by CETPs ● Sludge (Septage) Management ● Regulation of Floodplain ● Utilization of Treated Wastewater ● Other Issues (Land allotment, IEC, Monitoring etc.)	
16	Open Burning	MCD, NDMC, DCB, DSIIDC, F&CD, DFS, DDA, Revenue	● Enforcement: Municipal solid waste (MSW)/ Biomass Burning ● Strict vigilance on Dumping of Waste Strict vigilance on landfill fires 100% Collection of Waste	

17	Increasing Green Cover	Greening agencies, Department of Forest	Development of city forest, parks and gardens Extensive plantation drive during pre-monsoon. Development of green spaces at barren/ vacant lands	
18	Increasing Blue cover	Wetland authority of Delhi, Water bodies owning agencies	Restoration of water bodies in Delhi	

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

1. Special CEO (DM)- Nodal Officer for State.
2. Sub-divisional Magistrate of respective District – 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)	● Provide season report containing duration of Heat Wave, maximum temperature location wise. ● Obtain feedback on cases, plan and measures taken ● Revise plan accordingly ● Report to Government	

2.		Information & Public Relation (I & PR) Department	● Collect feedback on publicity, reach and implementation of plan from media and others sources. ● Collect all news items/ reports on Heat wave plan published/ telecast. ● Collect all news items/ reports on Heat wave.	
3.		Medical & Health Department and Medical Professionals	● Perform an epidemiological case review of heat- related mortality during the summer. ● Conduct and gather Epidemiological outcome from the data on heat risk factor, illness and death, based on average daily temperature. ● Incorporate data and finding into future versions of Heat Action Plan Measure ● Mortality and morbidity rates based on data before and after the plan's interventions.	
4.	Emergency Services	1077 Emergency Helpline No. Of Delhi	● Review implementation of Heat wave Action Plan. ● Obtain feedback on case, plan, and measures taken. ● Revise plan accordingly ● Report to Government	
5.		Labour & Employment Department	● Review implementation of Heat Wave Action plan. ● Obtain feedback on case, plan and measure taken. ● Revise Plan accordingly ● Report to Government	
6.		Transport Department	● Review implementation and effectiveness of plan ● Obtain and give feedback for further improvement of plan.	

7.		Education Department	- Review implementation and effectiveness of Plan. ● Obtain and give feedback for further improvement of plan.	
8.		Animal Husbandry Department	● Review implementation of Heat wave Action Plan. ● Obtain feed on cases, plan, and measures taken. ● Revise Plan Accordingly ● Report to Government	
9.		Information Technology (IT) Department	● Collect data of temperature. ● Collect data on number of downloads of mobile app & map accordingly.	
10.		NGOs, Community Group/ Individuals.	● Educate community on regular basis.	
11.	Increasing Green Cover	Greening agencies, viz. Department of Forest, PWD, I&FC, MCD, NDMC, DUSIB, DDA, etc.	● Development of city forest ● Extensive plantation drive ● Development of green spaces at barren/vacant lands ● Development parks and gardens	
12.	Increasing blue Cover	Wetland Authority of Delhi, Water bodies owning agencies	● Restoration of water bodies in Delhi	

4.1 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
Heat Exhaustion	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.
Heat		Feeling hot	Brief,	No seizure	Full	

Syncope	Adults	& weak; light-headedness followed by brief loss of consciousness	generalized loss of consciousness and short period of disorientation,	activity, no loss of bowel or bladder continence, no focal weakness, no aphasia	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
Heat Stroke	All	Severe overheating; profound weakness;	Flushed, dry skin (not always), core temperature ≥ 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
        - Anticholinergic drugs
        - Barbiturates
        - Diuretics
        - Alcohol
        - 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

4.4 Advisory issued by NDMA for Heat Wave Season

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	● To disseminate the advisory issued by NDMA for Heat Wave Season to the Line Departments. ● To create awareness amongst General Public regarding Heat Wave.	● To disseminate the advisory issued by NDMA for Heat Wave Season to the Line Departments. ● To create awareness amongst General Public regarding Heat Wave. ● To ensure that all the basic facilities	● Collect Feedback on action taken ● Conduct meeting to review implementation of Heat Wave Mitigation Measures.
2.	Delhi Jal Board	● Preparation for arrangement of Drinking Water	● Provision for Drinking Water	● Collect Feedback on action taken ● Conduct meeting to review implementation of Heat Wave Mitigation Measures.
3.	Department of Education	● Issue necessary directions on Heat Wave Mitigation Measures.	● Rescheduling of the timing of schools/ educational institutions	● Collect Feedback on action taken ● Conduct meeting to review implementation of Heat Wave Mitigation Measures.
4.	Directorate of Health Services	● Preparation for deployment of Medical team at	● To provide all Emergency Medical Services	● Collect Feedback on action taken ● Conduct meeting to review

		all Polling Stations	at all Polling Stations	implementation of Heat Wave Mitigation Measures.

(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 sever 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..

(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.
- Enforce changed timings of schools, colleges, institutions etc. as and when required locally

Chapter Five

5

Adaption and Mitigation Measures

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 Local bodies, 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.

- Delhi Government will work with NDMA and UNEP Cool Coalition to prepare a world-leading Delhi Cooling Action Plan in period 2025-27 to Beat the Heat, based on scientific assessment of UHIE following a UNEP methodology including long-term monitoring and evaluation of its interaction with urban air quality. Level of detail of analysis will be deepened over this period in collaboration with UNEP as part of the Swiss government funded BeCool project. As part of this, specific interventions and mechanisms will be identified for public and private investment to help improve indoor and outdoor thermal comfort, including for most vulnerable populations, and to enhance uptake of affordable and sustainable cooling with prioritization covering passive design in buildings, nature, heat-resilient urban design, and efficient and clean active cooling that limits impacts on the population, environment, economy and Delhi's power grid.

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 needs 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 adaptation.

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)

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

- 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

- Advice 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 Healh 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.

6.1 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 alerts 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.

6.2 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

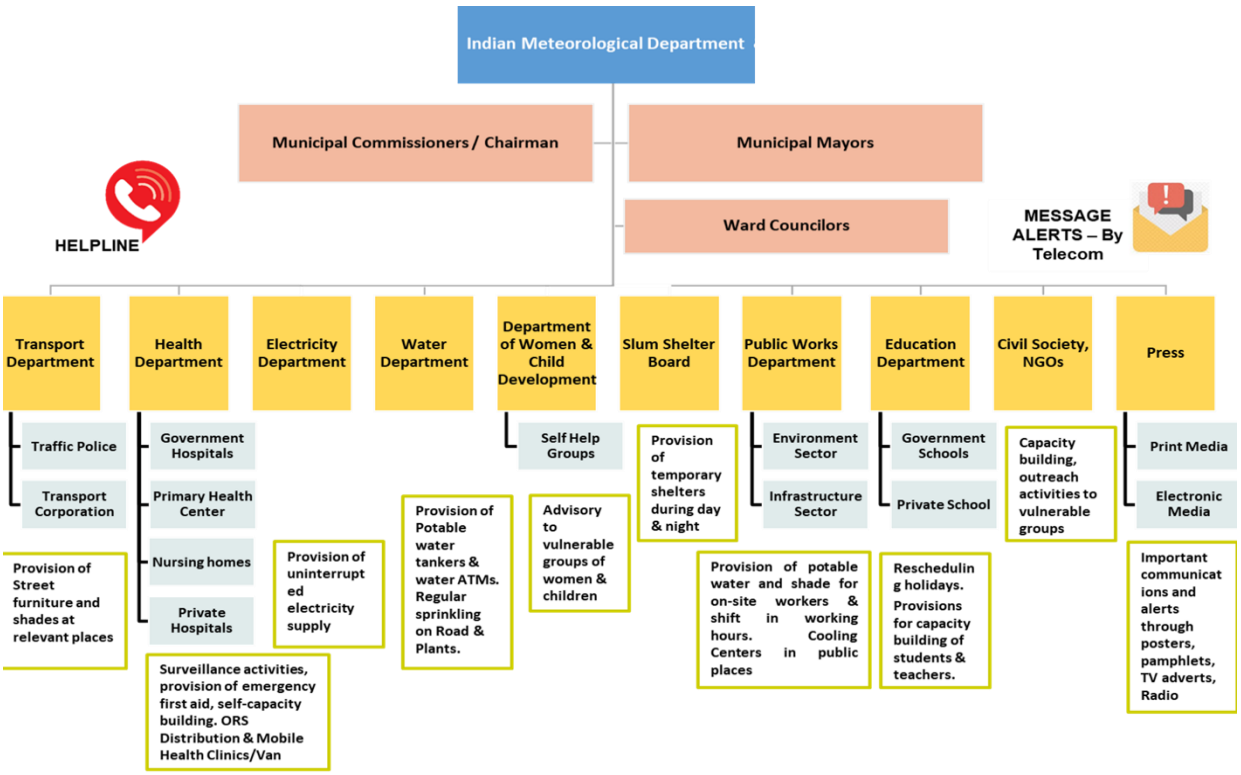
- Participate in annual evaluation of Heat Action Plan

6.3 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.



Chapter Seven
Case study-based details of potential solutions

7

This chapter provides details of the proposed solutions in the previous chapter based on selected case studies of their implementation across multiple countries. The following solutions have been proposed, catering to numerous thematic areas: EWS, infrastructure, public health resilience, and urban greening.

Table 1: Contents of the proposed solutions

Name of the solution	Theme and scale of the solution		
	Infrastructure	Public health	Sustainable urban planning
Green Roof	■		
Cool Roof	■		
Green Facade	■		
Cooling Shelter	■	■	■
Shade Structure on Footpaths			■
Urban Greenery			■
Cool Pavements	■		■
Development of Urban Acupuncture	■		■
Thatch / Palm leaves roofing.	■		
Hollow Concrete / Terracotta Tiles	■		

1. Name of Solution - Green Roofing Systems
Location - Open Roofs with direct exposure

A green roof is a layer of vegetation planted over a waterproofing system installed on top of a building. It helps mitigate urban heat by cooling the environment, reducing building temperatures, and improving overall thermal comfort.

Types of Green Roof Systems

Green roofs come in three main types: **extensive, intensive, and semi-intensive**, varying in design, vegetation, maintenance, and structural requirements.

Intensive Green Roof

*Intensive green roofs are **heavier and more complex** due to their deeper soil layer, often exceeding **6 inches**. This allows them to support a variety of plant species, including shrubs, perennials, and even small trees, creating a park-like setting. Due to their weight, these roofs require regular irrigation, maintenance, and structural reinforcement. They significantly contribute to urban cooling by absorbing and retaining heat, preventing temperature spikes in buildings, and improving air quality through excellent plant coverage.*

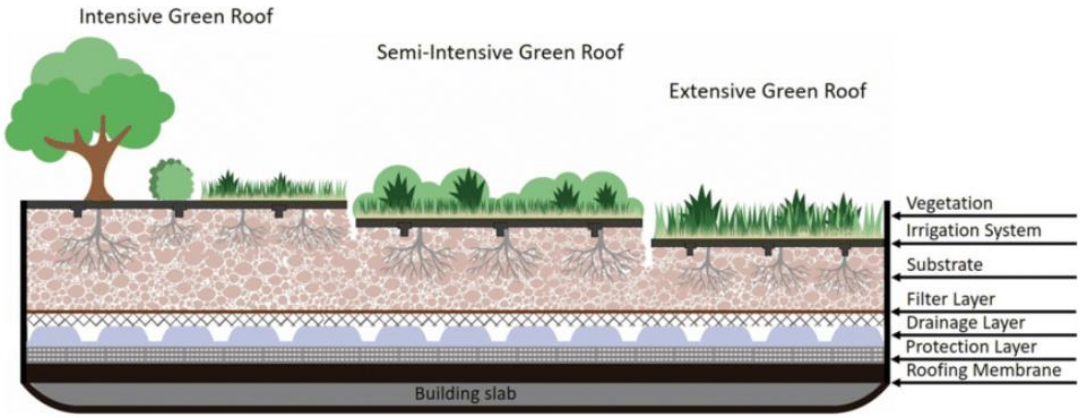
Semi-Intensive Green Roof

*Semi-intensive green roofs combine elements of both extensive and intensive systems. They can support a mix of grasses, ground covers, and small shrubs with a moderate soil depth. They require **intermediate levels of maintenance and irrigation** compared to intensive green roofs. These roofs are commonly used in commercial and institutional buildings where a balance between ecological benefits and functional aesthetics is needed.*

Extensive Green Roof

Extensive green roofs are the lightest and most low-maintenance type. They have ashallow soil depth, typically between **2 to 6 inches**, and support hardy, drought-resistant plants such as sedums, grasses, and mosses. These roofs are designed primarily for environmental benefits rather than aesthetic or recreational purposes. Because they require minimal irrigation and upkeep, they are ideal for retrofitting buildings with limited structural capacity.

Figure 1: Cross Section of Green Roof



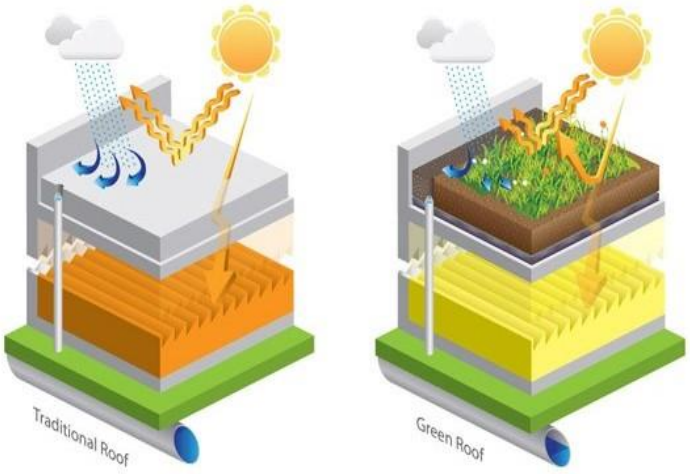
Source: Calheiros, Cristina, Stefanakis, Alexandros. 2021. Green Roofs Towards Circular and Resilient Cities. Circular Economy and Sustainability. 1. 10.1007/s43615-021-00033-0.

How green roofs help in reducing heat

Green roofs play a vital role in **reducing urban heat** through various natural cooling mechanisms:

1. **Evapotranspiration & Cooling:** Plants absorb and release water as vapor, naturally lowering surrounding air temperatures.
2. **Thermal Insulation:** The soil and vegetation act as a barrier, reducing heat transfer into buildings, leading to **lower indoor temperatures in summer** and **heat retention in winter**.
3. **Reduction of Urban Heat Island (UHI) Effect:** Several studies demonstrate that green roof temperatures can be 16–22°C (60.8–71.6°F) lower than that of conventional roofs. When transforming 80–90% of the roofs in a city to green roofs, they may reduce the average ambient temperature between 0.3°C and 3°C (32.5°F and 37.4° F) (Santamoursi 2014). Research conducted in Lagos , Nigeria, showed that a green facade reduces internal air temperatures by an average of 2.3°C (36.14°F) (Akinwolemiswa et al. 2018), and reduces the temperature of the facade itself between 2°C and 10°C (35.6°F and 50°F) compared to the natural stone (Eisenberg and Polcher 2020).
4. **Heat Absorption & Delayed Heat Release:** Green roofs absorb solar radiation and release it slowly, preventing temperature spikes during the day and stabilizing nighttime temperatures.

Figure 2: Heat Dissipation in Green Roof in contrast with Conventional Roof



Source: Heidarinejad, Ghassem and Arash Esmaili.2016. "Assessment of Green Roof Energy Savings compared to Conventional Roof.", Environmental Science, Engineering.199603023

Figure 3: Thermal Map of Roofs with green roof and conventional roof

On a typical day, the Chicago City Hall green roof measures almost 80°F (40°C) cooler than the neighboring conventional roof.

Potential Location of Implementation of Green Roof Systems

Source:

1. *World Bank, 2021. A Catalogue of Nature-based Solutions for Urban Resilience. Washington, D.C. World Bank Group*
2. *Akinwolemiwa, O., Bleil de Souza, C., De Luca, L. M., Gwilliam, J. 2018. Building community-driven vertical greening systems for people living on less than £1 a day: a case study in Nigeria. Building and Environment 131, 227-287. (10.1016/j.buildenv.2018.01.022).*
3. *Eisenberg, B. and Polcher, V. 2020. Nature-Based Solutions Technical Handbook. UNaLab Horizon. https://unalab.eu/ system/files/2020-02/unalab-technical-handbook-nature-based-solutions2020-02-17.pdf*
4. *Santamouris, M. 2014. Cooling the cities–a review of reflective and green roof mitigation technologies to fight heat island and improve comfort in urban environments. Solar energy, 103: 682–703.*

2. Name of Solution - Cool Roof Systems

Location - Open Roofs with direct exposure

A **cool roof system** is a heat-mitigating solution designed to reduce urban temperatures by reflecting more sunlight and absorbing less heat compared to conventional roofs. It plays a crucial role in **mitigating the urban heat island (UHI) effect**, lowering indoor temperatures, and improving energy efficiency. Ahmedabad, a city in India known for its extreme summer heat, has successfully implemented **cool roof strategies** to combat rising temperatures and enhance thermal comfort for its residents.

How Cool Roof Systems Work

Cool roofs utilize **high-albedo (reflective) materials** or **coatings** that reduce heat absorption and improve energy efficiency. These roofs can be categorized into:

1. **Reflective Coatings & Paints** – These are applied to existing roofs with high solar reflectance, reducing surface temperatures.
2. **Cool Roofing Sheets & Membranes** – Prefabricated sheets with reflective properties that minimize heat absorption.
3. **High-Albedo Tiles & Roofing Materials** – Light-colored, heat-reflective tiles that help keep rooftops cooler.

Conventional roofs can reach temperatures of 150°F or more on a sunny summer afternoon, sun. Under the same conditions a reflective roof could stay more than 50°F (28 °C) cooler**.**

Implementation of Cool Roofs in Ahmedabad

Ahmedabad, one of India's hottest cities, experiences summer temperatures exceeding **45°C (113°F)**. The city adopted **cool roof solutions** to address extreme heat conditions under its **Heat Action Plan (HAP)**. The initiative focused on:

1. **Pilot Cool Roof Program (2017)**

- Ahmedabad Municipal Corporation (AMC) launched a **pilot project** covering **3,000 low-income houses** with white reflective coatings, reducing indoor temperatures by **2–5°C** (NRDC 2017)
- The project focused on **slum areas, informal settlements, and public buildings**, where people were most vulnerable to extreme heat.

2. **Scaling Up in 2019**

- The **cool roof program expanded** to include more households, commercial buildings, and public infrastructure based on successful pilot results.
- The initiative encouraged **private developers** and homeowners to adopt cool roofing materials.

3. **Integration into Urban Planning (2020–Present)**

- AMC made cool roofs part of **building bylaws and urban heat resilience strategies**.
- Government and private agencies partnered to **subsidize** cool roofing solutions for low-income communities.
- Roof cooling materials such as **white lime coatings, solar-reflective paints, and cool tiles** were promoted citywide.

Benefits of Cool Roof Implementation in Ahmedabad

1. **Reduction in Indoor Temperatures**

   Cool roofs **lower indoor temperatures by 2–5°C**, improving thermal comfort, especially for vulnerable populations (NRDC 2017)

2. **Energy Savings & Reduced Cooling Costs**

   - A cool roof can reduce the amount of energy needed for air conditioning by up to 15 per cent on a single-story building, leading to substantial savings on energy bills (EESI 2012).

3. **Mitigation of the Urban Heat Island (UHI) Effect**

   - Large-scale implementation of cool roofs helps **reduce citywide temperatures**, making Ahmedabad more **resilient to heat waves**.

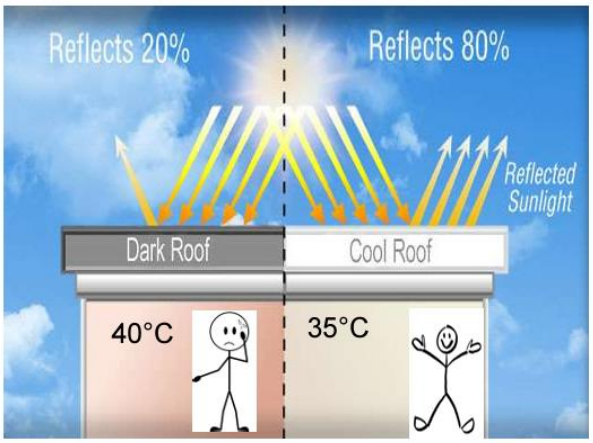
4. **Improved Public Health & Heat Resilience**

   - Reduced indoor heat exposure minimises **heat-related illnesses and deaths**, particularly for low-income communities and elderly populations.

5. **Scalability & Affordability**

- The Cool Roof program is **cost-effective**, requires minimal investment, and can be **easily implemented on new and existing buildings**.

Figure 4: Difference between Dark Roofs and Cool Roofs



Source: S. Himmelstein. 2017. "California Study: Cool Roof Technology impacts Air Quality

Source:

1. *United States Department of Energy. n.d. "Cool Roofs". accessed at https://www.energy.gov/energysaver/cool-roofs#:~:text=A%20cool%20roof%20is%20designed,a%20sunny%20summer%20afternoon%2C%20sun.*
2. *NRDC. 2017. "Cool Roofs: Protecting Local Communities from Extreme Heat"*
3. *EESI. 2012. "Fact Sheets: Cool Roofs" accessed at* https://www.eesi.org/papers/view/fact-sheet-cool-roofs#:~:text=A%20cool%20roof%20can%20reduce%20the%20amount,leading%20to%20substantial%20savings%20on%20energy%20bills.

3. Name of Solution - Ground-Based Green Facade and Facade Bound Greening
Location - Building Facade, Periphery of Building

Ground-based - Ground-based green facades are green walls with climbing plants rooted in ground planters. With adhesive pads as part of their anatomy, the climbing or self-clinging plants can grow directly on the wall or in a unique frame connected to the wall. The plants extract water and nutrients from the soil at ground level, grow very tall, and adjust to climate fluctuations and lighting conditions. Many flowering and evergreen species can add aesthetic experience to exterior walls, calm, and freshen the air

Figure 5: Ground-based green facades, either self-climbing or with the support structure

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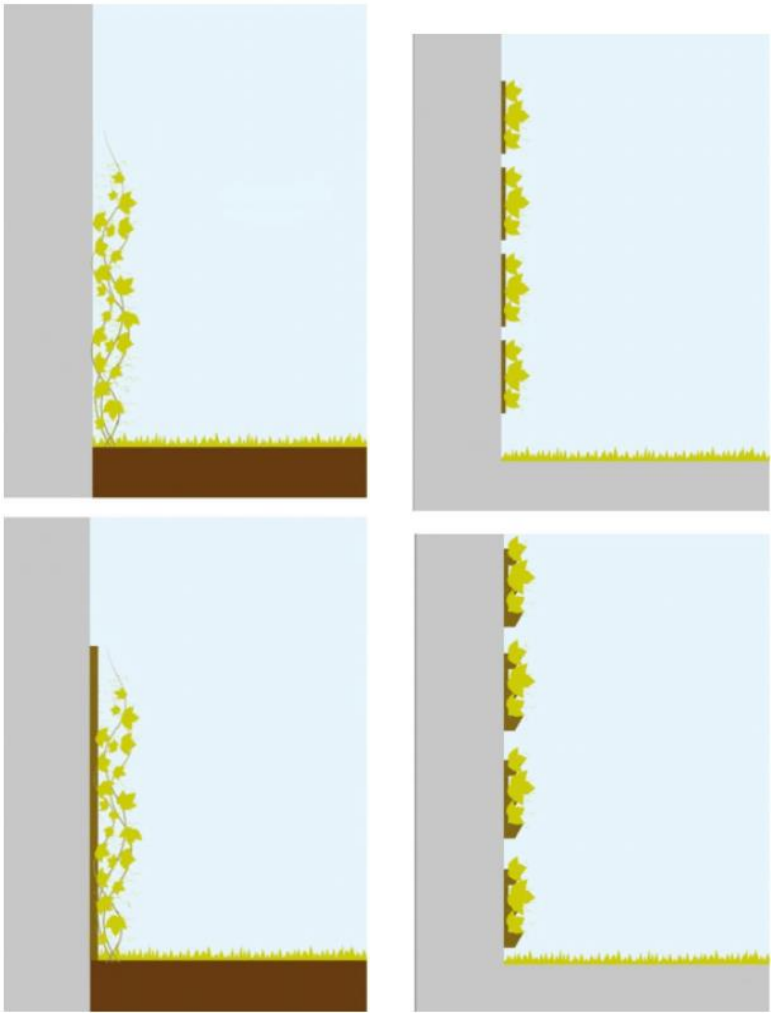


Source: Closing Water Cycles in the Built Environment through Nature-Based Solutions: The Contribution of Vertical Greening Systems and Green Roofs Water, 2021.

Facade-bound greening - Facade-bounded greening is a type of green wall using irrigation technology and unique substrates to reduce the weight of green facades. They are more expensive than ground-based greening and require higher use of resources in construction and maintenance. Facade-bounded greening allows for a combination of 10–15 plant species, most often mosses and perennials, and grows fast and uniform. The thin layer of soil inhibits their suitability in cold, temperate regions.

Figure 6: Wall-based green facades, either with panels attached to the wall or as stand-alone systems

Source: Closing Water Cycles in the Built Environment through Nature-Based Solutions: The Contribution of Vertical Greening Systems and Green Roofs. Water. 2021.

Heat Regulation

- The vegetation layer of the green facade absorbs solar radiation through photosynthesis, protects the heat transmission into the building, and provides shade if trees are planted. It reduces building temperature and cools the surrounding air.
- Research conducted in Lagos, Nigeria, showed that a green facade reduces internal air temperatures by an average of 2.3°C (36.14°F), and reduces the temperature of the facade itself between 2°C and 10°C (35.6°F and 50°F) compared to the natural stone (World Bank 2021)

Potential Location of Implementation of Green Facade Treatment

Source - *World Bank, 2021. A Catalogue of Nature-based Solutions for Urban Resilience. Washington, D.C. World Bank Group*

4. Name of Solution - Cooling Shelter

Location - Places of high footfall and pedestrian-intensive locations

Cooling shelters in cities serve as **climate-resilient spaces** designed to provide relief from extreme heat, particularly during heatwaves. These shelters are strategically located in **high-footfall areas such as bus stops, markets, parks, and transport hubs**, offering shaded and ventilated spaces for public use.

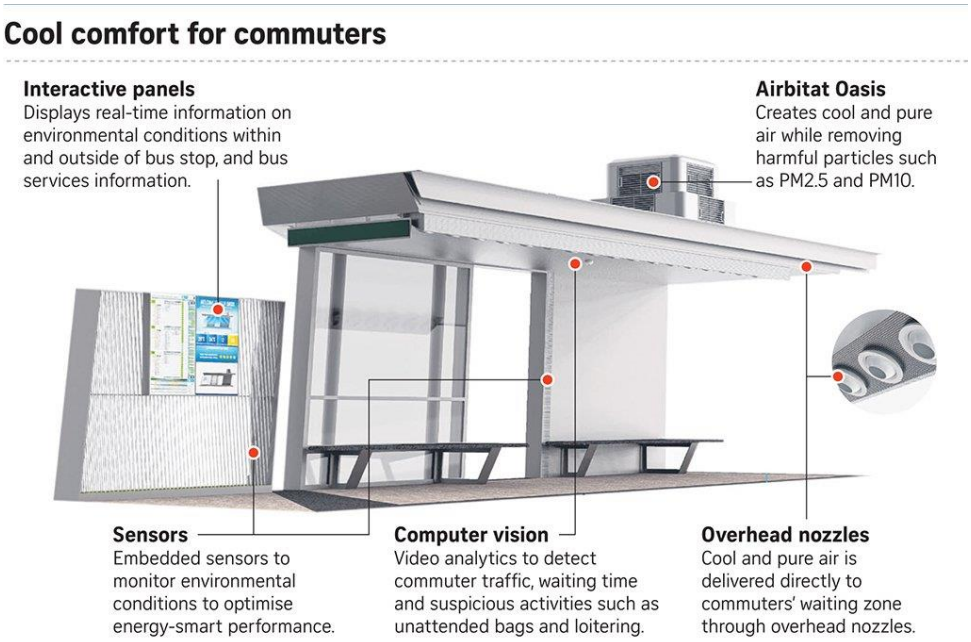
They incorporate **passive cooling techniques**, including **green roofs, bamboo or perforated structures, solar-reflective materials, and evaporative cooling systems**. Some shelters also integrate **water dispensers, misting systems, and vegetation** to enhance cooling further.

Cooling shelters help protect vulnerable populations, improve urban thermal comfort, and contribute to a city's **heat action plan by reducing** heat exposure and offering a comfortable resting place.

Figure 7: Cooling Shelter

Source: Freepik

Figure 8: Components of Cooling Shelter



Source: Ilyas Sholihyn. 2018. "Singapore trials 'smart' bus stop that tracks commuters detects shady activities, and blows cool air".

With more than 900 plus multi-purpose cyclone shelters, already established in the state, it provides a good opportunity to also leverage the existing infrastructure for a combination of passive cooling (green roofs, cool roofs) and active cooling solutions (misting, AC, fans).

Example of Jodhpur Cooling Shelter (NRDC 2024)

Figure 9: Ahmedabad Cooling Bus Shelter

Source: Ahmedabad Cooling Bus Stop

Source:

1. Hess, Jeremy.J. 2023. “Cooling Centres”, Risl Reduction Guidance
2. Open Gov. 2018. “Smart Bus Stop being trialled in Singapore to improve the commuter experience”, Singapore. accessed at https://opengovasia.com/2018/03/12/smart-bus-stop-being-trialled-in-singapore-to-improve-commuter-experience/

5. Name of Solution - Shading Structures on Footpaths
Location - Pedestrian Pathways

Shading infrastructure is crucial in **enhancing pedestrian comfort, reducing heat exposure, and improving walkability** in urban areas. Shading is an effective method of improving microclimate conditions in cities, and shading structures such as canopies and covered walkways can improve pedestrians’ thermal comfort in open urban spaces (Hsing-Yu Ou et.al 2023). By integrating shading solutions, cities can create **cooler, more comfortable, and safer pedestrian environments** while mitigating the **urban heat island (UHI) effect**.

Fabric Canopies & Tensile Structures(Latifa Sultana et.al 2019)

- Lightweight, **fabric-based shading systems** (e.g., tensile fabric canopies) offer **flexibility and easy installation**.

- Reflective or light-colored fabrics help **reduce heat absorption**.
- Ideal for **temporary events, public plazas, or narrow streets where trees cannot be planted**.

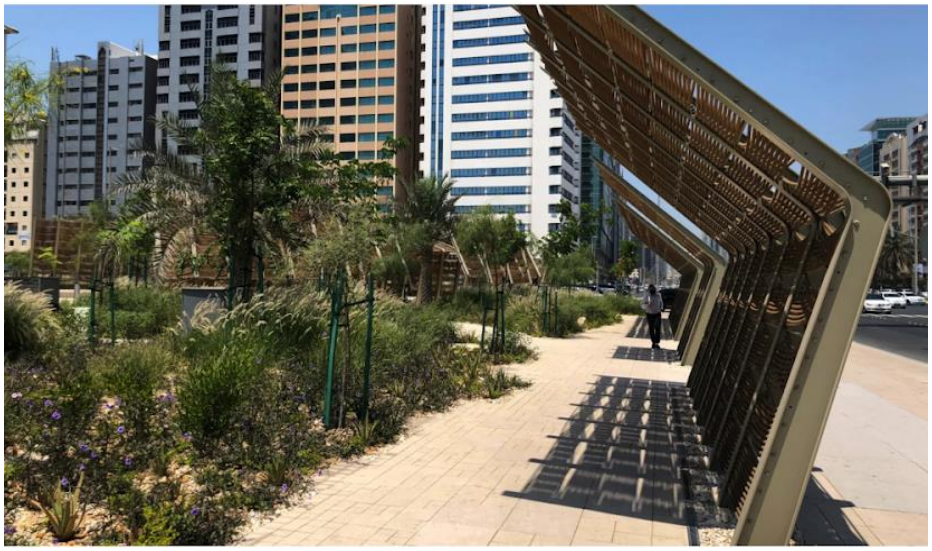
Bamboo & Wooden Shade Structures (Renwu Wu et al. 2023)

- **Sustainable materials** like bamboo and wood create **eco-friendly and visually appealing shading elements**.
- These can be used as **arched walkways, pergolas, or modular canopy designs**.
- Suitable for **urban promenades, cultural districts, and heritage sites**.

Benefits of Shading Infrastructure in Urban Areas

- **Enhances Pedestrian Comfort & Walkability:** Encourages people to **walk and use public spaces**, reducing car dependency.
- **Mitigates Urban Heat Island (UHI) Effect:** Reduces heat absorption from roads, buildings, and sidewalks.
- **Improves Public Health:** Lowers risks of **heat exhaustion, dehydration, and heat-related illnesses**.
- **Supports Sustainable Urban Design:** Integrating greenery and shading promotes **climate-adaptive city planning**.

Figure 10: Pedestrian Shelter



Source: Adele, Peters. 2021. "What US Cities can learn from Abu Dhabi about surviving record heat"

Source

1. Ou, Hsing-Yu, Tzu-Ping-Lin. 2023." *Effects of Orientation and Dimension of Shading Structure on Thermal Comfort". vol(243).* https://doi.org/10.1016/j.buildenv.2023.110715
2. Sultana, Latifa, Bari, Nafisa. 2019. *"A Study on the Impact of Tensile Fabric Structure in Semi-Outdoor Spaces of Tropical Cities".* International Journal of New Innovations in Engineering and Technology. vol(10)
3. Wu, Renwu, Na Wu, Xinge Nan, Hai Yan, Ke Wang, Tingting Ma, Juan She, and Zhiyi Bao. 2023. "*Effects of the Bamboo Communities on Microclimate and Thermal Comfort in Subtropical Climates*" *Forests* 14, no. 6: 1231. https://doi.org/10.3390/f14061231

6. Name of Solution - Urban Greenery

Location - Locations in cities with exposed pavements, exposed roads, and locations with less green covers

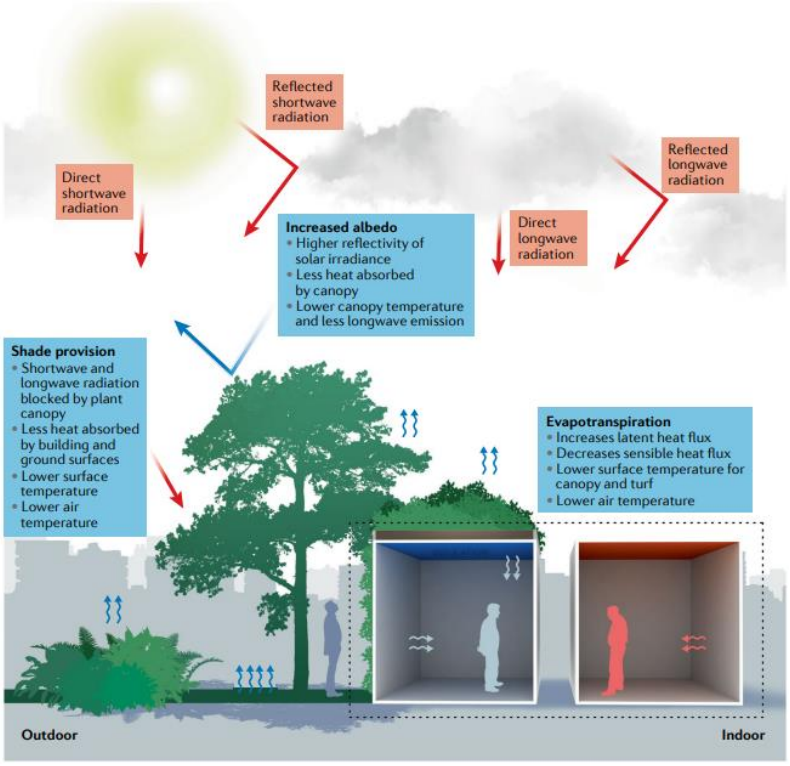
Urban greenery modifies shade provision, evapotranspiration, and albedo. Combining these three mechanisms reduces sensible heat gain, lowering heat gain and surface temperatures. Red boxes indicate warming mechanisms and blue boxes indicate cooling mechanisms.

How Urban Greenery Reduces Heat (Nyuk Hien Wong et al. 2021)

1. **Shade Provision**
   - Trees and vegetation block direct solar radiation, reducing the heat absorbed by buildings, roads, and ground surfaces.
   - This leads to lower surface temperatures and cooler surrounding air, creating shaded microclimates that enhance pedestrian comfort.

2. **Increased Albedo Effect**
    - Green canopies reflect more sunlight than dark urban surfaces, reducing heat absorption.
    - Lower canopy temperatures result in less longwave radiation emission, which helps cool the environment.
3. **Evapotranspiration Cooling**
    - Plants absorb water through their roots and release moisture through evapotranspiration, increasing humidity and reducing surrounding air temperature.
    - This process also lowers surface temperatures of green spaces, rooftops, and walls, preventing excessive heating of urban structures.

Figure 11: Factors contributing to UHI in cities



Source: Nyuk Hien Wong, Chun, Liang Tan, Dionysia, Denia Kolokotsa and Hideki Takebayash. N.d. "Greenery as a mitigation and adaptation strategy to urban heat".

Case Studies - Singapore Green Plan (2030)

The **City in Nature program**, launched in 2020, was a key initiative under **Singapore's Green Plan 2030.** It aimed to transform the country into a green, livable, and sustainable home for its citizens by 2030 (Green Plan Singapore 2023).
By 2030, Singapore intends to introduce **200 hectares of skyscraper greenery and plant over 170,000 more trees in industrial areas**, bringing nature into the city's dense urban fabric.

To improve accessibility to green spaces, Singapore committed to strengthening connections between green spaces by constructing **300 kilometers ofNature Ways and 500 kilometers of park connectors**. This would ensure that every household was within a 10-minute walk of a park.

Singapore Therapeutic Garden

- These gardens are designed based on scientific research to **encourage interaction with nature**, **enhancing the overall well-being** of visitors and residents (Green Plan Singapore 2023).
- These gardens are carefully planned spaces that provide a **calm and natural environment to promote relaxation, reduce stress, and improve mental and emotional health**. They aim to offer a restorative experience for individuals of all ages.

Figure 13: Therapeutic Garden

Source

1. Wong, N.H., Tan, C.L., Kolokotsa, D.D. *et al.* Greenery as a mitigation and adaptation strategy to urban heat. *Nat Rev Earth Environ* 2, 166–181 (2021). https://doi.org/10.1038/s43017-020-00129-5
2. Singapore Green Plan. 2023. "*A City of Green Possibilities".* accessed at https://www.greenplan.gov.sg/

7. Name of Solution - Cool Pavements
Location - Pedestrian Pathways and locations with high footfalls

Cool Pavements and Their Implementation in Urban Areas

Cool pavements are specially designed surfaces that reduce heat absorption and **lower urban temperatures** than conventional asphalt and concrete pavements. These pavements are essential in mitigating the **urban heat island (UHI) effect**, as traditional dark-colored roads and sidewalks absorb and retain heat, increasing surface and air temperatures.

Cool pavements use materials and technologies that **reflect more sunlight, absorb less heat, and enhance cooling**. They are categorized into:

1. **High-Albedo Pavements** – These pavements have **light-colored or reflective surfaces** that reduce heat absorption and increase solar reflectance (albedo), keeping temperatures lower.

2. **Permeable Pavements—**Made of materials like porous asphalt, permeable concrete, or interlocking pavers, permeable pavers allow water to seep through, reducing surface temperatures through evaporative cooling.

3. **Evaporative Pavements** contain water-retaining materials that **absorb and release moisture through evaporation**, cooling the pavement surface.

4. Benefits of Cool Pavements and Evaporative Pavements Work

Cool Pavements

1. **High reflectivity (Albedo Effect):** They reflect more sunlight rather than absorbing it as heat (Taha H et al. 2002).

2. **Lower surface temperatures:** Studies show they can be **10-20°C cooler** than traditional asphalt (Sophia Kappou et al. 2022).

3. **Durability & Sustainability:** Many superb pavement materials are designed to be **longer-lasting** and reduce energy costs.

Evaporative Pavements

1. **Moisture retention:** These pavements contain hydrophilic materials that **store water and gradually release it** through evaporation.

2. **Heat dissipation:** The evaporative cooling effect lowers surface temperatures, making surrounding areas more comfortable.

3. **Permeability:** They allow rainwater infiltration, reducing runoff and improving groundwater recharge.

Actionable Implementation of Cool Pavements in Urban Areas

1. **Public Spaces & Sidewalks** – Applying cool pavement coatings to pedestrian pathways and public squares reduces surface heat and improves walkability.

2. **Roadways & Parking Lots** – Using high-reflectivity materials in parking areas prevents excessive heat accumulation.

3. **Playgrounds & Sports Courts** – Implementing cool pavement surfaces in schools and parks enhances thermal comfort for children and athletes.

4. **Bus Stops & Transit Hubs** – Applying permeable and evaporative pavements in transportation areas lowers heat stress for commuters.

5. **Residential & Commercial Driveways** – Using permeable concrete or reflective coatings in driveways improves local cooling and stormwater management.

Figure 14: Types of cool pavements and their uses

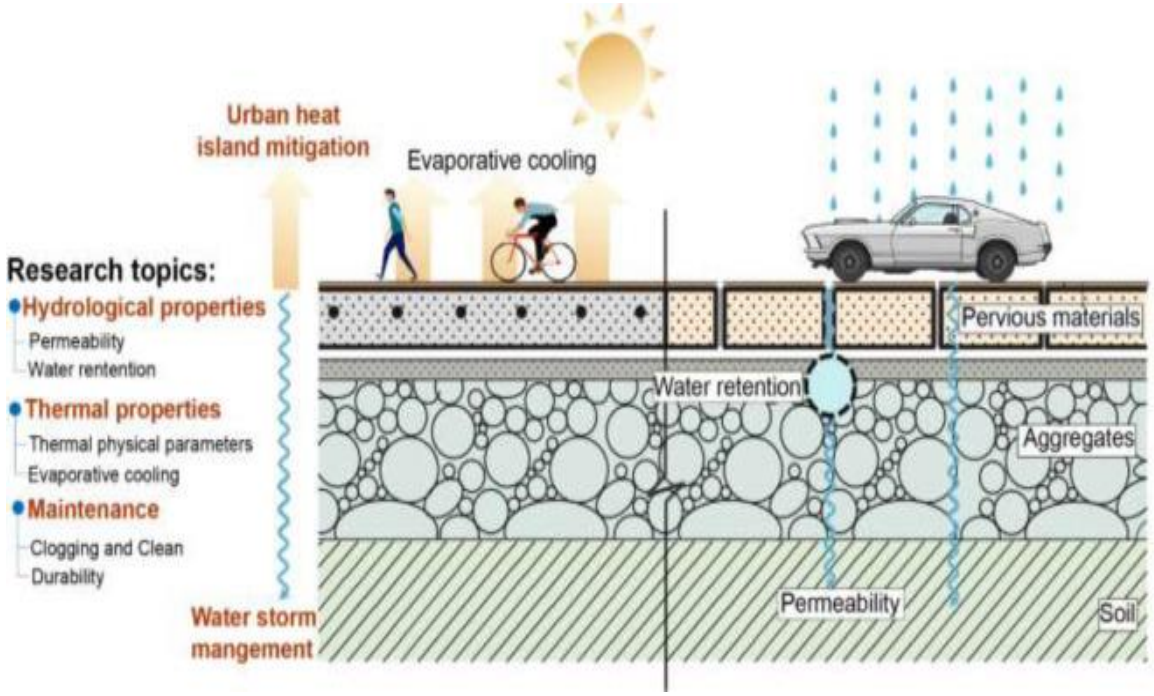
Pavement type	Solar Reflectance (SR)	Uses	Pavement surface life
Clear Resin Binders	Depends on aggregate	New construction & maintenance for streets, sidewalks, parking lots, etc.	20 years
Coatings (e.g., cementitious coating, elastomeric coating)	New: 35–55%	Coatings for preventive maintenance for streets, driveways, parking lots, etc.	1 to 5
Light-Colored Aggregates (e.g., chip seal)	Depends on aggregate	Overlay for preventive maintenance for highways, streets, parking lots	2 to 5 years
Light-Colored Cement (e.g., slag, white cement)	New: 70–80%	New construction & maintenance for highways, streets, sidewalks, parking lots, etc.	40 years
Porous Asphalt Cement (AC), Pervious Portland Cement Concrete (PCC), & Reinforced Grass Pavements	Depends on pavement type	New construction, to aid with stormwater management	varies
Portland Cement Concrete (PCC)	New (gray cement): 35–50% Aged (gray cement): 20–35%	New construction & maintenance for highways, streets, sidewalks, parking lots, etc.	40 years

Cool pavements are **cost-effective, environmentally friendly, and improve urban resilience** against extreme heat. Their integration with **green infrastructure**, such as **tree-lined streets and shaded pedestrian pathways**, further enhances city cooling benefits.

Figure 15: Dark Pavements v/s Cool Pavements

Source: Lui, Hui, John, Harvey, Arash, Saboori, Ali, A Butt. 2017. "Development and Application of LCA Tool for Cool Pavement". University of California

Figure 16: Evaporative Cooling



Source: Performance synergism of previous pavement on stormwater management and urban heat island mitigation: A review of its benefits, key parameters, and co-benefits approach. Water Research. 2022

The UHI effect is due to the materials used in the construction of urban areas, which absorb and store more heat during the daytime than rural areas, later releasing it and boosting afternoon and night-time temperatures.
Reflective pavements (RP) r**educe the amount of light** and, therefore, heat absorbed by pavements. Reflective materials can be used to coat existing pavements or to construct entirely new ones.

Figure 17: Thermal Infrared Vision of cool pavements compared to a normal asphalt road

Thermal infrared (left) and visible (right) images of a road with light and dark segments. The infrared image shows that the light segment (bottom) is about 17°C (30°F) cooler than the dark segment (top). (Image courtesy of Larry Scofield, APCA)

Source

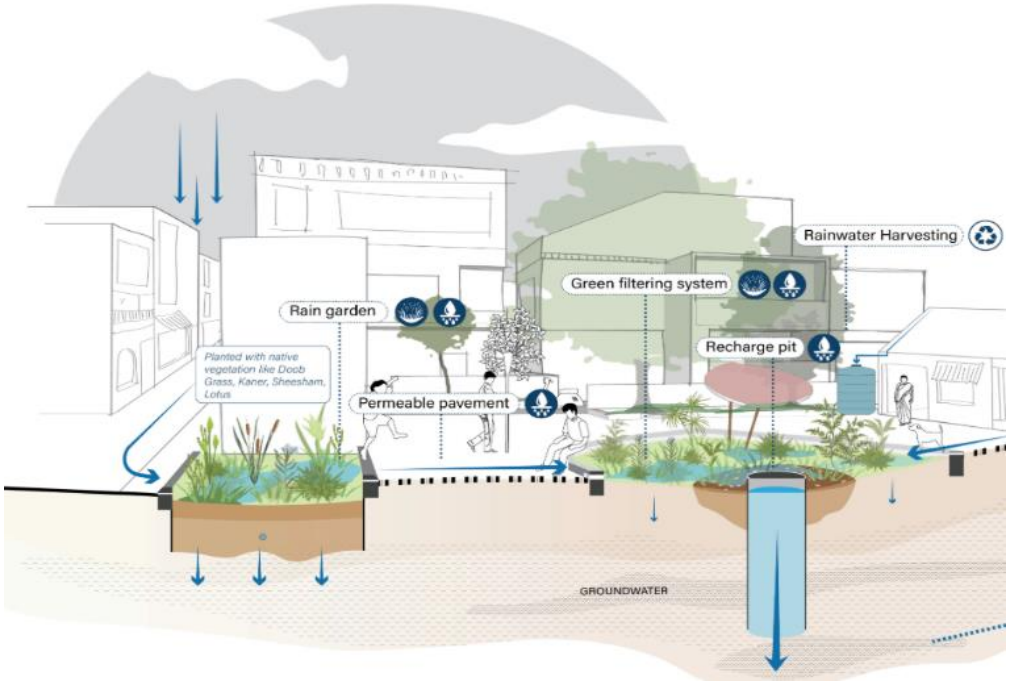
1. USEPA. 2024. "*Using Cool Pavements to Reduce Heat Islands". accessed at* *https://www.epa.gov/heatislands/using-cool-pavements-reduce-heat-islands*
2. Kappou, Sophia, Manolis Souliotis, Spiros Papaefthimiou, Giorgos Panaras, John A. Paravantis, Evanthie Michalena, Jeremy Maxwell Hills, Andreas P. Vouros, Aikaterini Ntymenou, and GiouliMihalakakou. 2022. "Cool Pavements: State of the Art and New Technologies" Sustainability 14, no. 9: 5159. https://doi.org/10.3390/su14095159
3. H, Taha, Hammer H, Akbari H. 2002. Meteorological and air quality impacts of increased urban surface albedo and vegetative cover in the greater Toronto area, Canada. Lawrence Berkeley National Laboratory report No. LBNL-49210. Berkeley, CA.

8. Name of Solution - Development of Urban Acupuncture

Location - Urban Voids, Pocket Parks, Kitchen Gardens in Hospitals

Areas with high public activity levels can be used to incorporate the Disaster Risk Reduction (DRR) concept. These public spaces can also leverage the **small niches, corner greens/buffers, and neighborhood parks to be holistically developed into blue-green acupunctures of varying scales**. Multiple acupuncture points can also be designed in conjunction. For example, recharge wells can be part of a stormwater park that can help improve the overall livability of the area. If the groundwater level is shallow, water collected into these wells can be treated using native plants. In cases where it's deep, the water can retain and recharge naturally.

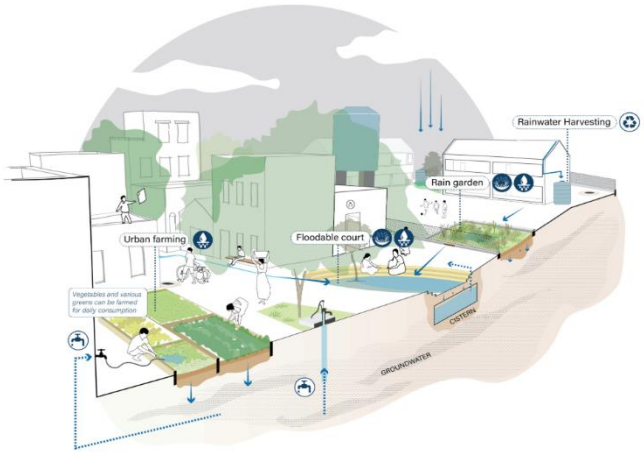
Figure 18: Development of Urban Blue-Green Acupuncture



Source: *WRI India. 2021, "Creating a flood resilient Indian "Sheher" through Water Sensitive Urban Design"*

In cities, the marginalised neighborhoods are adversely affected by flooding and are further crippled with challenges such as inadequate access to WASH and the right to healthy spaces. These urban settlements are highly dense, organic, and lack open spaces; the blue-green acupunctures will have multi-functional and circular values. Small pockets of open spaces (community kitchen gardens, wetlands) will be carved up, which can be synergistically designed to provide clean water, livelihood, and public green spaces. Efficient rainwater harvesting and recharge wells can ensure access to safe, clean water for the community.

Figure 19: Leveraging small open spaces to act as temporary ground for water



Source - WRI India. 2021, "Creating a flood resilient Indian "Sheher" through Water Sensitive Urban Design"

9. Name of Solution - Thatch / Palm Leaves for roofing

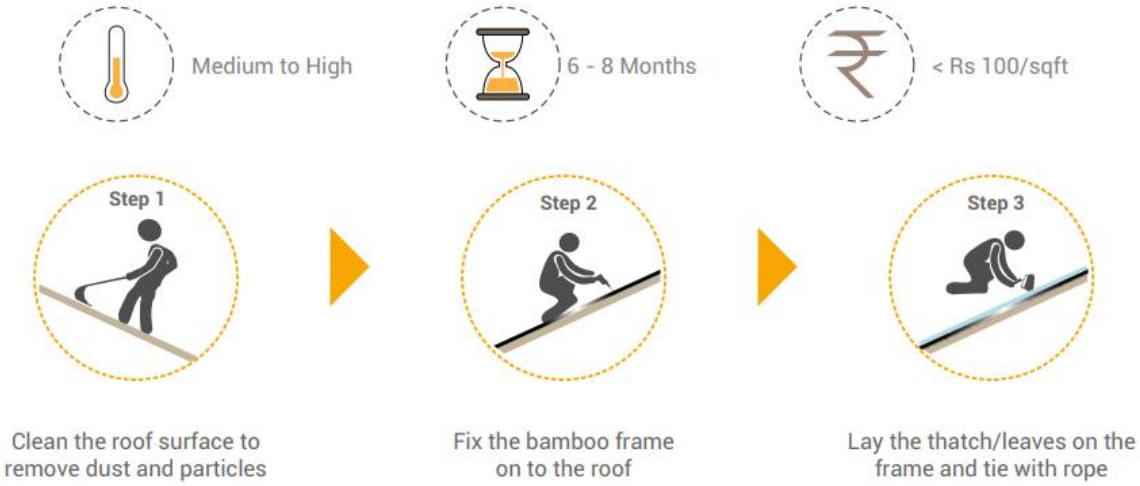
Location - Rural and Peri-Urban Areas

Bamboo, Thatch, and palm leaves are locally available across India and can be installed as a secondary roof screen, reducing the heating effect.

Traditional materials like bamboo, thatch, and palm leaves offer excellent heat mitigation and solar reflectance benefits, making them ideal for sustainable architecture.

With natural light tones, thatch and palm leaves reflect some solar radiation while providing effective insulation due to the trapped air within their fibers, keeping interiors cooler.

When used in slatted or woven forms, bamboo creates a semi-permeable barrier that allows light and air to pass through, reducing heat buildup.



Method for Installation

Figure 20: Deployment of Thatch / Palm leaver over roofs

Source: *NDMA 2021 “House Owners’ Guide to Alternate Roof Cooling Solutions," New Delhi*

Source -

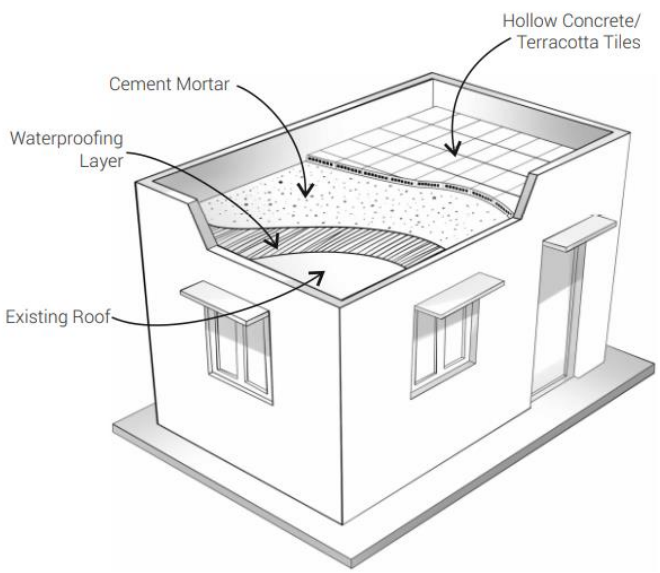
1. *NDMA (2021) “House Owners’ Guide to Alternate Roof Cooling Solutions," New Delhi*

10. Name of Solution - Hollow Terracotta/ Concrete Tiles

Location - Exposed Rooftops

- Hollow concrete/terracotta tiles have high thermal and sound insulation properties, limiting heat flow. The air inside the cavities provides insulation from heat.
- Hollow concrete tiles contribute to heat mitigation by enhancing thermal insulation and reducing heat absorption. Their **hollow cores trap air as a natural insulator, slowing heat transfer and cooling surfaces**.
- Unlike solid concrete, which retains heat and radiates it back into the surroundings, hollow tiles minimize thermal mass, reducing the urban heat island effect.
- Additionally, their design allows for **better airflow, further aiding in cooling by dissipating trapped heat**.
- Hollow concrete tiles can significantly lower surface temperatures, creating a more comfortable microclimate, especially in hot and humid regions when used in pavements, roofs, or facades.
- Their ability to accommodate **water-permeable designs also supports cooling through evaporative effects**, enhancing their role in sustainable urban development.

Figure 21: Deployment of Hollow Concrete / Terracotta Tiles on existing roofs



Source: *NDMA. 2021 "House Owners' Guide to Alternate Roof Cooling Solutions," New Delhi*

Source -

1. *NDMA (2021) "House Owners' Guide to Alternate Roof Cooling Solutions," New Delhi*

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

EMERGENCY TOLL FREE NUMBER		
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

Nodal Officers

GOVERNMENT OF NCT OF DELHI
DELHI DISASTER MANAGEMENT AUTHORITY,
DIVISIONAL COMMISSIONER, REVENUE DEPARTMENT (HQ),
B- Block, 5, SHAM NATH MARG, DELHI-110054 Email: ddma.delhi@nic.in
Toll free No. 1077 (24X7) Ph. No. 011-23982164

F. No. 1(393)/DDMA(HQ)/Heat Wave/2019/Part File-1/811 Dated: 17/04/2025

ORDER

In reference to the order No. F. No. 1(393)/DDMA(HQ)/Heat Wave/2019/Part File-1/478 Dated 28.04.2024 regarding nomination of senior level Nodal Heat officer at State and each of the district level (SDM level) for heat wave management.

In this regard, the update order for designate as Chief Heat Officer for the State of Delhi and Nodal Heat Officers for all 11 Revenue district are as follow: -

S. No.	Name of the state/ District	Designation
1.	Delhi	Special CEO (Disaster Management)
2.	East (Delhi)	SDM (Preet Vihar)
3.	West (Delhi)	SDM (Patel Nagar)
4.	North (Delhi)	SDM (Alipur)
5.	South (Delhi)	SDM (Meharauli)
6.	North-East (Delhi)	SDM (HQ) District North-East Delhi
7.	North-West (Delhi)	SDM (Kanjhawala)
8.	South-East (Delhi)	SDM (HQ) District South-East
9.	South-West (Delhi)	SDM (Najafgarh)
10.	Central (Delhi)	SDM (Kotwali)
11.	New Delhi (Delhi)	SDM (Delhi Cantt.)
12.	Shahdara (Delhi)	SDM (Vivek Vihar)

The copy of Heat Wave Action Plan for the year 2025-26 is enclosed herewith for kind reference.

This issues with prior approval of competent authority.

(Parmod Kumar)
Sub-Divisional Magistrate
Delhi Disaster Management Authority

To,

All the Concerned officers.

Copy to:

1. Director (NDMA), Govt. Of India, NDMA Bldg.A-1, Safdarjung Enclave, New Delhi -10029.
2. PS to Chief Secretary, Delhi,5th Level, Delhi Secretariat, Delhi -110002.
3. PA to ACS (Revenue)-cum-Divisional Commissioner,5, Sham Nath Marg, Delhi-110054.
4. System Analyst, Revenue Department (HQ), GNCT of Delhi, 5 Sham Nath Marg Delhi-54.

(Parmod Kumar)
Sub-Divisional Magistrate
Delhi Disaster Management Authority

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Annexure – 1:
Delhi Heat action implementation template, District-wise

Delhi Heat action implementation template, District-wise

Delhi Heat action implementation template, District-wise

Name of District:
Summer Season: April- August
Name of the Subdivisional Magistrate:
Knowledge Partner:
***When the actual maximum temperature remains 45 degrees Celsius or more irrespective of the normal maximum temperature, heat waves should be declared.**

PREPARDNESS EARLY WARNING/ Advisories / Instructions							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline (April -July)**	**Target area/ Audience**	**Funds required**	
1.	Change working hours for the labour department Alternate Action- Protect Occupational Groups from Heat Stress	Develop labour guidelines for prevention of heat stress among workers such as changing working hours (curtail afternoon work), mandatory rest, and availability of water, shade and cooling centers for the workers, Guaranteed pay (parametric insurance) in case of prolonged heat waves Heat preparedness measures at labour	**NDMA, DDMA and Labour Dept GNCTD, Municipal Corporation, Concerned KP, Private Sector- Industry Bodies, Gig Workers associations, E-commerce platforms, Indoor workers- especially House helps, Self Employed Womens Associations etc.**				

		chowks. Free access to public parks and Extension of opening hours, especially during afternoon hours for enabling resting place for outdoor workers. In addition to drinking water facility, improvements in public toilets, especially for women so that water consumption is not reduced due to unavailability of public restrooms . Conduct awareness sessions at labour chowks or worksites, Distribution of Heat-Relief Kits Explore the possibility of ClimaHealth Atlas as a Digital cool-route-map of the					

		closest cooling structures, public parks, ambulance service, health centre, police station					
2.	Modify preschool, school and college operational guidelines	Shift operational school hours to prevent heat stress during the summers. Paint roofs with white paint to improve indoor temperature. Availability of water, ORS, and Shade near school playgrounds, school buses. Trained staff of the entire school system- including teachers, drivers, helpers, etc., for early identification and appropriate management (including onsite	**NDMA, DDMA and DoE, Concerned KP SEEDS**	**April- July**	**East, North, North West, South East Delhi (Informal settlements including schools) (SEEDS)**	**No**	

		rapid cooling) of heat exhaustion, syncope, cramps and heat stroke. Urine Colour chart in schools to assess the hydration status of children and adolescent girls. Engage school children and adolescents in increasing community action and awareness. Establish Buddy System in schools and colleges. Safe and pleasant transport to and from school including public transport. Encourage, light-colored, loose-fitting uniforms					

		Provide a heatmap of schools in Delhi – low, moderate, high, very high for targeted school hour planning					
3.	Install weather stations (AT & RH sensors) across the city for continuous monitoring of AT (Air Temperature) and RH (Relative Humidity)	Monitoring outdoor air temperature and relative humidity across the city (example on key traffic signals/ junctions) will support preparedness for early action in hot pockets of the city and issue warning at spatial level. This will also enable live microclimate data monitoring and generated from various districts to understand which are warmer neighbourhoods of the city. This is similar to current Air Quality Index monitored across the city.	**DDMA, SEEDS**	**April- July**	**East, North, North West, South East Delhi (Informal settlements)**		

		Integration with citizen-reported data: Apps or SMS-based systems where people can report symptoms or hotspots can enhance ground truthing. Live dashboard visualizations: A centralized portal (publicly accessible or for internal agencies) showing live AT, RH, UHI, hospital admissions, etc.					
4.	Prepare the city UHI map to identify hot spots to prioritize action for preparedness	UHI maps following the NDMA- UNEP-CEPT UHI assessment methodology will help the city identify hot spots and prioritize preparedness action in the hot spots	**DDMA/ KP**				
5.	Establish localised heat thresholds	Each district to establish their own thresholds by	**No immediate action , UC Berkley and IMD to**				

		utilizing percentile-based systems derived from regional temperature data over the past five years and eventually by correlating mortality or morbidity data with weather conditions such as heat and humidity. Integrate data from UCB and IMD along with Resilience360 AI/ML-based severity of heat risk based on built-environment as a dashboard view of localized threshold and impact. Sachet/ CAP	**support pilots, Concerned KP** **NDMA**				
6.	Targeted communication and engagement of	District wise shortlist special need population, trade groups that are particularly over	**ADRA India**	**April- June**	**Southeast Delhi/ Informal workers, migrants,**	**NA**	

	at-risk **trade-groups** Communities including markets, cooperatives, and special need population	exposed to adverse impact of heat to develop an outreach and communication plan with men and women.			**urban slum population, SHGs, Children, Women.**		
7.	Heat-Ready Public Places	Improve Ventilation, shading, cool roof paint, water availability and clean restrooms at public places that see heavy footfall-metros, bus stops and markets. Install Ice Slurry Stations and Free Cold UV-Purified Drinking Water Units	**ADRA India** **IECC-UC Berkeley for Ice-Slurry Machine Pilot**	**May**	**Southeast Delhi/ Informal workers, migrants, urban slum population, SHGs, Children, Women**	**NA**	

PREPAREDNESS Database							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
8	Improve heat-health surveillance	Develop improved data collection and reporting practices for heat-related mortality and morbidity, including explicit indicators for reproductive health, at the minimum, effects on pregnant women (UN Women). Digitize data management by integrating UCB's data collection metrics with Resilience360 ground-truthing tool and reporting platform to bring efficiency in data management	**UC Berkley to guide Health department, Concerned KP**				
9	Heat impact assessment framework	Develop heat impact assessment indicator framework	**NDMA, RMI, DDMA, CDRI**	We will be able to	MoHUA, Department of Education,	No	

	(power outage, food distribution, PDS)	for mapping of sectoral impacts of heat on different urban systems		complete this by December	Academica, Decision makers, Philanthrophies		
10	Quick response teams and volunteers to manage heat related illnesses in field and during transit to health facility (Apada Mitra, Redcross etc.)						
11	Geo-tagged list of health facilities equipped for managing minor, moderate and severe heat related illnesses (UPHC, Speciality hospitals and Medical Colleges, both	Readily available data on the nearest health facility with capability to treat heat related illnesses					

	public and private)- for both adult and children						
12	List of Public shelter homes where people in transit, homeless, can poor sleep at night	Well ventilated, cool shelter homes with provision of water and restrooms					
	Data on presenting symptoms and treatment provided from ambulance services (including private ambulances)						
13	Database from insurers on admissions with diagnoses related to heat stress						

PREPAREDNES AWARENESS AND PUBLICITY							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
14	IEC campaigns for vulnerable groups	Pre-record messages or schedule social-media posts with extreme heat warnings in Hindi,English and regional languages for IEC campaigns for better reach. Information can be disseminated via phones, posters, public speakers, radio, TV, newspapers and LED TV displays of water machines and others at public places ensuring that women inside homes are able to access these messages through	**NDMA** **UNICEF , UN-Women, UNEP, assigned KP of the concerned district, and DDMA** **IECC-UC Berkeley to help in designing risk-communication** **ADRA India** **SEEDS**	**April- Aug** **April- July**	**Southeast Delhi/ Informal workers, migrants, urban slum population, SHGs, Children, Women** **SEEDS: East, North, North West, South East Delhi (Informal Settlements)**	**NA**	

		at least one mode of communication (UN Women). Explore possibility for automated and targeted multi-lingual dissemination – both omni-channel and multi-channel, both text and digital displays					
15	Health emergency services	Displays on ambulances to build public awareness. Utilize ClimaHealth Atlas asDigital cool-route-map of the closest cooling structures, ambulance service, health centre, police station	**Health Department, assigned KP of the concerned district, DDMA**				
16	Targeted awareness campaigns for occupationally heat-exposed	Conduct awareness campaigns for those professions occupationally exposed to high heat, such as the	**Health Department, Police Department, Labour, Concerned KP, DDMA** **ADRA India**	**April - June**	**Southeast Delhi/ Informal workers, migrants, urban slum**	**NA**	

	workers	police personnel, logistics workers, construction workers etc on the health impacts of extreme heat and measures to prevent heat stress. This includes women working within homes (cooking in kitchens or home-based contract work for low income women) with poor ventilation for extended durations of time, by extension this applies to non-home based men & women working in similar heat-trap contexts (such as food sector workers) (UN Women). Make aware the population on ClimaHealth Atlas as Digital cool-	**SEEDS**		**population, Women** **East, North, North West, South East Delhi (Informal Settlements**		

		route-map of the closest cooling structures, ambulance service, health centre, police station					
CAPACITY BUILDING PREPARDNESS							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
17	Cool vests/jackets for outdoor personnel	Provide cool vests/jackets to police, traffic personnels and to prevent heat stress during summers. Develop Digital heat-risk map of police post for personnel allocation	**Delhi Police, Concerned KP, DDMA ADRA India**	**May**	**Police officials on beat duty**	**NA**	
18	Capacity building for health sector	Training programmes, capacity-building efforts for medical institutions and healthcare workers including nursing	**Health Department, Concerned KP, DDMA** **ADRA India**	**April - June**	**Southeast Delhi/Frontline health workers**		

		staff, paramedics, and frontline workers to diagnose, manage and report heat related illnesses including heat stroke and deaths and illnesses through national and state heat health reporting mechanisms. Develop Simulation-based Playbook with ClimaHealth SOP (a) map the risk of health Centre and neighborhood, (b) plan OPD staffing, inventory of medical supplies based on risk profile (c) report using centralized digital tool as a practice					
19	Capacity building in architecture,	Capacity building for architecture, engineering and	**Concerned departments, DDA,**				

	engineering and urban planning institutions	urban planning institutions to ensure experimentation with passive cooling techniques that are locally appropriate, do not trap heat and increase maladaptive carbon emissions. Develop Digital heat-risk map of individual wards with meta data for architecture upgradation / strengthening and spatial planning Designing education modules for heat sensitive urban planning (zoning and urban and building design) in architecture and planning institutions	**NCRPB Concerned KP DDMA, UNEP** **SPA, TCPO, NIUA**	July.	Urban Planners, TCPO, NIUA	NA	

		for long term capacity building.					
20	Electricity resilience programme (CDRI)	Conduct analysis of physical electricity sector vulnerabilities, especially at the community distribution level, to heat and infrastructure upgrades to prevent failures and fires during a heat wave. Develop Digital heat-risk map of building and ward to plan for power demand based on built-environment and spatial analytics	**CDRI , DDMA**, Delhi Transco Limited,**Concerned KP**				
21	Regional information and training centers (NIDM)	Provide funds to urban and rural local bodies to establish regional information and training centres for enhancing public awareness on	**Concerned KP NIDM, DDMA**				

		extreme heat and its health effects. Explore Simulation-based Playbook with SOP for District Disaster Relief Officers and Climate Cell Officers (a) map the risk of critical buildings – school, health centre, police station, transport hub (railway, metro, bus), food warehouse and mandi, cold chain (b) map the heat risk of critical neighborhoods – marginalized, high women and elderly population, informal settlement, social worker (c) report using centralized digital tool as a practice (d) Standardize Heat Resilience					

		SOP with Four Actions framework for pre-heat and during-heat					
MITIGATION							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
22	Building regulations to integrate Passive Building design	Building to integrate passive design strategies such as shading, landscaping, thermally efficient materials including cool/green roof to maintain thermally comfortable indoor environment. Passive building design strategies for all types of buildings should be recommended in the building bye-laws. Low cost & temporary actions for cooling	**Town Planning Department, UNEP, CPWD, Concerned KP, DDMA, NCRPB, DDA, MCD**				

		infrastructural actions in informal settlements and/or low income neighbourhoods.					
23	Planning for Heat resilient urban development	Heat Sensitive urban planning and zoning (*including revision in Development control regulations and bye-laws*) to be conducted before development or revision of master plans	**Delhi Development Authority, SPA, TCPO, NCRPB and NIUA Concerned KP and DDMA**	July	Delhi Development Authority, SPA, TCPO and NIUA Concerned KP and DDMA	NA	
24	Cool roofs	Invest in a cool roofs program to regulate indoor temperatures in urban heat hotspots by using reflective materials.	**Ministry of Housing and Urban Affairs (MoHUA), CPWD, The Energy and Resource Institute (TERI), Concerned KP, DDMA**	Apr- July	**East, North, North West, South East Delhi (Informal settlements)- SEEDS UNEP**		UNEP- Cool Roof initiative for two bus stops of Delhi (Maharana Pratap Kashmiri Gate ISBT and Swami Vivekanand ISBT Anand Vihar)

25	Green roofs	Maintaining indoor ambient temperatures at heat hotspots through installation of vegetation-covered green roofs, walls, and corridors.	**Ministry of Housing Affairs (MoHUA), CPWD, Concerned KP, DDMA, DDA**				
26	Rooftop rainwater harvesting	Invest in installation of rainwater harvesting structures in public and private buildings to prevent water scarcity during a heatwave.	**The Energy and Resource Institute (TERI), CWC, MoEF&CC, Concerned KP, DDMA**				
27	Artificial water storage structures for agriculture and livestock	Create artificial water storage structures for agriculture and livestock to mitigate water shortages during heatwaves.	**CWC, PWD, MoEF&CC, Concerned KP, DDMA**				
28	Greening initiatives	Invest in green (tree plantation, shaded streets, urban forest, parks) or blue infrastructure (lakes, water bodies) depending	**MoEF&CC CWC, Ministry of Agriculture, Concerned KP, DDMA** ADRA India **SEEDS**	June- July	Southeast Delhi **South East Delhi (Informal**	NA	

		upon the local context and climate to reduce microclimate air temperature and achieve affordable thermally comfortable outdoor space. These green/blue initiative should be implemented in hot pocket of city as identified through UHI mapping. (a) Provide streets and roofs risk map – for targeted greening initiative with high impact (b) Digital map of greening (before and after)			**settlements) - SEEDS**		
29	Community cooling action plan	Formulate a localised community cooling action plan that promotes passive cooling techniques, efficient refrigeration and	**Concerned Department/Institution, RWAs, DDMA, Concerned KP**				

		cooling equipment at commercial, institutional and residential spaces.					
30	Promote active and passive cooling measures in workplaces	Fund plans that can provide subsidies for implementing active and passive thermal comfort measures in workplaces with a large number of informal workers. Including setting standards and/or monitoring for adequate ventilation in informal work spaces (UN Women).	**Concerned Department/Institution, DDMA, Concerned KP**				
31	Upscale schools and educational infrastructure for heat resilience and thermal comfort in occupied spaces	Invest in equipping school classrooms and educational spaces with passive solutions like cool and green roofs, and low cost active cooling measures like BLDC fans and Evaporative Air	**DoE, MCD, Other Concerned departments KPs and DDMA** **SEEDS**		**East, North, North West, South East Delhi (Informal settlements – SEEDS)**		

		Coolers to reduce indoor heat stress while studying					
32	Urban Heat Island Mapping Vulnerability assessments	Invest in conducting a vulnerability assessment for both geographies and sectors/occupations to identify at-risk populations and areas that require more attention during a heatwave. Explore with AI Resilience on Resilience360 heat risk map at building level incorporate UHI as a input parameter. (a) map the vulnerable critical buildings – school, health centre, police station, transport hub (railway, metro, bus), food warehouse and mandi, cold chain	IIT- Delhi, Building Materials and Technology Promotion Council (BMPTC), Concerned KP	April-July(SEEDS)	**East, North, North West, South East Delhi (Informal settlements)**	No	

		(b) map the vulnerable critical neighborhoods – marginalized, high women and elderly population, informal settlement, social worker					
33	Urban Heat Mitigation measures integration in Delhi Master Plan	Long term heat mitigation measures, example retrofit of streets, tree plantation initiatives, parks, green corridors, lakes (if applicable), change of surface characteristics of streets in the hot spots of the city. These measures will be recommended based upon climate modelling which will predict reduction in temperatures in the hot spots post implementation of the measures.	DDA/TCPO/KP/UNEP				
	Dedicated Heat	Create a “Heat Action Plan	DDMA, MCD, KP				

	Resilience Cell within DDMA or Municipal Corporation for year-round work.	Scorecard" to track implementation at the ward or district level.					
RESPONSE							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
34	Health care facilities during heat waves	Vulnerable populations in hotspot areas to be identified, with readiness to provide immediate relief in response to illness reports, ensuring prompt and effective aid.Ice-pack dispensers to be installed for vulnerable communities. Primary health centres, Anganwadi centres (UN Women),	SDRF, Apda Mitra Volunteers, Health Department, Animal Welfare Board, Concerned KP, DDMA				

		emergency centres, ambulances, and hospitals to be well-equipped for the treatment of heat-related illnesses, ensuring comprehensive healthcare support. Veterinary hospitals should be stocked with adequate medical supplies.					
35	Set up cooling wards in hospitals and health centres Set up cooling centres at community level	Set up cooling wards in hospitals and health centres to mitigate heat stress for patients, ensuring focus on Ob/Gyn wards (UN Women) and Neonatal/Pediatric Wards. If located on the top floors, these can be shifted to the lower floors within the facility. Operational plans in place to meet	Health department, Concerned KP, DDMA ADRA India	April - June	**Southeast Delhi/ Informal workers, migrants, urban slum population, SHGs**	NA	

		surge demands. Mock drills could be undertaken and skill stations could be established to develop capacity of healthcare staff on management of heatstroke. Engage with Private healthcare sector					
36	Preparedness of, Pre-schools, schools and colleges	Schools to be stocked with ORS, first-aid kits, and cool water. Training and awareness workshops should be arranged for all school staff on comprehensive heat stress management and prevention. Training of teaching	Education Department. Concerned KP, DDMA				

		and non-teaching staff on early detection of heat stress and shock and response and referral protocol.					
	Passenger health and safety measures in buses and bus terminals during heat waves	Bus terminals and buses should be equipped with ORS, first-aid kits, and water points for passenger health and hydration. Temperature and preventive measures should be displayed at the bus terminals and bus screens.	Transport Department , Concerned KP, DDMA				
37	Shelters for livestock	Build shelters for livestock with adequate shade and drinking water to reduce heat stress on livestock.	Animal welfare board, Concerned KP, DDMA				
38	Piloting water mist systems during extreme heat	Vulnerable hotspot locations, bus stops, unshaded roads, pathways	Transport Department, DDA, CPWD, MCD, Concerned KP and DDMA	July	Pedestrians and public commuters	Solution Deployment funds	

		and traffic signals and large corridors of public assembly shall be equipped with water misting system to reduce the immediate ambient temperature. *This can be integrated with the existing newly installed water mist systems for pollution control*					
Governance to bring alignment between short term actions and longer-term vision/priorities							
SL. No.	**Action envisaged**	**Details about actions**	**Implementing / Supporting Govt. Authority**	**Timeline**	**Target area/ Audience**	**Funds required**	**Remarks If any**
39	Creation of procedural assets within GoD and MCD/NDMC for long term predictability of actions						

40	Multi-level Stakeholder coordination		SEEDS	April- July	**East, North, North West, South East Delhi (Informal settlements)**	No	
41	Investment in environmental factors to reduce risk.						

Annexure – 2:
Communication Plan

Communications Strategy for the Extreme Heat Risk Management in NCT Delhi

2025

Prime Minister Narendra Modi, while chairing a meeting to review the preparedness for the ensuing heat wave season, on 11 April 2024, stressed upon the “whole of Government” approach and asked all arms of the government at Central, State and District levels and various Ministries need to work in synergy on to tackle the heat waves. The Prime Minister directed the officials to ensure the timely dissemination of essential IEC / awareness material in regional languages through all platforms, including television, radio, and social media. This strategy aligns with that direction and builds upon global best practices such as risk communications and community engagement (RCCE) model, placing people at the center of communication efforts.

The need for a robust communications strategy

India is experiencing increasingly frequent and severe heatwaves due to climate change, with Delhi among the most vulnerable regions. According to the India Meteorological Department (IMD), 2023 recorded over 320 heatwave days across the country, with Delhi clocking temperatures above 45°C for over 20 days. The National Disaster Management Authority (NDMA) reports that over 17,000 deaths occurred between 1992 and 2015 due to heatwaves in India.

The urban poor, the elderly, outdoor workers, children, and people with chronic illnesses are particularly at risk. Rising temperatures strain public health infrastructure, reduce worker productivity, and increase energy and water demand—making heatwave preparedness not just a health issue but a social, economic, and developmental concern.

Objectives:

- Timely dissemination of accurate, accessible, and actionable information on heatwaves.
- Raise risk perception and awareness among high-risk groups.
- Promote protective behavior to prevent heatstroke, dehydration, and other heat-related health impacts.
- Engage stakeholders for effective disaster preparedness and resilience.
- Build public trust and empower communities.
- Strengthen feedback mechanisms for adaptive communication.
- Facilitate inter agency communication related coordination in NCT Delhi.
- Thought leadership reinforcement on making Delhi Heat Resilient

Target Audience

- Government, Policy makers, Line ministries
- Emergency Responders, Medical Professionals, Hospitals.
- Technical Specialists, Scientific Community
- The Private Sector including markets, trade groups and corporates.
- NGOs/CSOs/Academicians/Media, schools/ teachers.
- Youth, communities at risk and special needs groups, such as the elderly, children, pregnant &lactating women, disabled persons, and women.
- General public and RWAs

Communication Tools

1. **IEC material and Knowledge products: P**osters, banners, flash cards, SOPs, Guidelines packaged into various formats as per usage and in regional languages to cater to migrant population.Heat hazard IEC material in multiple formats such as audio, videos, posters, leaflets, flash cards, etc.
2. **Training Packages and SOPs**
3. **Social media packages- Package developed for campaigns including** Key messages on heat, multi-media assets, that can be readily used across the districts in NCT Delhi.
4. **Media Outreach**

    - **Blogs, articles, OpEds** by subject matter experts on extreme heat risk management.
    - **Newsletters and Monthly Reports**
    - **Short videos of the key leadership/ experts/ influencers**
    - **TV/Radio interviews**

5. **Documentary films**
6. **Robust website of DDMA and digital presence for comprehensive heat wave reports**
7. **U – Report**

Social and Behaviour Change Communications Framework

SBCC Pillar	Application in Heatwave Context
Knowledge	Build public understanding of heat risks.
Attitude	Shift perceptions from fatalism to urgency.
Behaviour	Promote protective actions like hydration.
Social Norms	Encourage heat-safe practices in communities.
Enabling Environment	Reinforce behaviors through services and policies.

Key Strategic Interventions for DDMA

1. Establish thought leadership in Extreme Heat Risk Management

Highlight the leadership by institutionalizing a system that enables regular sharing of information to highest level of policy makers.

Action point:

- **Monthly reporting :** Regularly compile and share a concise monthly report outlining DDMA activities, programs, new initiatives, and achievements in the area of heat wave risk management.
- **Highlight NCT Delhi's vision and contribution to Heat wave risk management:** Emphasize and disseminate information regardingstrategic significant contributions during emergencies.
- Highlight DDMAs work through strategic documents such as the heat wave risk management initiative report and disseminate it with key stakeholders

2. Strengthening technical support on communication across all levels

- Mapping key organizations and exploring synergies and leveraging their strengths to promote the DRR agenda on heat wave.
    - Partner with telecommunications companies to disseminate timely information on heat wave.
    - Partner with cultural and civic groups to share heat wave information at community level.
    - Partner with groups serving high risk communities to create information about safety for those communities.
    - Partner with groups in the private sector to create information about business continuity in the event of a heatwave.

3. Highlight the guidelines, SOPs

Articulate and communicate about these initiatives through overarching efforts of various line departments of the Delhi Government including but not limited to : a) Delhi Jal Board, b) Health Department, c) Education Department, d) MCD, e) NDMC, f) Agriculture, g) DDA, h) Food and Civil Supply

4. Extreme Heat Risk specific campaigns for effective disaster preparedness

Strengthening disaster preparedness through thematic and specialized campaigns designed in alignment with the seasonality in NCT Delhi.

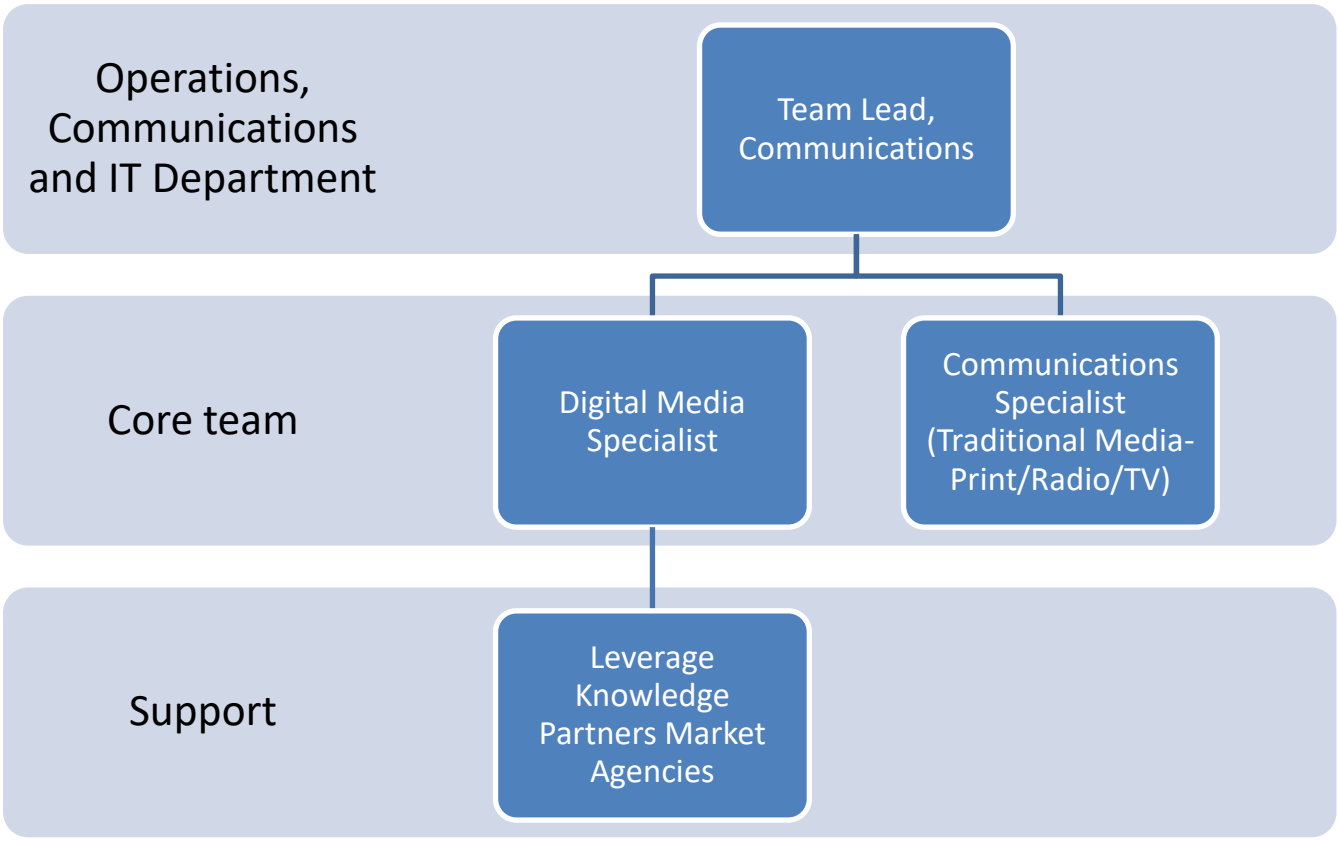
Key action points:

- Audience centric 360 degree campaign including offline, online medium, OOH, TV, mix media, street play, Delhi metro, Cinema Hall
- Share community stories of their survival and resilience.
- Develop relevant IEC material and translate in regional language including Hindi, Bengali, Assamese, Odiya, Tamil and Gujarati.

5. Coordination, Collaboration and Knowledge management (KM)

- Establish mechanism to collaborate with stakeholders at all levels to simplify and facilitate information sharing.
- Collation of gender disaggregated data from credible sources to be embedded in the campaign.
- Monitor the conversation on social media and media platforms to guage areas of interest relevant to DRR or dispel any misinformation.
- Maintain an archive/repository of :
    - Publications
    - Reports
    - Academic Papers
    - Media Coverage
    - High-resolution Photographs
    - Open design files of guidelines
    - Raw video footage

6. Reframing & Operational Capacity



7. Standardize Branding and Communications Guidelines

- **Promoting consistent brand identity** is critical when it comes to showcasing DDMAs work, be it publications or events or social media.
- **Develop a style-guide for editorial consistency and standardisation.**
- **Develop SOPs for DDMAs on Communication during crisis, Handling Media, etc.**
- **Develop heat wave media kits for journalists**
- **Establishing Protocols for Handling Media Queries and training g training spokesperson for media.**

8. Develop partnerships & Collaborations

a) Partnership for KPs

b) Partnership for producing (Video & Audio)

c) Partnership for dissemination

9. Monitor and Evaluate

Develop a comprehensive monitoring and evaluation framework to ensure that our communication strategy aligns with best practices and continuously improves to foster a safer and heat-resilient NCT Delhi.

- **Monitor the reach and engagement** levels across various communication channels.
- **Evaluate the response and actions** taken by the audience after receiving DDMA communications.
- **Measure the impact of communication** on decision-making and preparedness.
- **Track the accuracy of information** and fact-checking processes.
- **Analyze audience demographics** and preferences to customize content.
- **Establish response time benchmarks** for different communication activities.
- Monitor the distribution of **critical information during extreme heat events.**
- **Assess the readability and clarity** of communication materials through readability tests.

10. Communications Matrix

Communication Product	Objective	Language	Target Audience
Animated Video on "Heatstroke Aid"	First response knowledge	Hindi, English	Youth, School children, Teachers
Radio PSA on Hydration Tips	Promote protective action	Hindi, English	Outdoor workers, elderly, migrants
Do's & Don'ts Infographic	Basic awareness	Hindi, English	General public, RWAs
WhatsApp Tip Cards	Mobile-friendly reminders	Hindi, English	Parents, community workers
Poster for Clinics	Health symptoms & referrals	Hindi, English	Pregnant women, healthcare seekers
Op-Ed in Newspaper	Build policy momentum	English	Policymakers, think tanks

Division of Responsibilities for Heatwave Communication Plan Implementation

For implementation of the communication strategy for extreme heat risk management in Delhi, the following division of responsibilities is proposed:

1. Content Development (Technical Team)
Led by: XXX

- Finalize key messages and communication themes
- Validate health-related content and protective behaviors
- Review and simplify SOPs and guidelines for public use

2. IEC and Multimedia Production
Led by: XXX

- Design and produce posters, infographics, flashcards, banners, short videos, and audio jingles
- Ensure consistency with DDMA branding guidelines
- Align materials with seasonal themes and high-risk groups

3. Translation and Language Support
Led by: xxx

- Translate IEC material into Hindi, Bengali, Assamese, Odia, Tamil, and Gujarati
- Ensure cultural and linguistic relevance for migrant populations and high-risk communities

4. Media and Public Outreach
Led by: Press Information Bureau and DDMA Communication Cell

- Draft and disseminate press releases, Op-Eds, and leadership messages
- Coordinate TV and radio programming, interviews, and outreach
- Organize media briefings and press kits for journalists

5. Community Engagement
Led by: NGOs, RWAs, ASHA workers, and civil society networks

- Mobilize local champions, schoolteachers, and SHGs
- Conduct community meetings, door-to-door outreach, and street plays
- Distribute printed materials in localities with high heat vulnerability

6. Youth Mobilization
Led by: XXX

- Implement peer-to-peer awareness in schools and colleges
- Organize competitions, rallies, and creative contests on heatwave preparedness

7. Social Media and Digital Engagement
Led by: XXX

- Develop a schedule for daily updates and interactive content
- Manage WhatsApp broadcast groups, IVRS tips, and Instagram stories
- Monitor and respond to questions, rumors, and misinformation online

8. Monitoring and Evaluation
Led by: xxx

- Develop and track campaign indicators (reach, engagement, behavior change)
- Conduct rapid assessments and pre/post KAP surveys
- Generate weekly and monthly M&E reports

9. Emergency Alerts and Last-Mile Dissemination
Led by: Telecom partners and District Administrations

- Disseminate real-time alerts through SMS, robocalls, radio crawls, and metro announcements
- Ensure availability of IVRS and public announcement systems in crowded zones

Annexure 3: Labour Department Circular

OFFICE OF THE COMMISSIONER (LABOUR)
LABOUR DEPARTMENT, GNCT OF DELHI
5- SHAM NATH MARG, DELHI- 110054

F.No.15(11)/Lab/2019 /282-285 **Dated:-** 16/04/2025

CIRCULAR

Indian Metrological Department has predicted that the temperature in Delhi and Northern Plains will be higher than normal from April to June 2025. To prepare for the same, all the establishments/factories/shops/construction sites are advised to make the following arrangements and take precautions at the work place as under

In order to cope with the weather conditions and as effective strategy to tackle the situation and as part of Heat Action Plan, Director of Industrial Safety, Electrical Inspectorate, all District In-charges in their respective jurisdiction should ensure that all the establishments/factories/shops/construction sites should make following arrangements and take precautions at the work place as under –

1. Change the shift of work as far as possible, to avoid peak hours (12 - 4 PM).
2. Ensuring necessary arrangements to regulate piece rate and requirement/urgency for undertaking physical work during summer.
3. Ensure adequate clean drinking water availability at the work place.
4. Ensure availability of cooler/fans at the work place.
5. Make emergency kit (Ice packs, ORS, etc.) for the construction workers/employees.
6. Heat related illness should be attended properly and promptly and report of any case of heat related illness should be made to nearby health facility/hospital. Co-ordination with Health Department for regular health check-up of workers.
7. Work place should not be over-crowded and should be properly ventilated.
8. Slowing down the pace of work, especially if the workers feels even slight heat strain.
9. Negotiating different schedules to let workers do the hardest work during the coolest parts of the day.
10. Rescheduling rest timings to avoid work during high/ extreamly hot temperatures, where this is not possible, a two-person crew should be assigned to perform work during extremely hot temperatures.
11. Providing rest areas as near to the work place as practicable.
12. Making workers aware of the dangerous excessive heat and humidity and remedial measures.
13. Display of posters and banners with heat wave safety tips and emergency contact numbers.

10. Rescheduling rest timings to avoid work during high/ extremely hot temperatures, where this is not possible, a two-person crew should be assigned to perform work during extremely hot temperatures.
11. Providing rest areas as near to the work place as practicable.
12. Making workers aware of the dangerous excessive heat and humidity and remedial measures.
13. Display of posters and banners with heat wave safety tips and emergency contact numbers.
14. All Fire-fighting equipment such as Fire Extinguishers, Sand Buckets, Water supply for fire fighting and Fire Alarm should be in place and in working condition.
15. Flammable Items such as flammable chemicals, solvent etc. should be kept at isolated cool place and be handled by authorised persons.
16. Stair cases should be free from any obstacle.
17. Work place should be in hygienic condition.
18. No worker should be allowed to work in the direct exposure of sunlight.
19. All Electrical equipment should be switched off when they are not in use.
20. Sensitizing/imparting training to the workers/employees about the precautions to be taken during the heat wave conditions including covering of their head during direct exposure to sunlight etc.
21. All electrical installation works in the NCT of Delhi shall be executed by an Electrical Contractor Licensed in this behalf and under the direct supervision of a person holding a Certificate of Competency and by a person holding a permit issued.
22. All electrical equipment shall be selected so as to withstand safely the stresses and the environmental conditions which it may be subjected.
23. All electrical equipment shall be selected so that it will not causes harmful effects on other equipment or impair the supply during normal service including switches operations.
24. After completion of wiring, a general inspection shall be carried out by competent personnel to verify that the provisions of National Electrical Code have been complied with. This shall verify that all equipment, fittings, accessories, wires and cables, used in the installation are of adequate rating and quality to meet the requirements of the load. General workmanship of the electrical wiring with respect to the layout and finish shall be examined for neatness facilitating easy identification of circuits of the systems, adequate clearances.

Verification of all the protective devices for their rating, range and upward/downward variation in device settings shall be ensured.

25. All electrical circuits and sub-circuits should be controlled and protected through main switch fuse units (SFUs)/ circuit breakers (CBs) of requisite capacity for protection against over load and short circuit. The supply of electricity to all electrical installations of 2 KW and above shall be controlled by a Residual Current Device (RCD) for providing protection against electric leakage.

26. There shall be no joints in the electric wires/cables installed as far as possible. In case of requirements, the joints shall be properly made and covered adequately as per the relevant Standards.

27. The arrangements shall be made for adequate emergency lights as per the provision of the National Electrical Code.

28. All non-current carrying metallic parts and the metallic frames of the electrical appliances/equipment shall be properly earthed.

29. Fire extinguisher dealing with electric fire/sand buckets filled with dry sand shall be kept at conspicuous place.

30. Every item of the electrical system used in the installation shall confirm to the Electrical Safety Regulations.

31. The owner of the electrical installation with more than 250 KW connected load shall designate electrical safety officer, who possess a degree in Electrical Engineering with at least five years experience in operation and maintenance of electrical installations or a Diploma in Electrical Engineering with at least ten years experience in operation and maintenance of electrical installations. The electrical safety officer shall carry out recommended periodic tests and inspect the electrical installation at intervals not exceeding one year and keep a record thereof.

32. As per the Regulation 33 (1) of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023, upon receipt of an application for a new or additional supply of electricity and before commencement of supply or recommencement of supply after the supply has been disconnected for a period of six months, the supplier shall either test the installation himself or accept the test results submitted by the consumer when same has been duly signed by the licensed electrical contractor.

33. As per the Regulation 45 (1)(a) of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 every electrical installation of notified voltage and below shall be inspected, tested and self-certified by the owner or supplier or consumer.

34. Any kind of inflammable material shall not be stored near the electric panels, switch boards and equipment's/appliances.

35. In case of fire, the electric supply needs to be immediately switched off.

Director of Industrial Safety, Electrical Inspectorate and all District In-charges to ensure strict compliance.

This issues with the approval of Competent Authority.

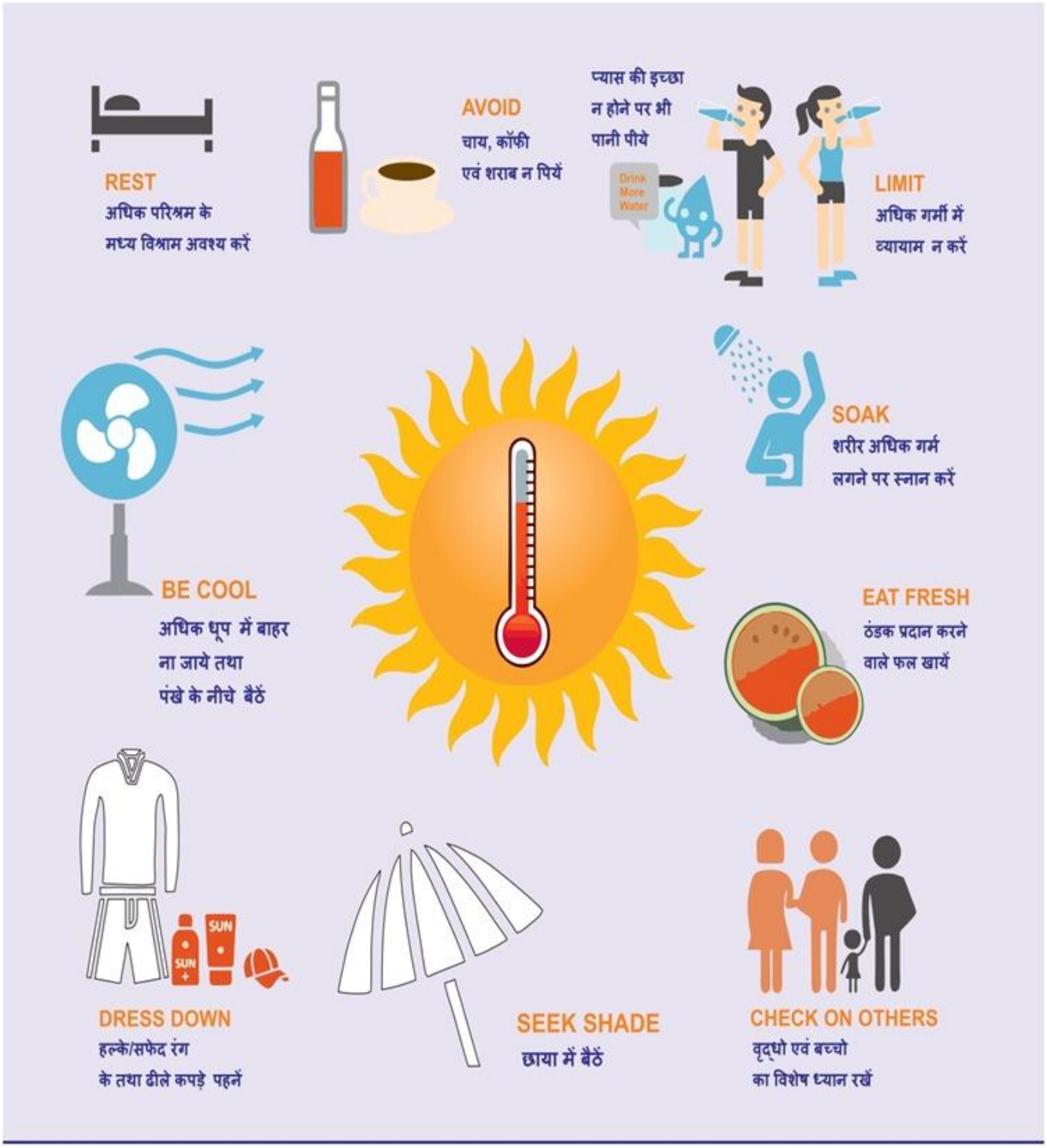
(K.M Singh)
Joint Labour Commissioner

Copy to-

1. Special Secretary, DDMA, GNCTD
2. PS to Commissioner Labour.
3. All District JLC/DLCs, DISH and Electrical Inspectorate to sensitize the market association, industrial association, trade association and construction sites regarding the above advisory.
4. System Analyst to upload this advisory on the website of Labour Department.

Annexure 4:
Do’s and Don’ts

लू/उष्माघात जानलेवा हो सकता है, इससे बचाव ही उपचार है



लू-तापघात जानलेवा हो सकता है, इससे बचाव ही उपचार है.

ठंडक प्रदान करने वाले
पेय पदार्थ पियें

सफेद या हल्के रंग के
कपड़े पहनें

अधिक गर्मी में घर से
बाहर न निकलें

छाया में बैठकर विश्राम करें

बुजुर्गों, बच्चों एवं गर्भवती
महिलाओं का विशेष ध्यान रखें

घर की छत पर
चूने/सफेद रंग का पेन्ट करें

सिर पर गीला कपड़ा तथा
शरीर को कपड़े से ढककर
बाहर निकलें

प्यास की इच्छा न होने पर भी
बार-बार पानी पियें

लू-तापघात जानलेवा हो सकता है, इससे बचाव ही उपचार है.

लू-तापघात के लक्षण

शरीर का तापमान बढ़ना एवं पसीना न आना | सिरदर्द होना या सर का भारीपन महसूस होना | त्वचा का सूखा एवं लाल होना | उलटी होना | बेहोश हो जाना | मांसपेशियों में ऐंठन

लू- तापघात का प्राथमिक उपचार

(१) व्यक्ति को ठंडे एवं छायादार स्थान पर ले जायें
(२) एम्बूलेन्स को फोन करें (108)
एवं नजदीक के स्वास्थ्य केन्द्र पर ले जाएं

(४)
अगर बेहोश न हो तो
ठंडा पानी पिलायें

(५)
जितना हो सके कपड़े
शरीर से निकाल दे

(८)
पंखे से शरीर पर
हवा डालें

(६)
शरीर के ऊपर पानी
से स्प्रे करें

(३)
व्यक्ति को पैर ऊपर
रखकर सुला दे

(७) गीले कपड़े या स्पंज रखें

Delhi Disaster Management Authority
Government of NCT of Delhi
5, Sham Nath Marg, Civil Lines,
Delhi, 110054