



Climate Policy and
Technology Center

**Environment Protection and
Climate Change Department**

Government of the Punjab

Punjab Heatwave Action Plan 2026

A Climate Governance Instrument for
Preparedness and Response in Punjab



CONTENTS

FOREWORD	2
List of Abbreviations	3
MISSION and VISION	5
1. CHAPTER ONE: INTRODUCTION AND CONTEXT	
1.1 Background	8
1.2 Definition of Heatwave	9
1.3 Scope and Objectives	10
1.4 Rationale for the Heatwave Action Plan	11
1.5 Linkages with Climate Change and Air Pollution	12
2. CHAPTER TWO: PUNJAB CLIMATE PROFILE & HEAT RISK ANALYSIS	
2.1 Punjab's Geography and Climate	13
2.2 Temperature Trends and Projections	15
2.3 Urban Heat Island Effect	17
2.4 District-Level Vulnerable Hotspots & Risk Classification	17
3. CHAPTER THREE: HEATWAVE EARLY WARNING & ALERT SYSTEM	
3.1 Role of Environment Protection and Climate Change Department	20
3.2 Heatwave Colour-Code System	20
3.3 Warning Dissemination Mechanism	21
4. CHAPTER FOUR: HEATWAVE ACTION PLAN WITH DEPARTMENTAL RESPONSIBILITIES	
4.1 Departmental Responsibilities	25
4.2 Measures to be taken by Gov. Department for Vulnerable Population	40
5. CHAPTER FIVE: PUBLIC AWARENESS & CLIMATE COMMUNICATION	41
5.1 Heatwave Risk Communication Framework	41
5.2 Multi-Channel Communication System	41
5.3 Targeted Communication for Vulnerable Groups	43
5.4 Monitoring, Feedback and Communication Effectiveness	43
6. CHAPTER SIX: MONITORING & EVALUATION FRAMEWORK	44
CONCLUSION	46
ANNEXURES	48
REFERENCES	52

FOREWORD

Climate change is no longer a future threat; it is an immediate reality confronting the people of Punjab. Rising temperatures, intensifying heatwaves, and prolonged periods of extreme heat are straining our communities, health systems, and public infrastructure. The Environment Protection & Climate Change Department (EPCCD), through its Climate Policy and Technology Centre (CPTC), recognizes this challenge and will lead a coordinated, evidence-based response.

This Punjab Heatwave Action Plan (PHAP) 2026 has been developed to provide a comprehensive policy, preparedness, and response framework aligned with the Government of Punjab's climate commitments and Pakistan's National Climate Change Policy. It draws on international best practices, local climate data, and multi-departmental collaboration to protect the lives and livelihoods of Punjab's citizens.

The PHAP will not simply serve as a reactive emergency document; it is a forward-looking climate governance instrument that integrates early warning systems, urban heat mitigation, and inter-departmental coordination. It reflects EPCCD's institutional mandate to lead climate action in Punjab and ensures that heatwave management will be embedded within the province's broader environmental and development agenda.

We call upon all government departments, local governments, civil society, and citizens to uphold their responsibilities under this Plan and work collectively to safeguard Punjab from the growing hazard of extreme heat events.

Secretary
Environment Protection & Climate Change Department
Government of the Punjab

Abbreviation Full Form

BHU	Basic Health Unit
CPTC	Climate Policy and Technology Centre
DC	Deputy Commissioner
DG	Director General
EPCCD	Environment Protection & Climate Change Department
ERC	Emergency Response Coordinator
HHWS	Heat Health Warning System
IPCC	Intergovernmental Panel on Climate Change
IV	Intravenous
LG&CD	Local Government and Community Development Department
LST	Land Surface Temperature
NDMA	National Disaster Management Authority
ORS	Oral Rehydration Salts
P&D	Planning and Development
P&SHD	Primary and Secondary Healthcare Department
PDMA	Punjab Disaster Management Authority

PHAP	Punjab Heatwave Action Plan
I&CD	Information and Culture Department
PMD	Pakistan Meteorological Department
PTA	Pakistan Telecommunication Authority
SMS	Short Message Service
SUPARCO	Pakistan Space and Upper Atmospheric Research Commission
UC	Union Council
UHI	Urban Heat Island
UNDRR	United Nations Office for Disaster Risk Reduction
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WBG	Wet Bulb Globe Temperature
WHO	World Health Organization
WMO	World Meteorological Organization
P&SHD	Primary & Secondary Healthcare Department
SHMED	Specialized Healthcare & Medical Education Department

LIST OF ABBREVIATIONS

MISSION

To reduce heat-related impacts in Punjab by enhancing public awareness, strengthening institutional capacity, communication, and decision-making for effective heat risk management

VISION

A safe, healthy, and resilient Punjab



Chapter One

INTRODUCTION AND CONTEXT

1.1 Background

Heat waves have become a major global and regional concern because of their serious impacts on human health and society. They are defined as periods of unusually high temperatures that persist for several days, often leading to heat stress and increasing the risk of illness and death, especially where preparedness and adaptation measures are limited.

With climate change, temperature extremes are becoming more frequent, longer-lasting, and more intense. Many developed countries have made significant progress in managing heat-related risks by implementing effective response strategies. However, in developing countries like Pakistan, heat waves remain relatively understudied and harder to manage due to limited resources and lower adaptive capacity.

Punjab is Pakistan's most populous and economically vital province, home to over 127 million people. It is increasingly exposed to the escalating threat of extreme heat events intensified by anthropogenic climate change. Heatwaves in Pakistan's southeastern plains, which encompass the core of Punjab, are most lethal when they strike this densely populated region, even at physical intensities lower than those recorded in the southwest.

These extreme heat events are strongly linked to a rise in health problems, including cardiovascular and respiratory diseases, and can lead to severe, life-threatening conditions. Globally, heat waves have already caused thousands of deaths, highlighting the urgent need for improved awareness, planning, and response systems (GCIS).

Historical records document major heatwave events affecting Punjab's zones in 1952, 1978, 1984, 1988, 2002, 2006, 2009, and 2010, with the 2010 event affecting 82.9 percent of the national population. The duration of heatwaves in Pakistan has been increasing by 0.71 days per decade, and the area simultaneously experiencing maximum and minimum temperatures above the 95th percentile has been growing by 1.36 percent of the total national area per decade (Khan et al., 2018).

In Punjab's urban centres, the Urban Heat Island (UHI) effect is making heatwaves even more severe. In Lahore, temperatures in built-up urban areas have been recorded as much as 4.1°C higher than surrounding rural areas. Over the past decade, the number of heatwave days has doubled, while average annual temperatures have continued to rise by 0.14–0.16°C each year.

1.2 Definition of Heatwave

A heatwave is defined as a period of abnormally and persistently elevated atmospheric temperature that induces heat stress and poses a direct risk to human health and life. The World Meteorological Organization (WMO) defines:

"A heatwave as a condition in which the daily maximum temperature remains significantly above the climatological average approximately 5°C or more for at least five consecutive days".

At the physiological level, the human body maintains optimal function at approximately 37°C; sustained exposure to higher ambient temperatures forces the body to absorb environmental heat, rapidly leading to dehydration, heat exhaustion, and, if untreated, potentially fatal heatstroke.

Heatwaves are context-specific and can also be defined using relative temperature increases or percentile-based methods. Both daytime and nighttime temperatures are important, as high nighttime temperatures prevent recovery from daytime heat. Tools like the Heat Index and Wet Bulb Globe Temperature are also used to assess the combined effects of heat, humidity, and environmental conditions on human health (GCIS).

1.3 Scope and Objectives of the Plan

This Punjab Heatwave Action Plan (PHAP) 2026 is developed by the Environment Protection and Climate Change Department (EPCCD), Government of Punjab, through one of its attached departments, i.e. Climate Policy and Technology Centre (CPTC). It applies to all urban, peri-urban, and rural populations across Punjab, with prioritized focus on the high-risk southern and central divisions as the most thermally exposed areas of the province.

- Establish EPCCD as the focal institution for heatwave management in Punjab.
- Integrate climate science, satellite data, and environmental monitoring data into a provincial heatwave early warning system with district-level operational reach.
- Coordinate multi-departmental roles and responsibilities to ensure a coherent, non-duplicative, and accountable response.
- Protect vulnerable populations, including outdoor workers, the elderly, children, pregnant women, and low-income households, through targeted, evidence-based interventions.

1.4 Rationale for a Heatwave Action Plan

According to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), heatwaves in Pakistan are projected to become more frequent, prolonged, and intense under future warming scenarios. The AR6 further highlights that major cities in Pakistan are expected to experience substantially higher levels of urban heat stress as a result of climate change. In 2026, the World Meteorological Organization (WMO) confirmed the development of El Niño, a climate phenomenon characterized by the warming of ocean surface temperatures in the central and eastern equatorial Pacific Ocean. It typically occurs every two to seven years and lasts around nine to twelve months, disrupting global weather patterns. This warming is expected to intensify in the coming months, increasing the likelihood of extreme weather events worldwide. When combined with ongoing climate change, El Niño significantly raises global temperatures, leading to more intense and frequent heatwaves, along with associated impacts such as droughts, irregular rainfall, and marine heat events. In South Asia, it often results in hotter and drier conditions, increasing the likelihood and severity of heatwaves. While El Niño is a natural phenomenon, its impacts are further intensified by climate change, as warmer atmospheric and ocean conditions amplify extreme weather events. This underscores the urgent need for strengthened early warning systems, preparedness, and adaptive planning to protect vulnerable populations and key sectors (WMO, 2026).

The June 2015 Karachi heatwave, which caused over 700 deaths within three days, demonstrated how rapidly heat emergencies can overwhelm health systems when preparedness measures are absent (Masood et al., 2015). Punjab's increasing urbanization, dependence on agriculture, and growing exposure to extreme heat make proactive planning essential. Punjab currently lacks a coordinated institutional framework for extreme heat preparedness despite rising climate risks. Existing disaster management systems primarily focus on floods, smog, and emergency response, while extreme heat remains under-addressed as a slow-onset but high-mortality hazard. Departments often operate in silos, early warning dissemination remains fragmented, urban planning rarely integrates thermal resilience, and vulnerable populations such as outdoor labourers, informal settlements, elderly populations, and school children remain insufficiently protected.

This Heatwave Action Plan will provide a coordinated framework for prevention, preparedness, response, recovery, and long-term adaptation in Punjab.

1.5 Linkages with Climate Change and Air Pollution

Heatwaves are strongly associated with climate change, as rising global temperatures are increasing the frequency, intensity, and duration of extreme heat events. Climate change is also contributing to prolonged warm periods and shifting seasonal patterns. In addition, heatwaves are closely linked with air pollution, as higher temperatures accelerate the formation of ground-level ozone and worsen air quality, particularly in urban areas. Stagnant atmospheric conditions during heatwaves further trap pollutants, increasing public health risks. Together, climate change, heatwaves, and air pollution create compounded environmental and health impacts, highlighting the need for integrated mitigation, adaptation, and urban planning strategies.

Hot weather usually comes with weak winds, so polluted air gets trapped near the ground instead of being dispersed. As a result, pollution levels increase, and air quality becomes worse during heatwaves. The relationship also works in the opposite direction. Air pollution, especially from substances like black carbon and greenhouse gases, traps heat in the atmosphere. This makes the environment warmer and can intensify heatwaves. In cities, this effect becomes stronger because buildings, roads, and concrete absorb and hold heat, a phenomenon known as the urban heat island effect. When heating and pollution happen together, the impact on human health becomes more serious. People may face heatstroke, dehydration, breathing problems like asthma, and even heart-related diseases. Vulnerable groups such as children, older adults, and people with existing illnesses are at higher risk. Overall, heatwaves and air pollution are connected in a harmful cycle. Heat increases pollution, pollution increases heat, and together they create a serious environmental and public health problem, especially in cities and already polluted areas.



Chapter Two

CLIMATE PROFILE & HEAT RISK ANALYSIS

2.1 Punjab's Geography and Climate

Spanning approximately 205,345 sq. km, Punjab is Pakistan's most populous province. Its location within the Indus plains, diverse agro-climatic zones, and extensive river systems render it acutely vulnerable to climate change impacts, including heatwaves, droughts, and hydro-meteorological extremes. The province experiences a hot semi-arid climate characterised by extreme seasonal contrasts, with temperatures ranging from approximately -2°C in winter to as high as 50°C in summer, and average annual maxima typically between $28-32^{\circ}\text{C}$.

Over recent decades, a clear and measurable warming trend has emerged, particularly in southern districts, with increases in both minimum and maximum temperatures and a rising frequency of summer days exceeding 40°C . Punjab receives the bulk of its annual rainfall during the monsoon season (July–September), with above-normal precipitation recorded in 2022 and 2023, influenced by La Niña events and shifting atmospheric patterns. The province contributes approximately 60 percent of Pakistan's national GDP, making climate-driven heat stress a significant economic, as well as humanitarian, concern. (Ameen et al., 2024)

Decadal Mean Temperature over Punjab (1990-2025)

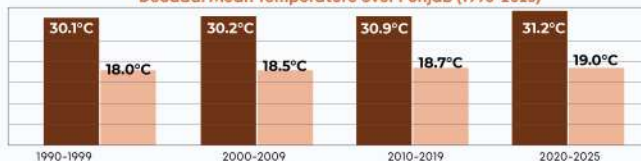


Figure 1. Decadal Mean Maximum and Minimum Temperature Trends in Punjab (1990–2025)

(Data Source: ERA 5)

Figure 1 presents the long-term warming trend in Punjab using decadal average temperatures from 1990 to 2025. The data clearly shows a consistent rise in both maximum and minimum temperatures over time. The average maximum temperature has increased from approximately 30.4°C in the 1990s to about 31.3°C in the period 2020–2025. Similarly, the average minimum temperature has risen from around 18.0°C to 19.1°C .

This gradual but continuous increase indicates that Punjab is experiencing a sustained warming trend rather than short-term variability. The rise in maximum temperatures points to hotter daytime conditions, which can intensify heatwave severity. At the same time, the increase in minimum temperatures suggests warmer nights, reducing the natural cooling period that is critical for human recovery, especially for vulnerable populations such as the elderly, children, and outdoor workers.

The combined increase in both day and night temperatures contributes to longer and more intense heat stress periods. This can lead to higher risks of heat-related illnesses, increased energy demand, pressure on water resources, and worsening air quality conditions.



2.2 Temperature Trends and Projections

Temperatures across Punjab have risen consistently over recent decades, with documented trends across key climate indices. At the national level, 2024 was Pakistan's ninth warmest year on record, with the national average temperature reaching 23.52°C (0.7°C) above the long-term mean. July 2024 was the second-hottest July in 64 years of records, and October 2024 shattered all previous records as the hottest October ever documented, with temperatures 2.48°C above average. Looking ahead, the IPCC AR6 projects with high confidence that extreme heat events in South Asia will become more intense and more frequent by the end of the 21st century. Under high-emissions scenarios, heat stress thresholds dangerous to human health are projected to be exceeded by 50-150 additional days per year. For Punjab specifically, a continued temperature rise up to 2.16°C under high-emission scenarios is projected by 2050.

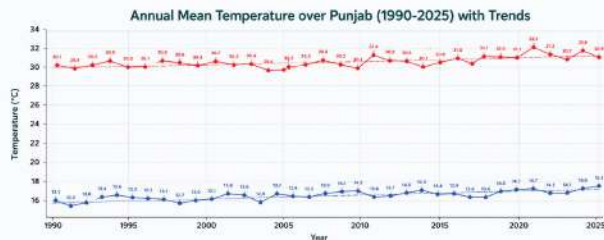


Figure 2: Annual Mean Maximum and Minimum Temperature Trends in Punjab (1990-2025).

(Data Source: ERA 5)

Figure 2 shows the year-wise variation in average maximum and minimum temperatures in Punjab from 1990 to 2025. The graph highlights both short-term fluctuations and a clear long-term warming trend. While temperatures vary slightly from year to year, the overall pattern shows a gradual increase in both maximum and minimum temperatures over time.

The average maximum temperature generally remains above 30°C throughout the period, with recent years showing more frequent peaks above 31-32°C. Similarly, minimum temperatures have increased from around 17-18°C in the early 1990s to nearly 19-20°C in recent years. This indicates that not only days are becoming

hotter, but nights are also getting warmer. The trend lines in the graph clearly show an upward direction for both maximum and minimum temperatures, confirming a consistent warming pattern across Punjab. The increasing minimum temperatures are particularly important, as they reduce nighttime cooling, leading to continuous heat stress and higher health risks. In recent years, there is also slightly greater variability, with some years experiencing higher spikes in temperature. This suggests increasing uncertainty and intensity of heat conditions, which can make heatwaves more unpredictable and difficult to manage.

Decadal variations in mean maximum (Tmax) and minimum (Tmin) temperatures across Punjab from 1990 to 2025 are presented in Figure 3. Overall, both Tmax and Tmin show a gradual increasing trend over time, indicating warming conditions in the province. Earlier decades (1990-1999) remained relatively stable, while recent years, especially after 2010, show higher temperature values. The 2020-2025 period records the highest temperatures, with Tmax exceeding 32°C and Tmin approaching 20°C in some years. The rising trend, particularly in minimum temperatures, suggests warmer conditions and increasing heat stress across Punjab.

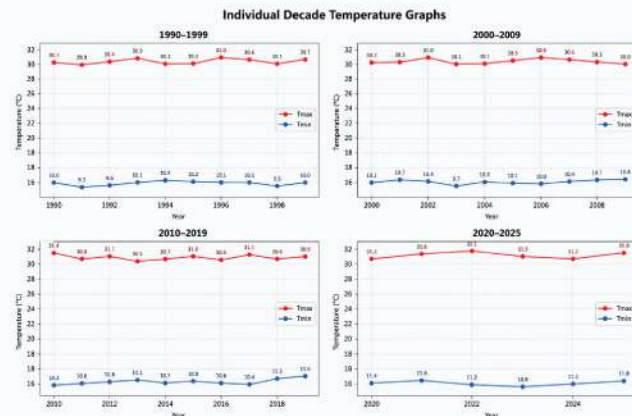


Figure 3: Decadal Trends in Mean Maximum (Tmax) and Minimum (Tmin) Temperatures in Punjab (1990-2025)

(Data Source: ERA 5)

The three projection maps produced by NDMA (Figure 4) for the 2026 summer season translate the long-term warming trend into an immediate operational picture. In April, Punjab's southern and central divisions are already shown in deep orange and red, indicating high heat intensity across Multan, Dera Ghazi Khan, Bahawalpur, and Rahim Yar Khan, while northern districts remain comparatively cooler in yellow and blue tones. By May, the high-intensity red zone expands significantly northward, engulfing Faisalabad, Sargodha, and parts of Lahore division, confirming that May represents the threshold month when heat risk escalates rapidly across the province. By June, virtually the entire Punjab plains are covered in orange and red, with only the Rawalpindi-Murree foothills retaining cooler conditions. This month-by-month progression reinforces the operational calendar established in this plan that emergency protocols cannot wait until temperatures peak but must be activated in April when the escalation begins and sustained through the entire pre-monsoon and early monsoon window.

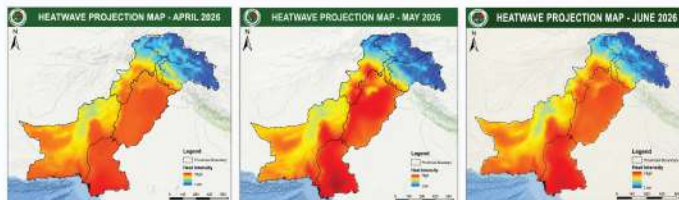


Figure 4: Heatwave Projection Maps for Punjab — April, May, and June 2026 (NDMA)

2.3 Urban Heat Island Effect

The Urban Heat Island (UHI) effect will serve as a critical amplifier of heatwave risk in Punjab's major cities. In Lahore, dense infrastructure, extensive impervious surfaces, and the progressive loss of vegetation have created significant thermal disparities relative to surrounding rural areas. Daytime UHI intensity in Lahore ranges from 0.6°C to 3.9°C, and nighttime temperature elevations of 1.1°C to 2.8°C, prevent the physiological recovery that cooler nights would otherwise provide. Between 2014 and 2024, Lahore's built-up area expanded from 297 sq. km to 927 sq. km, while vegetative cover collapsed from 769.6 sq. km to just 182.8 sq. km a reduction that has measurably elevated land surface temperatures, particularly in central high-density zones. (The Urban Unit, 2025) (Shakoor et al., 2026).

Surface Temperature (LST) monitoring by SUPARCO and EPA Punjab confirms elevated thermal signatures across Lahore, Faisalabad, Multan, and Gujranwala. These cities also host the majority of Punjab's industrial and transport emissions creating compound risk scenarios where heat stress and air pollution events co-occur, further

2.4 District-Level Vulnerable Hotspots and Risk Classification

Punjab does not experience uniform heating across its geographical extent. A clear north-south thermal gradient is evident throughout the province, with southern divisions consistently recording higher land surface temperatures than central and northern regions. The spatial distribution of Land Surface Temperature (LST) indicates that districts within Bahawalpur, Rahim Yar Khan, Dera Ghazi Khan, and Multan divisions remain comparatively hotter, whereas northern districts exhibit relatively cooler conditions.

To provide a clearer understanding of temporal variations, year-wise LST maps and analyses for the period 2015–2025 are presented in the Figure 5 enabling the identification of annual temperature fluctuations and emerging warming trends. While the decadal mean LST map offers an overall representation of long-term thermal patterns across Punjab, the year-wise assessment highlights interannual variability and supports a more detailed interpretation of changing surface temperature conditions across the province.

SURFACE TEMPERATURE 2015–2025

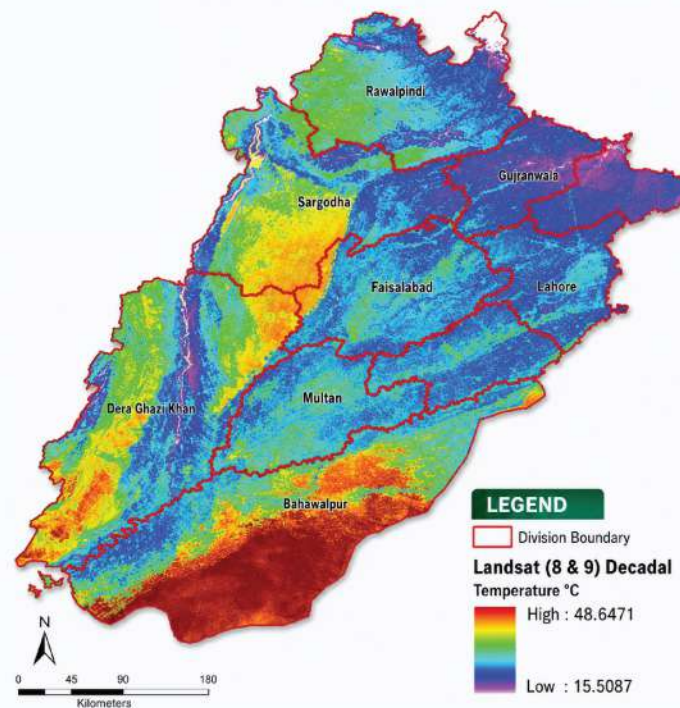


Figure 5: Decadal mean Land Surface Temperature (LST) across Punjab (2015–2025) derived from Landsat 8 and 9 imagery.

Chapter Three

3. HEATWAVE EARLY WARNING & ALERT SYSTEM

3.1 Role of Environment Protection and Climate Change Department (EPCCD)

The Environment Protection and Climate Change Department (EPCCD), Punjab, will serve as the lead coordinating department to activate the Heatwave Early Warning and Alert System and the planned heatwave management response. EPCCD will be at the forefront to ensure that scientific forecasts are effectively translated into timely and coordinated action at provincial and district levels in case of heatwave events. EPCCD will coordinate with PMD, relevant provincial government departments, and district administrations to ensure the smooth flow of early warning information and its timely dissemination. During peak summer months (May–July), ensure real-time information sharing, continuous monitoring, and effective communication so that all relevant departments can respond quickly and reduce heat-related risks.

3.2 Heatwave Colour-Code System

3.2.1 Foundation and International Alignment

The Punjab's Punjab's Heatwave Colour-Code System is a four-tier early warning and response framework designed to protect the public from the health risks of extreme heat (Figure. 6). The plan follows international best practice from the World Health Organization (WHO) and the World Meteorological Organization (WMO) on Heat Health Warning Systems (HHWS), and is grounded in the WHO principle that heat health action plans must integrate early warning, risk communication, and coordinated inter-sectoral responses to reduce heat-related morbidity and mortality. The system is structured into four operational categories:

Green (Normal Conditions): This stage represents safe and stable climatic conditions, where forecast temperatures remain below 40°C and no heat-related health risk is anticipated. It indicates routine weather conditions typical of the season. At this level, normal public activities will continue without restriction, while meteorological and health departments maintain routine monitoring and baseline surveillance.

Yellow (Normal / Watch Conditions): This stage signals early heat build-up, typically when temperatures rise 2–3°C above seasonal averages. Although not immediately dangerous, it serves as a precautionary alert level to enhance public awareness and institutional readiness. Early warning communication and preparedness measures are activated.

Orange (Heat Warning Stage): Significant heat stress risk. Activates partial emergency preparedness across health, municipal, and utility departments.
Trigger: extreme heat forecast within 48 hours or sustained high-temperature event underway.

Red (Heat Emergency Stage): Extreme and prolonged heat conditions associated with severe and immediate health risk. Activates full emergency response, all shady shelters open, outdoor worker restrictions enforced, and mobile medical teams deployed.
Trigger: dangerous heat conditions are active, with temperatures Forecast $\geq 42^{\circ}\text{C}$ and minimum temperature $\geq 30^{\circ}\text{C}$ for 2 or more consecutive days.

As an alert severity escalates from Yellow to Red, institutional involvement expands proportionally, ensuring a scalable and adaptive governance response consistent with the UNDRR Sendai Framework principles, which focus on reducing disaster risk through early warning, preparedness, and coordinated response.

Thresholds for Heatwave		
Alert	Criteria	Public Advisory
Normal Day	Forecast < 40°C	
Hot Day Alert	Forecast 40°C - 41.9°C	- Avoid outdoor activities. - Cover your head. - Drink more water. - Wear light colored and loose cotton clothes.
Hot Day Warning	Forecast ≥ 42°C	- Avoid heat exposure. - Drink sufficient fluids. - Replenish body salt through IV Fluids. - Wear light colored and loose cotton clothes. - Walk and sit under shades.
Heatwave Emergency	Forecast ≥ 42°C and minimum temperature ≥ 30°C for 2 or more consecutive days. Significant levels of heat related illness and mortality reports.	- Extreme care needed for vulnerable people. - Avoid heat exposure. - Drink sufficient fluids. - Replenish body salt through ORS. - Wear light colored and loose cotton clothes. - Walk and sit under shades. - Call emergency helpline for any additional assistance.

Figure 6: Four-tier color coding system

3.3 Warning Dissemination Mechanism

The heatwave warning dissemination system represents an integrated, multi-layered governance framework designed to transform scientific climate data into timely public warnings and coordinated institutional responses across Punjab. It connects early detection systems, provincial decision-making bodies, district-level operations, and community communication networks into a single continuous flow of information and action. EPCCD will establish a Heatwave Management Cell headed by DG, CPTC, that will connect with the Local Government, Health Department, and the Meteorological Department (PMD). The cell will conduct regular pre-summer "inter-sectoral" meetings to ensure every department knows who to call when temperatures spike.

Multi-Source Surveillance & Early Detection

The Pakistan Meteorological Department (PMD) continuously monitors temperature trends, forecasts heat extremes, and issues preliminary heat alerts when defined thresholds are exceeded. Where available, satellite-based remote sensing data from sources such as SUPARCO and other platforms may be utilized to identify urban heat islands, surface temperature anomalies, and rapidly warming zones within cities. In addition, EPCCD collects meteorological data through its air quality monitoring stations. These complementary data streams will collectively support surveillance and the early detection of heat-related risks. All these data streams will be used for surveillance and early detection (Figure 7)



Figure 7. Multi-Source Surveillance & Early Detection

The Climate Watch: Centralized Data Fusion & Alert Generation

The incoming alerts/ triggers and advisories from PMD will be integrated to the central dashboard in the Climate Watch of EPCCD. The technical sources within EPCCD may further supplement this system by providing spatial and environmental data. Together, these input streams (alerts from PMD, SUPARCO's remote sensing data and EPCCD stations meteorological data) will establish a comprehensive early warning foundation that ensures heat risks are detected, and technical alerts are generated through both ground-based observations and advanced geospatial technologies. Once heatwave trigger hits the province, the heatwave Management Cell will act as the bridge for timely coordination between provincial line departments and district administrations for activation of pre-planned response (Figure 8).

Strategic Oversight by Heatwave Management Program Committee (HMP)

The Heatwave Management Program Committee (HMP) notified vide notification No. 1(153)PO(Env&CC)P&D/2023 dated 19.04.2023, will provide strategic oversight and policy-level direction. The committee will prepare, review and approve the heatwave management plan and ensure the inter-agency coordination, clarity in roles, and well-publicized triggers to activate a planned response.

The committee will align provincial priorities, prevent duplication of response efforts, and ensure that all institutions act under a unified command structure. The Committee will further recommend ways to empower implementation agencies to supply the required levels of services and support in a way that is coordinated and efficient.

Operational Implementation-Tiered Response Framework

- ▶ A structured and hierarchical response mechanism will operate across three levels.
- ▶ At the provincial level (Tier A), EPCCD in coordination with the PMD, Provincial Disaster Management Authority (PDMA), and divisional administrations, will lead emergency preparedness and ensure inter-agency coordination. This level will focus on overall command, resource allocation, and alignment of all departments.
- ▶ At the district level (Tier B), line departments will implement targeted operational measures based on sectoral responsibilities. Health departments will prepare hospitals and deploy emergency response teams, while water authorities will ensure supply continuity and dispatch water tankers where needed. Agricultural departments will issue advisories for crop and livestock protection, labour departments will enforce heat-related work restrictions, education departments will adjust school timings or suspend classes when necessary, and energy departments will ensure uninterrupted electricity supply while. Local governments will manage public shelters and support urban heat mitigation measures.
- ▶ At the community level (Tier C), the alert will be transmitted to local governments, including tehsil and union council representatives, ensuring last-mile dissemination. Frontline networks such as health workers, religious leaders, and civil society organizations will play a key role in spreading awareness and guiding vulnerable populations. Communities will be engaged directly to adopt protective behaviours, particularly for children, elderly individuals, and outdoor workers.

Inclusive Multi-Channel Communication

Alongside administrative responses, a parallel communication system will ensure that heatwave alerts reach the widest possible population. Led by the EPCCD's Strategic Communication Cell (SCC), a unified messaging framework will be deployed to ensure technical accuracy and consistency across all platforms. SMS alerts will be sent in Urdu and Punjabi language to mobile users, enabling rapid and direct communication.

The Government of Punjab's Information and Culture Department will lead the mass media rollout, leveraging its network to provide real-time updates and guidance via government websites and social media. Broadcast media, including television and radio channels, will disseminate continuous public advisories to bridge the gap for those with limited digital access. This coordinated multi-channel strategy ensures that life-saving information reaches both urban centers and the most remote rural populations.

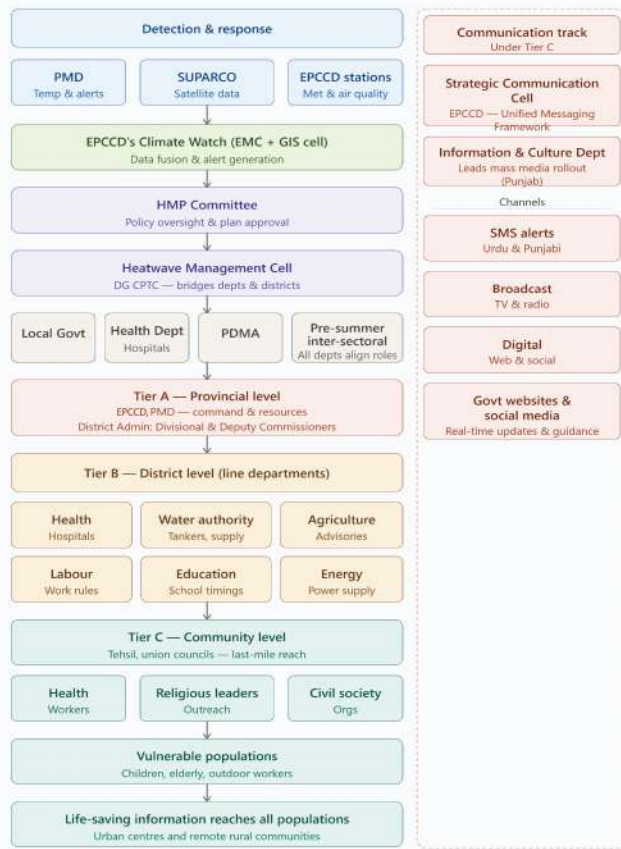


Figure 8. Coordinated Heatwave Monitoring and Emergency Response Mechanism



Chapter Four

4. HEATWAVE ACTION PLAN WITH DEPARTMENTAL RESPONSIBILITIES

EPCCD serves as the lead coordinating department for heatwave management in Punjab, responsible for directives regarding activation of pre-planned response, and reporting formats, while ensuring overall provincial coordination. All line departments will function as per their specific contingency plans, assign roles in this plan, and maintain continuous communication throughout the heat season. Responsibilities of each department are structured into three phases: before, during, and after heatwaves. Each department will submit its annual heatwave action plan to EPCCD by 15 March for placing the same before Heatwave Management Program Committee and designating a focal person for effective coordination.

4.1 Departmental Responsibilities

a) Environment Protection & Climate Change Department (EPCCD)

Before the Heat Wave

- Obtain seasonal heat forecasts/ alerts from PMD and integrate them with SUPARCO and EPCCD's allied climate data sources for provincial risk assessment to generate alerts and activate the response plan
- Convene a pre-season provincial coordination meeting with focal persons of all relevant departments for preparedness alignment
- Establish and activate a permanent Heatwave Management Cell (HMC) headed by DG, CPTC, for continuous inter-departmental coordination
- Develop and standardise reporting formats, data-sharing protocols, and communication templates for all departments
- Maintain and update a provincial heat vulnerability database, identifying high-risk zones and vulnerable populations for targeted planning

During the Heat Wave

- ▶ Activate the HMC immediately upon receipt of a PMD heat alert & advisory
- ▶ Integrate meteorological, satellite, and field data into a real-time provincial heat risk assessment system
- ▶ Issue daily provincial heat risk bulletins to the Chief Minister's Secretariat, PDMA, and all relevant departments
- ▶ Monitor inter-agency response performance through district and divisional reporting systems
- ▶ Identify operational gaps and coordinate corrective actions
- ▶ Ensure consistency and coordination of public messaging in collaboration with the Information and Culture Department

After the Heat Wave

- ▶ Compile a comprehensive provincial heatwave impact and response report integrating all departmental inputs
- ▶ Present findings to the Heatwave Management Programme Committee and relevant stakeholders for policy review
- ▶ Convene a post-season provincial review meeting to evaluate response effectiveness and institutional coordination
- ▶ Maintain a real-time dashboard of heat impacts, including hospital admissions, mortality data, and hotspot mapping
- ▶ Update the provincial heat risk model and vulnerability database based on lessons learned and field data
- ▶ Recommend institutional and operational improvements for strengthening future heatwave preparedness and response systems

b) Pakistan Meteorological Department (PMD)

Before the Heat Wave

- ▶ Provide seasonal heat forecasts for Punjab to the Environment Protection and Climate Change Department (EPCCD).
- ▶ Issue an initial heat advisory to EPCCD, followed by an updated, detailed advisory with district-wise temperature projections before the onset of the heat wave.
- ▶ Nominate a focal person to coordinate with the Heatwave Management Cell.

During the Heat Wave

- ▶ Upgrade advisories into formal warnings when temperatures exceed the defined thresholds.
- ▶ Provide round-the-clock technical support during active heat wave events.

After the Heat Wave

- ▶ Issue a formal all-clear notification to EPCCD once the heat wave episode ends.
- ▶ Submit a technical report to EPCCD, including district-wise peak temperature records and related observations.

c) Divisional Commissioners

Before the Heat Wave

- ▶ Notify a divisional Emergency Response Coordinator (ERC) to oversee the process
- ▶ Direct all Deputy Commissioners and divisional departmental heads to submit their heat wave plans.
- ▶ Hold a divisional pre-season coordination meeting.
- ▶ Relay all advisories and alerts from PMD and EPCCD to Deputy Commissioners on the day of receipt.
- ▶ Coordinate and ensure availability of facilities/ logistics/HR in the division

During the Heat Wave

- ▶ Coordinate with line departments for immediate activation/ implementation of their respective roles assigned in this plan and their own heatwave contingency plans upon receiving activation notice.
- ▶ Receive feedback on actions by all line departments and stakeholders and submit a divisional summary to EPCCD each morning.
- ▶ Deploy divisional reserves to districts where local resources are insufficient.
- ▶ Report any heat-related deaths or major incidents immediately.

After the Heat Wave

- ▶ Compile a consolidated divisional post-event report and submit it for analysis to improve preparedness for next years.
- ▶ Review or evaluate the effectiveness of actions, operations, and arrangements of line Departments to overcome any lapse faced during the heatwave.
- ▶ Communicate the recommended amendments in action plan(s) of line departments as a result of review.

d) Deputy Commissioners

Before the Heat Wave

- ▶ Form a District Heat Wave Emergency Response Committee with heads of key line departments.
- ▶ Ensure availability of facilities/logistics/HR.
- ▶ Ensure submission of heatwave management plans by line departments
- ▶ Identify all relief camps and cool shelter sites and formally notify EPCCD and the Divisional Commissioner.

- ▶ Confirm that all district line departments have operational plans and confirmed resources.
- ▶ Relay all advisories from EPCCD and PMD to union councils and field formations on the day of receipt.

During the Heat Wave

- ▶ Activate the District Emergency Response Committee immediately upon receiving an alert.
- ▶ Ensure coordination of line Departments to establish relief camps and cool centers at preidentified sites.
- ▶ Ensure implementation of the Heatwave Management Plan by line Departments.
- ▶ Submit a daily district situation report to the Divisional Commissioner.
- ▶ Maintain a district incident log of all heat-related cases and deaths and share daily with the Commissioner's Office.
- ▶ Evaluate the effectiveness of heatwave management plans of the line Department during heat spells.

After the Heat Wave

- ▶ Compile the district post-event report & submit to the Divisional Commissioner.
- ▶ Document resource gaps, response delays, and recommend changes for the following year.

e) Health Departments (SHMED and P&SHD)

Before the Heat Wave

- ▶ Train all doctors, nurses, and paramedics on clinical management of heat stroke and heat exhaustion.
- ▶ Establish a written coordination protocol with Rescue 1122 covering referral pathways and daily reporting.
- ▶ Prepare a contingency plan for health departments to combat heat waves.
- ▶ Check the preparedness at all levels.
- ▶ Capacity building and training of all concerned staff and health workers to implement various components of the contingency plan to combat heatwaves.
- ▶ Ensure availability of facilities, doctors and nurses, supplies (IV Fluids) and medicines at all levels of health care facilities (hospitals, dispensaries and BHUs, etc).
- ▶ Convey heat wave alert to all levels of health care facilities (hospitals, dispensaries and BHUs etc).

During the Heat Wave

- ▶ Collaborate with offices of Commissioner and Deputy Commissioner to setup heat wave relief camps / cool centers, equipped water coolers, drinking water and emergency supplies in identified areas for treatment
- ▶ Prepare Epidemiological data of affected people.

- ▶ Extend outpatient hours and run emergency wards 24 hours at all district and tehsil hospitals.
- ▶ Deploy mobile medical units to high-risk locations such as labour markets, brick kilns, and bus stands.
- ▶ Report age- and sex-disaggregated heat admissions and deaths each day.

After the Heat Wave

- ▶ Share final epidemiological data on heat illness and deaths.
- ▶ Review medicine stocks, capacity, and staff deployment against actual demand.
- ▶ Update the contingency plan before the following season.

f) Emergency Services Department (Rescue 1122)

Before the Heat Wave

- ▶ Prepare heat wave emergency action plan of Rescue 1122 with special focus on coordination with relief camps / cool centers established by Deputy Commissioner(s).
- ▶ Capacity building and training of all rescue personnel in first aid for heat stroke, including cooling techniques and rehydration.
- ▶ Stock ambulances and rescue stations with oral rehydration salts, ice packs, water, and emergency medicines confirm readiness.
- ▶ Map all district relief camps and cool shelter locations before the season begins.

During the Heat Wave

- ▶ Respond to all heat-related emergency calls, administer first aid on site, and transport patients to hospitals.
- ▶ Submit a daily log of all calls, including location and patient data to the district administration.
- ▶ Conduct proactive visits to high-risk sites such as brick kilns, construction sites, and labour markets.
- ▶ Prepare Epidemiological data of affected people

After the Heat Wave

- ▶ Submit a post-event operational report to Deputy Commissioner covering calls attended, response times, and outcomes.
- ▶ Update the heat wave response plan based on the season's experience/ lessons learnt.

g) Information and Culture Department

Before the Heat Wave

- ▶ Prepare a heat wave public communication plan covering TV, radio, print, outdoor signage, and social media.
- ▶ Prepare awareness materials in Urdu and regional languages on warning signs, protective measures, and when to seek medical help.
- ▶ Establish a protocol for immediate broadcast of heat advisories across all government channels.

During the Heat Wave

- ▶ Increase public awareness by broadcasting heat advisories and pre-emptive measures by use of media.
- ▶ Arrange expert segments on TV channels and radio on heat safety for outdoor workers, the elderly, and children.
- ▶ Monitor for misinformation and report significant incidents

After the Heat Wave

- ▶ Issue the all-clear message through all channels as soon as received information.
- ▶ Compile a complete record of all communications issued and submit it.

h) Labour Department

Before the Heat Wave

- ▶ Develop a system for communication of the heat wave alert to offices and factories and other facilities under their domain to change timings of shifts to avoid exposure of workers to heat wave.
- ▶ Distribute practical guidance for employers on shift adjustments, rest breaks, shade, drinking water, and first aid.
- ▶ Conduct pre-season inspections of high-risk workplaces and document compliance.
- ▶ Capacity building and training of all staff at healthcare facilities under its control to provide emergency relief to victims of heat wave.

During the Heat Wave

- ▶ Enforce mandatory rest periods and adjusted shifts at outdoor worksites during peak heat hours.
- ▶ Keep record of heat wave incidents occurred at any level under their area of domain.
- ▶ Age and gender wise record keeping and taking remedial measures
- ▶ Ensure provision of medical facilities through mobile vans wherever applicable
- ▶ Provision of clean water and sheltered areas for workers through collaboration.

After the Heat Wave

- ▶ Submit a report covering inspections, incidents, compliance levels, and recommendations for regulatory changes.
- ▶ Update the plan according to lessons learnt.

i) Livestock & Dairy Development Department

Before the Heat Wave

- ▶ Issue advisory notes to farmers and livestock owners on protecting animals during heat.
- ▶ Ensure adequate stocks of veterinary medicines and oral rehydration solutions at all district veterinary hospitals
- ▶ Train field veterinary staff on recognising and treating heat stress in common livestock.

During the Heat Wave

- ▶ Deploy mobile veterinary teams to high-risk farming areas.
- ▶ Provide direct assistance to farmers for protecting animals and fodder.
- ▶ Report major livestock losses.

After the Heat Wave

- ▶ Document livestock losses, veterinary response, and lessons and update the contingency plan.
- ▶ Issue revised farmer advisories based on the season's experience.

j) Forestry and Wildlife Department

Before the Heat Wave

- ▶ Prepare short- and long-term tree plantation plans with a focus on indigenous species to reduce heat impact.
- ▶ Identify hotspot areas and plan protective measures for wildlife. Prepare a contingency plan to safeguard wildlife under their domain.

During the Heat Wave

- ▶ Execute the contingency plan with special focus on identified hotspot areas.
- ▶ Ensure availability of resources and medication for wildlife in affected areas.
- ▶ Report wildlife losses.

After the Heat Wave

- ▶ Identify new areas for tree plantation. Document losses and lessons and update the plantation and wildlife protection plan.

k) Parks and Horticulture Authorities (PHAs)

Before the Heat Wave

- ▶ Prepare a seasonal maintenance and watering plan for all parks, roadside trees, and green belts.
- ▶ Identify gaps in shade cover along major roads, markets, and bus stops and plan to address them.
- ▶ Develop nursery stock to address plantation gaps identified in previous seasons.
- ▶ Identify indigenous plants and trees that minimise heat wave effects and plan their plantation.

During the Heat Wave

- ▶ Increase watering frequency for roadside trees, parks, and green belts immediately upon receiving heat wave notice.
- ▶ Keep public parks open during evening hours to serve as informal cool spaces for residents.
- ▶ Water roadside plants to prevent wilting of vegetation.

After the Heat Wave

- ▶ Compile district-wise crop loss data
- ▶ Document effective adaptive practices and update farmer advisories accordingly.

l) Agriculture Department**Before the Heat Wave**

- ▶ Issue crop-specific heat advisories to farmers before the season.
- ▶ Identify resilient crop varieties and advise farmers on cropping patterns suited to extreme heat.
- ▶ Confirm water supply arrangements with irrigation authorities for crop needs during heatwave conditions.

During the Heat Wave

- ▶ Activate extension teams to provide direct guidance to farmers in affected areas.
- ▶ Monitor and report crop damage district-wise.
- ▶ Provide direct assistance to farmers in distress.

After the Heat Wave

- ▶ Compile district-wise crop loss data
- ▶ Document effective adaptive practices and update farmer advisories accordingly.

m) Water and Sanitation Agencies (WASAs)**Before the Heat Wave**

- ▶ Conduct a pre-season audit of water supply infrastructure and filtration plants, and confirm backup power and tanker fleet status.
- ▶ Identify chronic summer water shortage areas and confirm the planned response for each.

During the Heat Wave

- ▶ Maintain 24-hour water supply throughout the episode
- ▶ Deploy water tankers to shortage areas and all active relief camps as directed by district administrations.
- ▶ Increase water supply at hotspot areas through mobile sources.

After the Heat Wave

- ▶ Submit a report covering disruptions, tanker deployments, and overall system performance.
- ▶ Update the maintenance schedule to address weaknesses found during the season.

n) Development Authorities**Before the Heat Wave**

- ▶ Identify public spaces suitable for use as cool shelters or water distribution points and share confirmed lists with district administrations.
- ▶ Make passive ventilation and shade mandatory requirements in new building and housing scheme approvals.
- ▶ Plan and provide shelters at prominent public places, including bus stops.

During the Heat Wave

- ▶ Set up shade shelters and water points at key public locations upon receiving the heat wave activation notice.
- ▶ Assist district administrations in identifying additional venues for relief camps.
- ▶ Report infrastructure failures caused by extreme heat.

After the Heat Wave

- ▶ Submit a report covering infrastructure damage, shelters provided, and lessons for future planning.
- ▶ Integrate heat safety lessons into upcoming development schemes and update planning standards.

o) Education Departments (School, Higher & Technical Education)**Before the Heat Wave**

- ▶ Issue institutional guidelines on heat wave response, including clear criteria for suspending classes.
- ▶ Identify all institutions lacking adequate cooling, drinking water, or first aid and prepare a remediation plan.
- ▶ Ensure first aid facilities and clean drinking water are available at all educational institutions.
- ▶ Conduct tree plantation events and establish Environmental/Green Societies in institutions.

During the Heat Wave

- ▶ Suspend or adjust class timings at institutions without adequate cooling when temperatures reach dangerous levels.
- ▶ Ensure a continuous supply of cool drinking water at all operating institutions.
- ▶ Report institution closures and any health incidents among students and staff.

After the Heat Wave

- ▶ Submit a report covering academic disruptions, facility deficiencies, and health incidents.
- ▶ Update institutional guidelines and address facility gaps before the following season.

p) Industries, Commerce & Investment Department**Before the Heat Wave**

- ▶ Issue a pre-season directive to all registered industrial units on mandatory heat safety standards.
- ▶ Coordinate with the Labour Department on inspection protocols to avoid duplication.
- ▶ Assess availability of safety facilities at industrial units and ensure compliance.

During the Heat Wave

- ▶ Conduct targeted inspections of industrial units and report findings.
- ▶ Maintain age- and gender-disaggregated records of heat incidents at all levels under their domain.
- ▶ Report all serious heat-related incidents in industrial premises immediately.

After the Heat Wave

- Submit a report covering compliance, incidents, and recommendations for regulatory changes.

q) Civil Defence**Before the Heat Wave**

- rain civil defence volunteers in basic first aid for heat-related illness.
- Ensure all civil defence posts have drinking water and basic first aid supplies ready before the season.

During the Heat Wave

- Deploy trained volunteers to high-traffic public areas upon receiving the heat wave activation notice.
- Assist Rescue 1122 and health teams in directing affected individuals to relief camps or hospitals.
- Raise public awareness about safety measures during the heat wave.

After the Heat Wave

- Submit a report covering deployments, cases referred, and lessons from the season.

r) Housing, Urban Development and Public Health Engineering Department (HUD and PHED)**Before the Heat Wave**

- Service all rural water supply schemes before summer and confirm operational status.
- Identify rural and peri-urban areas with unreliable summer water supply and confirm contingency arrangements.

During the Heat Wave

- Monitor rural water supply schemes continuously and resolve any breakdown on priority report downtime.
- Make suitable government facilities available to district administrations as relief points.

After the Heat Wave

- Submit an infrastructure report covering breakdowns, response times, and maintenance gaps.

s) Social Welfare & Bait-ul-Maal Department**Before the Heat Wave**

- Maintain an updated district-wise database of registered community organisations and volunteers.
- Brief registered organisations on their expected roles and how to coordinate during a heat wave.

During the Heat Wave

- Activate registered volunteers and community organisations immediately upon receiving the heat wave notice.
- Facilitate provision of water, shade, and meals to vulnerable individuals at relief camps and public shelters.
- Encourage the public to help street animals and birds by arranging water and shade for them.

After the Heat Wave

- Submit a community response report covering deployments, persons assisted, and key lessons.

t) Police Department and Traffic Police**Before the Heat Wave**

- Prepare adjusted duty schedules for all outdoor officers to reduce continuous heat exposure.
- Ensure all field officers have access to clean drinking water and shaded rest points during duty.
- Train police officials on how to manage their duties during heat wave conditions.

During the Heat Wave

- Implement adjusted duty schedules and report any heat illness cases among personnel immediately.
- Manage traffic flow near relief camps and health facilities to ensure unimpeded emergency access.
- Provide umbrellas, shelters, and clean drinking water to officers on outdoor duty.

After the Heat Wave

- Submit a report covering personnel health incidents, operational support provided, and lessons from the season.

u) Punjab Employees Social Security Institution (PESSI)**Before the Heat Wave**

- Confirm that all PESSI hospitals and dispensaries have adequate medicine stocks, IV fluids, and rehydration salts.
- Coordinate with the Labour Department to ensure registered workers in high-risk industries know which PESSI facilities are available.

During the Heat Wave

- Operate all PESSI facilities on a 24-hour basis during an active heat wave.
- Report daily case numbers to EPCCD's Coordination Cell.
- Ensure that no registered worker is turned away, and report any capacity shortfalls.

After the Heat Wave

- Submit a report covering cases treated, facility performance, supply adequacy, and recommendations.

v) Local Government and Community Development Department (LG&CDD)**Before the Heat Wave**

- Direct all metropolitan corporations and municipal committees to identify suitable shelter locations and water distribution points.
- Confirm that municipal water supply systems are fully operational and tankers are fuelled before summer begins.
- Identify hotspot areas and plan for resource distribution in advance.

During the Heat Wave

- Deploy municipal water tankers to high-density areas, open markets, and clusters of vulnerable populations.
- Open designated municipal buildings and community halls as cool shelters.
- Maintain solid waste collection throughout the heat wave and report any major breakdown.
- Allocate resources to support vulnerable groups in coordination with district administrations.

After the Heat Wave

- Compile data on tanker deployments, shelters operated, and people assisted, and submit a report.

w) Provincial Disaster Management Authority (PDMA)**Before the Heat Wave**

- Coordinate with EPCCD and district administrations to review heat wave preparedness.
- Share heatwave alerts, guidelines, and instructions with all District Disaster Management Authorities (DDMAs).
- Ensure availability of basic emergency supplies such as water, tents, fans, and generators in high-risk areas.
- Identify high-risk districts and prepare simple, practical response plans in advance.
- Conduct short coordination meetings with key departments to ensure readiness and clarify roles.

During the Heat Wave

- Activate the control room for continuous monitoring and coordination.
- Maintain close communication with district administrations for rapid response.
- Support arrangements for emergency water supply, temporary shelters, and relief services.
- Collect daily situation updates from districts and share brief reports.

After the Heat Wave

- Collect simple reports from districts on response actions and support provided to affected people.
- Review what worked well and identify challenges faced during the response.
- Document key lessons learned from the heat wave management experience.
- Share findings and recommendations to improve future preparedness and response planning.

x) SUPARCO

- SUPARCO supports heat wave management through satellite-based monitoring, geospatial data, and remote sensing tools.

Before the Heat Wave

- Share satellite-derived heat maps and land surface temperature data before the summer season to identify high-risk hotspot areas.
- Provide geospatial analysis of urban heat islands, vegetation cover loss, and deforestation in Punjab to help departments prioritise their preparedness actions.
- Support EPCCD in updating the provincial heat risk database using remote sensing data.

During the Heat Wave

- Monitor heat wave intensity and spatial spread through satellite imagery and share daily updates.
- Provide real-time land surface temperature data to help identify emerging hotspots across Punjab districts.
- Support with geospatial data for targeting relief operations.

After the Heat Wave

- Conduct a post-event satellite analysis of affected areas covering temperature anomalies, vegetation stress, and land surface changes.
- Share findings for inclusion in the provincial response report and for updating the heat risk database.
- Identify new high-risk zones based on satellite data trends and recommend areas for priority tree plantation and urban greening.

y) Department of Aquaculture and Fisheries**Before the Heat Wave**

- Identify vulnerable fish farms and ensure basic preparedness (oxygen supply, water quality monitoring, and emergency support arrangements).
- Advise fish farmers on preventive actions like maintaining water depth, reducing stocking stress, and preparing aeration systems.

During the Heat Wave

- ▶ Monitor water temperature and fish health in high-risk areas and provide rapid technical support where needed.
- ▶ Ensure emergency measures such as aeration, oxygen supply, and controlled feeding to reduce fish mortality.

After the Heat Wave

- ▶ Assess fish losses and water quality impacts in affected farms and ponds.
- ▶ Document lessons learned and update preparedness measures for future heatwaves.

z) Energy Department

Before the Heat Wave

- ▶ Coordinate with DISCOs and relevant stakeholders to ensure readiness of the power system for peak summer demand.
- ▶ Identify vulnerable areas requiring priority electricity supply during extreme heat. Issue advisories on efficient electricity use to reduce peak load.
- ▶ Ensure planning for uninterrupted power supply to critical facilities (hospitals, water supply, emergency centers).

During the Heat Wave

- ▶ Maintain coordination with DISCOs for monitoring electricity supply situation.
- ▶ Support prioritization of power supply to critical services.
- ▶ Facilitate inter-agency coordination during major outages.

After the Heat Wave

- ▶ Review overall power supply performance in coordination with stakeholders.
- ▶ Identify gaps and recommend improvements for system resilience.
- ▶ Document lessons learned for future planning.

aa) WAPDA / DISCOS

Before the Heat Wave

- ▶ Carry out maintenance of transmission and distribution systems before summer.
- ▶ Ensure availability of spare parts and emergency repair equipment.
- ▶ Assess peak demand and prepare system capacity.
- ▶ Establish emergency response teams for quick restoration.

During the Heat Wave

- ▶ Ensure continuous electricity supply, especially to critical facilities.
- ▶ Minimize and quickly restore outages in affected areas.
- ▶ Prioritize hospitals, water supply systems, and emergency services.
- ▶ Manage load to avoid system breakdowns

After the Heat Wave

- ▶ Assess damages and service disruptions.
- ▶ Restore affected infrastructure.
- ▶ Review system performance and document lessons learned.
- ▶ Update preparedness plans for future heatwave

4.2 Measures by Govt. Department for the Vulnerable Population

- ▶ EPCCD, PMD, and PDMA should strengthen early warning systems and issue timely heatwave alerts through TV, radio, and SMS
- ▶ District administrations, in coordination with PDMA, should identify the most vulnerable communities for sensitisation, awareness, early warning, and emergency evacuation, and ensure district hazard maps are regularly updated down to the Union Council level
- ▶ Planning for heatwave response should be based on authenticated, disaggregated data (gender, age, and disability) to ensure inclusive targeting of vulnerable groups and evidence-based resource allocation
- ▶ Communication strategies should prioritize vulnerable households through community health workers, SMS alerts, mosque announcements, and door-to-door awareness campaigns in low-income areas to ensure timely and accessible information
- ▶ Primary and Secondary Healthcare Department Punjab will lead public awareness efforts on heat risks, hydration, and symptoms of heat exhaustion, while strengthening surveillance for high-risk populations
- ▶ Health system response will prioritize vulnerable groups (elderly, children, women, and persons with disabilities) by ensuring fast-track treatment, emergency triage, and priority access to services
- ▶ Mobile health clinics and outreach teams should be deployed in underserved rural and urban areas to provide on-site medical support and early detection of heat-related illness.
- ▶ Free or subsidized treatment and essential medicines, including ORS and emergency care supplies, should be made available through public health facilities to prevent progression of heatstroke
- ▶ District administrations will establish temporary shelters in schools, community halls, and other public buildings, particularly in high-risk urban slums and rural areas
- ▶ Emergency relief measures will include distribution of fans, water coolers, in heat-prone and underserved communities to reduce household heat exposure
- ▶ Water and Sanitation Agency and local authorities will ensure a continuous water supply and arrange water tanker services in areas facing shortages during extreme heat
- ▶ Social Welfare and Bait-ul-Maal Department, Punjab will provide targeted assistance to vulnerable households, while ensuring regular welfare checks for isolated elderly persons and persons with disabilities under the supervision of Punjab Disaster Management Authority
- ▶ Labour and Human Resource Department, Punjab to enforce occupational safety measures, including adjusted working hours, mandatory rest breaks, shift changes (early morning/evening), and provision of drinking water and shaded rest areas for outdoor workers
- ▶ Primary and Secondary Healthcare Department, Punjab, and Specialized Healthcare and Medical Education Department, Punjab should ensure hospital preparedness through dedicated heatwave units, emergency counters, and deployment of mobile medical teams for rapid response with priority treatment for vulnerable population groups.
- ▶ Overall coordination and monitoring of heatwave response should be led EPCCD to ensure integrated implementation across all departments with a strong focus on protecting vulnerable populations

Chapter Five

5. PUBLIC AWARENESS & CLIMATE COMMUNICATION

Effective public awareness and climate communication are therefore core operational imperatives of this Plan not supplementary activities. This section establishes the Government of Punjab's framework for translating meteorological data into life-saving public action, building climate literacy across institutions, and reaching every vulnerable citizen through all available channels.

Both EPCCD and the Information and Culture Department shall work in close coordination to maintain a unified provincial communication strategy capable of delivering rapid, accurate, and accessible information before and during heatwave emergencies.

5.1 Heatwave Risk Communication Framework

The public awareness campaign shall aim to increase understanding of heatwave risks and associated health impacts while encouraging preventive and protective behaviours during extreme heat conditions. Through continuous public engagement, the campaign will strengthen preparedness at institutional, community, and household levels, thereby reducing heat-related illness, mortality, and economic disruption.

EPCCD, through the Heatwave Management Cell and Strategic Communication Cell, shall operationalize a Heatwave Risk Communication Framework directly linked with the provincial colour-coded alert system. Communication intensity and public advisories shall escalate proportionally with the severity of heatwave conditions.

5.2 Multi-Channel Communication System

To ensure broad outreach and effective last-mile communication, EPCCD shall establish a multi-platform communication system integrating digital, institutional, media-based, and community-level dissemination mechanisms.

Mobile and telecom-based communication shall serve as one of the fastest means of public outreach. In collaboration with the Pakistan Telecommunication Authority (PTA) and telecom operators, geo-targeted SMS alerts will be disseminated in Urdu, Punjabi, and other regional languages. During severe heat emergencies, emergency mobile notifications and automated voice messages may also be used to reach low-literacy and vulnerable populations. Public safety instructions, emergency helpline numbers, and protective guidance will accompany all alerts.

Electronic and broadcast media shall serve as the primary mass communication channel for heatwave awareness and emergency advisories. Television channels and radio stations will broadcast heatwave warnings, scrolling alerts, weather advisories, expert interviews, and public service messages throughout the heatwave season. Radio bulletins will be particularly important for outreach to rural populations, transport operators, and remote communities with limited internet access. The Information and Culture Department shall coordinate closely with media organizations to ensure uninterrupted and verified dissemination of official advisories.

Digital and social media platforms will complement conventional communication systems by providing real-time updates and interactive public engagement. Official

government websites, heatwave dashboards, and social media accounts on Facebook, X (Twitter), Instagram, WhatsApp, and YouTube will disseminate infographics, short awareness videos, multilingual advisories, daily heat index maps, and weather updates. EPCCD's Strategic Communication Cell shall also monitor misinformation and ensure that all departments maintain consistent public messaging. A unified provincial communication identity and hashtag may be adopted to improve campaign visibility and public recognition.

Community-based communication networks shall play a critical role in reaching populations with limited access to digital or broadcast media. Local governments, union councils, Lady Health Workers (LHWs), civil society organizations, and community volunteers will support localized awareness and outreach activities. Mosque announcements and public address systems will be utilized for dissemination of urgent warnings and safety instructions, particularly during severe heat emergencies. Schools, colleges, community centres, and public institutions will display heat safety awareness materials and educational content.

Public display and outdoor communication measures shall further reinforce awareness efforts. Digital billboards, electronic displays, posters, banners, and informational signage will be installed at hospitals, schools, bus terminals, railway stations, markets, construction sites, industrial zones, and other public spaces. Public transport systems may also be utilized for dissemination of heatwave safety messages and emergency advisories. Advisories for general public are at (Annex-II)



5.3 Targeted Communication for Vulnerable Groups

Recognizing that heatwaves disproportionately affect vulnerable populations, EPCCD will develop targeted communication protocols for high-risk groups including elderly individuals living alone, children, outdoor labourers, traffic police personnel, persons with disabilities, pregnant women, and individuals suffering from chronic illnesses. Special attention shall also be given to low-income urban communities residing in densely built and heat-prone settlements. Advisories for vulnerable population are at (Annex-III.)

5.4 Monitoring, Feedback and Communication Effectiveness

EPCCD shall establish a mechanism to monitor and evaluate the effectiveness of heatwave communication, including message reach, public response, hotline usage, and engagement across digital and traditional media channels. Feedback will be gathered from district administrations, health facilities, local governments, and community networks to identify gaps in awareness and response.

The Government of Punjab's Information and Culture Department will support this process by monitoring media coverage, assessing the reach and consistency of public advisories across electronic, print, and digital platforms, and providing media analytics and audience feedback. It will also help evaluate the effectiveness of public service messages and overall campaign visibility.

EPCCD's Strategic Communication Cell will consolidate all monitoring data and feedback into post-heatwave evaluation reports to refine communication strategies and improve future awareness campaigns, ensuring a more effective and coordinated public response in subsequent heatwave events.

Chapter Six

6. MONITORING AND EVALUATION

To assess whether the plan is effectively reducing heat-related illness, death, and vulnerability across Punjab, and to guide annual improvements, EPCCD will lead the Monitoring and Evaluation (M&E) framework as a "digital nervous system" of the entire operation. A centralized digital dashboard will be established to integrate real-time data and alerts received from PMD, SUPARCO, EPCCD monitoring stations, district administrations, and relevant line departments. The dashboard will support continuous monitoring of heatwave risks, alert dissemination, departmental response actions, and public communication activities across the province. By shifting from static reports to a dynamic narrative of oversight, the proposed M&E framework ensures that no warning goes unheard and no department remains inactive.

The proposed M&E framework will monitor key performance indicators including heat alerts, activation of response mechanisms, hospital preparedness, dissemination of SMS and media advisories, and outreach to vulnerable communities. District administrations and sectoral departments will regularly submit implementation and response updates for consolidation and review.

EPCCD will prepare periodic monitoring reports during the summer season and share findings with the Heatwave Management Program Committee (HMP) for strategic oversight and corrective actions where necessary. Seasonal evaluations and after-action reviews will also be conducted to assess the effectiveness of coordination, response measures, and public awareness efforts. Instead of reviewing paper reports months later, the HMP will use the EPCCD dashboard's analytics for "course correction" meetings during the peak of summer. Lessons learned and performance gaps identified through the dashboard and review process will be used to improve future heatwave preparedness, communication systems, and inter-agency coordination across Punjab (Figure 9).



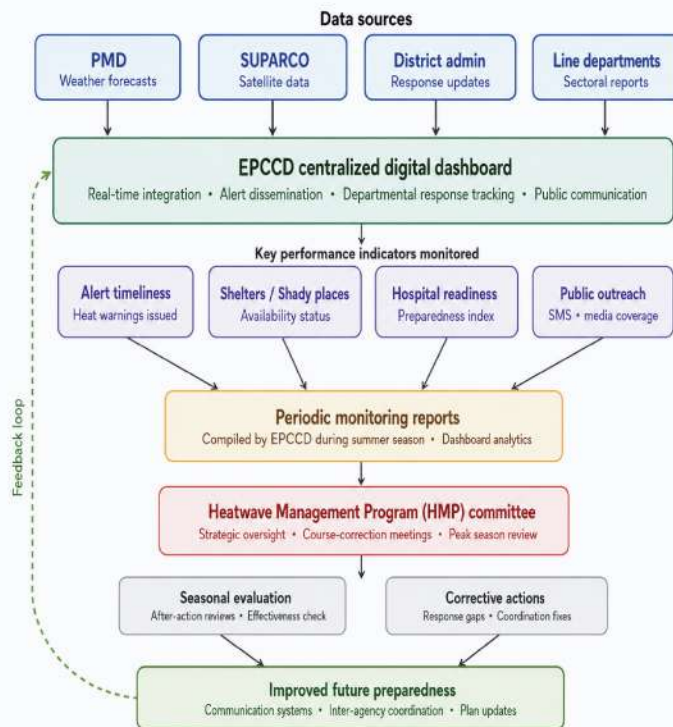


Figure 9. Punjab's heatwave M&E framework

CONCLUSION

The Punjab Heatwave Action Plan reflects a strong commitment by the Government of the Punjab to tackle one of the most urgent climate challenges facing the province. Rising temperatures, increasing heatwaves, and rapid urbanization are putting people especially the most vulnerable at serious risk. This Plan moves beyond emergency response and focuses on proactive, well-coordinated action by clearly defining roles across departments, strengthening early warning systems, and prioritizing protection for at-risk communities. It also openly recognizes existing gaps, such as limited coordination and resources, and outlines practical steps to address them. Ultimately, the success of this Plan depends on collective effort from government institutions to communities where timely actions, effective coordination, and care for vulnerable groups can save lives and build a more heat-resilient Punjab.

Sr. No.	Departments
1	Agriculture Department
2	District Administration
3	Civil Defence
4	Department of Aquaculture and Fisheries
5	Deputy Commissioners
6	Development Authorities
7	Education Departments (School, Higher & Technical Education)
8	Emergency Services Department (Rescue 1122)
9	Energy Department
10	Environment Protection & Climate Change Department (EPCCD)
11	Forestry and Wildlife Department
12	Housing, Urban Development & Public Health Engineering Department (HUD & PHED)
13	Information and Culture Department
14	Industries, Commerce & Investment Department
15	Labour Department
16	Livestock & Dairy Development Department
17	Local Government and Community Development Department (LG&CDD)
18	Parks and Horticulture Authorities (PHAs)
19	Pakistan Meteorological Department (PMD)
20	Police Department and Traffic Police
21	Provincial Disaster Management Authority (PDMA)
22	Primary & Secondary Healthcare Department / Specialized Healthcare & Medical Education Department
23	Punjab Employees Social Security Institution (PESSI)
24	Social Welfare & Bait-ul-Maal Department
25	SUPARCO
26	Water and Sanitation Agencies (WASAs)
27	WAPDA / DISCOs

Annex-I



**GOVERNMENT OF THE PUNJAB
PLANNING & DEVELOPMENT BOARD**

Dated Lahore, the 19th April, 2023

NOTIFICATION

NO.1/(153)PO(Env.&CC)P&D/2023. In pursuance of the directions of honorable Lahore High Court writ petition No. 227807/2018 titled as Haroon Farooq vs Government of the Punjab etc. conveyed vide letter number 7752/IAS dated 12.04.2023, received from Additional Advocate General (Admin) Punjab Lahore, a Heat Wave Management Programme Committee (HMP) is hereby notified under the Chairmanship of Secretary EPD with the following composition:

SR.#	NAME & DESIGNATION	STATUS
1	The Secretary EPD	In Chair
2	The Director General EPA	Secretary
3	Secretary LG&CDD	Member
4	Secretary HUD & PHED	Member
5	Secretary Forestry & Wildlife	Member
6	DG PHA	Member
7	DG LDA	Member
8	DG PR	Member
9	Senior Specialist Environment and Social Safeguard Urban Unit	Member
10	Any other member can be co-opted	Member

The following TORs may be observed by the above mentioned committee

1. Prepare, review, approve and implement heat wave management plan in cities of Punjab.
2. Engage stakeholders for preparation and management of heat wave plan in the cities.
3. Issue necessary standard operating procedures (SOPs) regarding arrangement for possible heat wave.
4. Prepare mechanism for inter-agency coordination, clarity in roles and well publicized trigger to activate a planned response.
5. Propose initiatives to transform the city into a resilient and sustainable urban sector and to improve the living conditions of the citizens.
6. Providing the public with timely and specific information before, during and after extreme heat emergencies.
7. Recommend ways to empowering implementation agencies to supply the required levels of service and support in a way that is coordinated and efficient.

Annex-II

Advisories for General Public

Below 40°C Normal	40 - 41.9°C Hot Day Alert	≥ 42°C Hot Day Warning	≥ 42°C + 2 days Heatwave Emergency
 Follow the daily weather forecast. Routine sun protection	 ▶ Avoid peak-hour outdoor activity ▶ Drink water regularly ▶ Wear loose light clothing	 ▶ Stay indoors; avoid sunlight ▶ Stock water & medicines ▶ Check on elderly & children	 ▶ Extreme caution, stay home ▶ Locate nearby shelters ▶ Call 1122 for emergencies
	BEFORE HEATWAVE ▶ Prepare cool spaces at home & work ▶ Stock water and ORS ▶ Know your nearest health facility	DURING HEATWAVE ▶ Avoid outdoor 11 AM - 4 PM ▶ Drink water every 20 minutes ▶ Never leave anyone in parked vehicles	AFTER HEATWAVE ▶ Continue hydration after cooling ▶ Monitor vulnerable persons ▶ Resume activities gradually

Annex-III

Advisories for Vulnerable Population Groups

Vulnerable Group	Alert Level	Before Heatwave	During Heatwave	After Heatwave
Children	Hot Day Alert 40°C - 41.9°C	Parents/Guardians shall: • Provide heat safety awareness • Ensure availability of clean drinking water • Prepare shaded areas and emergency response plan	Parents/Guardians shall ensure: • Outdoor sports and assemblies restricted during peak heat hours • Keep children hydrated and monitored for signs of heat stress	School management shall: • Monitor students for dehydration or heat-related illness • Gradually resume outdoor activities after official clearance
	Hot Day Warning ≥ 42°C	School management shall: • Pre-cool classrooms and nurseries • Increase fluid intake; pack oral rehydration salts (ORS) • Brief parents or caregivers on heat illness signs	Parents/Guardians shall: • Cancel all outdoor sports and daytime school activities • Supervise children continuously • Provide ORS if sweating heavily • Call 1122 if child shows confusion, vomiting, or high fever	Parents/Guardians shall: • Medical check if child had prolonged sun exposure • Avoid physical exertion • Record and report heat illness cases to district health office
Senior Citizens / Elderly	Heatwave Emergency ≥ 42°C + min. 30°C for 2+ consecutive days	Parents/Guardians shall: • Keep all children indoors or in cooled shelters • Activate emergency heat protocols • Hydration schedule every 20 minutes • Register vulnerable children with EDH / local health posts	Parents/Guardians shall: • Immediate evacuation to the nearest shelter/shady place in an emergency • Continuous hydration and temperature monitoring • Apply ice packs to neck, armpits, and groin	Parents/Guardians shall: • Full paediatric assessment before returning to school • Psychological support if trauma from heat distress
	Hot Day Alert 40°C - 41.9°C	• Identify elderly persons living alone, in old age homes or medical centers • Arrange cooling support via families and health workers	• Remain indoors in ventilated areas • Avoid outdoor exposure between 11 AM - 4 PM	• Follow-up health checkups • Check signs of weakness or dehydration symptoms
	Hot Day Warning ≥ 42°C	• Arrange daily welfare checks by family or community volunteer • Identify nearest shady area and plan transport	• Full indoor confinement; no errands or mosque attendance midday • Family members to call or visit twice daily • Cool sponge baths every 2 hours	• Full clinical assessment if any heat-related symptoms occurred • Family welfare debriefs with local health worker
	Heatwave Emergency ≥ 42°C + min. 30°C for 2+ consecutive days	• Avoid alcohol and caffeine; pre-hydrate morning and evening • Notify local health worker of any chronic conditions • Relocate to a cooled facility or family home proactively • Ensure 24-hour caregiver availability • District Social Welfare to enroll isolated elderly in alert registry • Pre-position mobile medical units in high-density elderly areas	• Call Riscue 1122 for any sudden weakness or chest discomfort • Shift to hospital if no air-conditioning is available • Continuous vital sign monitoring if staying home • Ice packs / cold towels on pulse points • Do not stay alone under any circumstances	• Replenish ORS stocks for next event • Mandatory medical review before discharge from safe/shady space. • Geriatric follow-up within 7 days • Incident documentation and reporting to DHO

Pregnant Women	Hot Day Alert 40°C – 41.9°C	- Disseminate awareness advisories on hydration and reduced outdoor exposure - Lady health workers to take part in spreading awareness	- Avoid direct sunlight exposure - Maintain hydration - Seek medical care in case of dizziness or fatigue	- Monitor post-heat-stress complications - Continue medical follow-up where required
	Hot Day Warning ≥ 42°C	- Pre-plan cool delivery room / facility - Discuss risk signs (reduced fetal movement, swelling) with midwife or doctor - Stock electrolyte drinks and light foods - Confirm backup transport to hospital	- Absolute indoor rest: avoid kitchen heat during cooking hours - Use cool wet cloth on forehead, neck, wrists - Seek immediate care if headache, visual disturbance, or fever - LHW to conduct daily home visit	- Postnatal check within 48 hours of heat event - Screen newborn for dehydration or fever - Counseling on breastfeeding frequency in heat
Outdoor Workers / Laborers	Heatwave Emergency ≥ 42°C + min. 30°C for 2+ consecutive days	- Get admitted to cooled maternal facility if in third trimester - Enroll in district maternal alert system - Daily vital signs check by LHW - Prepare emergency delivery kit at home	- Hospital admission for high-risk pregnancies (>36 weeks) - IV rehydration if oral intake inadequate - Continuous fetal monitoring in facility - Activate obstetric emergency protocol	- Full maternal and neonatal review before hospital discharge - Case reporting to District Health Authority - Mental health support if distressing event occurred
	Hot Day Alert 40°C – 41.9°C	Workplace owners shall: - Prepare shaded rest areas - Arrange ORS and drinking water at workplaces and construction sites - Issue wide-brim hats, light PPE, and water containers	- Mandatory 10-min shade break every 50 min of work - Drink 250 ml water every 20 min - Avoid tea and tobacco during shift - Report dizziness, nausea, or cramps to supervisor immediately	- Full rehydration before resuming next shift - Log heat incidents in site register for Labor Department review - Inspect and restock first-aid kits and water supply
	Hot Day Warning ≥ 42°C	- Mandatory 1 L water per hour per worker-policy - Take 5–10 min rest at a shady place every 1 hour - Buddy system i.e. pair all workers	- Keep yourself hydrated at all times - Reduce work intensity or increase breaks between work - Apply wet towels on neck and wrists during breaks - In any heat illness case, go to BHD immediately	- Submit incident report to District Labor Office via workplace management - Follow-up checkups if required
	Heatwave Emergency ≥ 42°C + min. 30°C for 2+ consecutive days	- Avoid all non-essential outdoor work during peak hours (10 AM – 5 PM) - Employers to provide cooled rest rooms	- Complete work stoppage for at-risk tasks - Seek shelter immediately - Drink ORS and cool water on site - Lie down, fan vigorously, and call 1122 without delay in emergency	- Compensatory rest day after extreme exposure - Formal investigation of any heat fatality or serious injury

REFERENCES

- Ameen, I., Kashif, M., Hameed, H.N., & Nida, H. (2024). Trend analysis of extreme weather indices in different districts of Punjab, Pakistan. *Agrobiological Records*, 18, 29–40.
- Down (2025, June 10). Heatwave in Punjab set to last until 12th: PDMA. <https://www.down.com/news/1916154>
- Eckstein, D. et al. Global Climate Risk Index 2021. Bonn: Germanwatch e.V., 2021.
- EP&CCD, Government of Punjab. Punjab Climate Change Policy and Action Plan, 2024. Lahore: EP&CCD.
- EP&CCD, Government of Punjab. Punjab Green School Certification Programme (PGSCP). Lahore: EP&CCD.
- Express Tribune (2025, June 11). Severe heatwave scorches Pakistan: temperatures soar past 50°C. <https://tribune.com.pk/story/2550328>
- Government of Punjab, EP&CCD. Punjab Heat Wave Management Plan 2023. Lahore: Government of Punjab.
- Government of Pakistan. National Disaster Management Act, 2010. Islamabad: NDMA.
- Government of Pakistan, Ministry of Climate Change. National Climate Change Policy (NCCP), Updated 2021. Islamabad: MoCC.
- Government of Pakistan, Pakistan Climate Change Act, 2017. Islamabad.
- Government of the Punjab. Punjab Local Government Act, 2022. Lahore: Law, Parliamentary Affairs & Human Rights Department.
- IPCC (2021). Climate Change 2021: The Physical Science Basis. Chapters 10 & 12. Cambridge University Press.
- Ijaz, M. et al. (2021). Assessment of climate variability among seasonal trends using in situ measurements: A case study of Punjab, Pakistan. *Atmosphere*, 12(8), 939.
- Khan, N., Shahid, S., Ismail, T., Ahmed, K., & Nawaz, N. (2018). Trends in heat wave related indices in Pakistan. *Stochastic Environmental Research and Risk Assessment*. <https://doi.org/10.1007/s00477-018-1605-2>
- Knowlton, K. et al. (2014). Development and implementation of South Asia's first heat health action plan in Ahmedabad (Gujarat, India). *International Journal of Environmental Research and Public Health*.
- Masood, I. et al. (2015). The deadly heat wave of Pakistan, June 2015. *International Journal of Occupational and Environmental Medicine*, 6(4), 247–248.
- National Disaster Management Authority (NDMA). Guidelines for Preparation of Action Plan – Prevention and Management of Heat-Wave. Islamabad: NDMA, 2019.
- Pakistan Meteorological Department (PMD). Heat Wave Advisory and Early Warning Protocols. Islamabad: PMD.
- Shakoor, H., Naseem, W. et al. (2026). Urban Heat Island hazard and disaster risk in major Pakistani cities. *Progress in Disaster Science*, 30, 100580.
- The Urban Unit (2025). Heatwave Management Plan of Lahore (2025–2028). Environmental and Social Safeguards Department, Lahore.
- UNDRR. Sendai Framework for Disaster Risk Reduction 2015–2030. Geneva: UNDRR, 2015.
- World Health Organization (WHO) / WMO. Heat-Health Action Plans: Guidance. Copenhagen: WHO Regional Office for Europe, 2008.
- World Meteorological Organization (WMO). Guidelines on the Definition and Monitoring of Extreme Weather and Climate Events. Geneva: WMO, 2023.
- Shaw, R., Y. Luo, T.S. Cheong, et al., 2022. Asia. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the IPCC [H.-O. Pörtner et al. (eds.)]. Cambridge University Press, pp. 1457–1579. <https://doi.org/10.1017/9781009325844.012>
- <https://agrobiologicalrecords.com/articles/18-0-Vol-18-29-40-2024-ABR-24-251.pdf>
- <https://epd.punjab.gov.pk/system/files/PCCP%20DRAFT%20112.pdf>
- <https://wmo.int/news/media-centre/wmo-prepare-el-nino>