HAQR

The Heat and Air Quality Resilience Plan

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SFDEM

San Francisco
Department of Public Health

ONESF
Building Our Future

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The Heat and Air Quality Implementation Plan represents two years of the Heat and Air Quality Resilience Project and establishes a framework to address current local extreme heat and wildfire smoke events while preparing for future ones.

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SECTION 1:

Executive Summary

Although climate change is global in scope, its impacts are local. This is especially true for extreme heat and wildfire smoke events in places that aren't accustomed to warm temperatures and poor air quality. Historically, San Francisco's temperatures rarely went above 80 degrees and took advantage of ocean breezes and reliable fog that served as a natural air conditioner for not only the City but the entire region. That has dramatically changed. The past ten years have brought multiple days of 100-plus degree weather and multiple weeks of dangerously unhealthy air from wildfires often hundreds of miles away. These unprecedented events are expected to continue to become more frequent and more extreme.

To make matters worse, San Francisco is particularly vulnerable to extreme heat events and wildfire smoke events because our bodies, buildings, infrastructure, services, and communities are not designed for extreme temperatures and poor air quality.

The Heat and Air Quality Resilience Plan (HAQR) is San Francisco's first comprehensive approach to identify and address the public health and infrastructure impacts of extreme heat and wildfire smoke in San Francisco. Foundational to the approach is an understanding that these health impacts are inequitably distributed. The people who carry the heaviest health burden are those most **exposed** to extreme heat and wildfire smoke, most physiologically **sensitive** to that exposure, and least likely to have the economic, social, or political **capacity** to prepare for or respond to these disasters.

Any process to effectively address the public health impacts and build resilience to extreme heat and wildfire smoke must include the participation of community, public, private, and academic partners. This includes organizations that:

- Represent, engage, or work closely with communities most vulnerable to the impacts;
- Plan or execute emergency preparedness and response activities;
- Provide health care or other community services;
- Build, regulate, or maintain housing and other facilities;
- Plan or manage open space, green infrastructure or other public works that can reduce urban heat islands; or,
- Deliver and maintain the services that sustain San Francisco's workforce and economy.

HAQR is a cross-sectional initiative to bring these partners together to identify, plan, and implement comprehensive medium-to-long-term adaptation strategies. The Heat and Air Quality Implementation Plan represents two years of the Heat and Air Quality Resilience Project and establishes a framework to address current local extreme heat and wildfire smoke events while preparing for future ones.

Implementation Plan Objectives

The objectives of the Heat and Air Quality Implementation Plan are to:

- Identify extreme heat and wildfire smoke as significant and inequitable health threats.
- Define a San Francisco resilient to the health impacts of extreme heat and wildfire smoke.
- Develop staff-level, leadership-level, and community-level consensus on the strategies and actions necessary to build that resilient San Francisco.
- Facilitate the short, medium, and long-term implementation of the strategies necessary to build that resilience across San Francisco.

Implementation Plan Strategies

These adaptation strategies are organized by Resilience Pathway. Resilience Pathways refer to the mechanism that connects a specific strategy to increases in community resilience to extreme heat and/or wildfire smoke. The Resilience Pathways in this document are:

1. San Francisco's buildings are adapted to reduce exposure to extreme heat and poor air quality.
2. San Francisco's exterior built and natural environments are adapted to reduce exposure to extreme heat and poor air quality.
3. San Francisco is made more resilient to extreme heat and wildfire smoke through equitable emergency preparedness, response, and resilience actions.
4. San Francisco is made more resilient to both current and future extreme heat and wildfire smoke events through City services that can predict and adapt to climate-related stressors.

Pathway 1: San Francisco's buildings are adapted to reduce exposure to extreme heat and poor air quality

Objective	Strategy
Planning and Research: Identify best practices to cool and ventilate San Francisco's buildings across a range of building types including multi-unit, affordable, and supportive housing	Identify Weatherization Best Practices
	Pilot Cooling and Clean Air Adaptation Projects
Policy and Regulations: Establish policy and regulations that incentivize extreme heat and wildfire smoke adaptations	Reconcile Administrative Barriers, e.g. Potential Code Conflicts
	Develop Heat and Air Quality Design Guidelines
	Investigate a Thermal Comfort Policy
Funding and Resources: Secure new funding sources while leveraging existing sources to implement adaptations	Identify and Track New Funding Sources
	Seek Funding to Bolster Priority Building Rehabilitations
Outreach and Engagement: Make extreme heat and wildfire smoke adaptations accessible to homeowners and renters in the communities most vulnerable to climate impacts	Develop Weatherization Clearinghouse
	Evaluate Weatherization Programs

Pathway 2: San Francisco's exterior built and natural environments are adapted to reduce exposure to extreme heat and poor air quality

Objective	Strategy
Planning and Research: Identify priority areas and green infrastructure projects throughout the City based on land use and health data	Develop HAQR Green Infrastructure Priority Projects
	Collect Green Infrastructure Data
	Investigate Strategies to Address Impervious Surfaces
Policy and Regulations: Facilitate implementation of climate-related green infrastructure improvements	Review Tree Planting Policies
Funding and Resources: Develop and streamline new and existing funding sources to implement adaptations	Develop Green Infrastructure Financing Strategy
Outreach and Engagement: Ensure the public understands how interventions are connected to community benefits through clear communication	Integrate Climate Health into Existing Green Infrastructure Outreach Activities

Pathway 3:
San Francisco is made more resilient to extreme heat and wildfire smoke through equitable emergency preparedness, response, and resilience actions

Objective	Strategy
Community Emergency Response Planning: Empower community- based organizations and other local institutions to partner with the City before extreme heat and wildfire smoke-related emergencies to develop preparedness and response plans, understand best practices, and identify resources	Identify and Promote Involvement Pathways
	Offer Trainings and Technical Assistance
Extreme Weather Respite Center Strategy: Provide accessible, culturally- competent City-run Weather Respite Centers with programmatic services through the Extreme Weather Resilience Program	Identify Respite Facilities
	Address Programmatic Needs
Support for Sheltering in Place: Make Preparedness and response services available to homebound seniors and others for whom community respite sites are not a practical option	Establish a Citywide Wellness Check Program
	Support and Expand Community Hubs
	Investigate Opportunities to Connect CBOs with Emergency Resources
Emergency Communications: Engage in regular two-way communications to mediate conflict, identify risk, and design and improve resilience actions	Refine Emergency Messaging
	Community Involvement in the Emergency Operations Center
	Create and Maintain 311 Call Script
	Evaluate Communications Methods

Pathway 4:
San Francisco is made more resilient to both current and future extreme heat and wildfire smoke events through City services that can predict and adapt to climate-related stressors

Objective	Strategy
Research and Data Analysis: Establish a research and data analysis framework to identify risk, track impacts, and evaluate interventions	Use Data to Identify Risk
	Track Health Impacts
	Leverage Data to Plan and Evaluate Interventions
Interdepartmental Coordination and Governance: Implement extreme heat and wildfire smoke adaptations through streamlined government collaboration and action	Offer Workforce Development Trainings
	Facilitate Future Planning Actions

SECTION 2:

The Heat and Air Quality Resilience Project

Over the last decade, extreme heat waves and wildfire smoke events have become increasingly common. While City emergency preparedness and response actions have worked to address the short-term health impacts of these events, there has not been a continuous effort to supplement these actions with the medium-to-long-term strategies necessary for San Francisco to become more resilient year to year.

The Heat and Air Quality Resilience Project coordinates the design, implementation, and evaluation of adaptation strategies to adapt San Francisco's communities, buildings, infrastructure, programs and services to be more resilient to extreme temperatures and air quality impacts. The Heat and Air Quality Resilience Project was developed to accomplish two goals:

- Centralize extreme heat and air quality resilience planning to foster increased interdepartmental coordination and align objectives, share research, and engage stakeholders.
- Facilitate the technical implementation and evaluation of specific extreme heat and air quality-related strategies.

While the Heat and Air Quality Resilience Project centralizes planning across departments and sectors, implementation of each adaptation action will still be driven by the departments with specific programmatic expertise. The goal of the HAQR is not to recreate projects but rather to provide a framework to integrate and support them.

Related San Francisco Heat and Air Quality Initiatives

The Heat and Air Quality Resilience Project (HAQR) builds upon previous City, community, and regional efforts to prepare for and respond to climate change, and specifically the health impacts of extreme heat and wildfire smoke. These actions, policies, and plans include:

Emergency Preparedness and Response Actions

San Francisco emergency preparedness and response actions are led by the Department of Emergency Management (DEM), Department of Public Health (DPH), and Human Services Agency (HSA). Specific actions, including activation thresholds, are identified in the City extreme heat and air quality emergency response annexes. These annexes are maintained by DPH and DEM.

- DEM's Extreme Weather Resilience Program and Neighborhood Empowerment Network (NEN) supports neighborhood and community-level response through resources, best practices, and technical assistance.
- DEM manages emergency communications activities, including SF72 and AlertSF.
- DPH Public Health Emergency Preparedness and Response (PHEPR) Branch coordinates with healthcare facilities, and provides training and technical assistance to community partners.
- HSA provides shelter, supplies, and support through In-Home Supportive Services (IHSS) during extreme weather events.

Mayoral Executive Directive 18-04

Mayoral Executive Directive 18-04 requested DEM, DPH, and the City Administrator's Office act to strengthen the City's preparedness and response to air quality and other weather-related emergencies. HAQR's work analyzing potential public respite facilities can be traced to this directive.

San Francisco General Plan and Related Elements

The SF General Plan is an overarching plan that serves as a comprehensive roadmap for how the City will change and develop into the future. It provides a comprehensive set of goals, objectives, and policies to guide the public and private sectors and influence how we live, work, and move about, as well as the quality and character of the City. It guides both public and private actions. As the update is developed, HAQR has provided feedback related to heat and air quality issues.

- Safety and Resilience Element of the General Plan, led by Planning Department (CPC), provides a comprehensive set of policies for minimizing San Francisco's contribution to the climate crisis and ensuring local resilience to multiple hazards. It helps protect the people and assets of San Francisco, especially areas and communities that face higher vulnerability to disasters. Communities of color and other vulnerable neighborhoods are often hurt first and worst in any disaster, and struggle more to recover and this element aims to focus support to these communities. HAQR supported the development and future implementation of policies in this document related to heat and air quality resilience.
- The San Francisco Environmental Justice Framework, borne out of California Senate Bill 1000, establishes priorities to advance health in communities of color and low-income communities that are disproportionately exposed to pollution and other health risks. The framework is part of the City's General Plan and is maintained by CPC. HAQR will integrate the EJ Communities Map into the implementation of its proposed strategies.

Hazard and Climate Resilience Plan

The Hazard and Climate Resilience Plan (HCR), led by the Office of Resilience and Capital Planning (ORCP), identifies the hazards, risks, and consequences the City can expect to face and proposes over 90 strategies to mitigate their potential impacts. Led by the Office of Resilience and Capital Planning (ORCP), this inter-agency effort coordinated 26 department perspectives and engaged community stakeholders to better understand and address the impacts of natural disasters on San Francisco. Many of the heat and air quality strategies from this planning effort were integrated into HAQR.

San Francisco Urban Forestry Plan

Urban Forestry Plan, led by Public Works, in collaboration with the Planning Department and Friends of the Urban Forest, promotes San Francisco's urban forest with a primary focus on street trees. The Urban Forest Plan identifies policies and strategies to proactively manage and grow the City's street tree population. The goal of the Plan is to create an expanded, healthy and thriving urban forest now and for the future. In conjunction with the Plan, a Street Tree Census and Street Tree Financing Study also took place. Through the green infrastructure working group, HAQR supports expanded capacity to solve data needs and identify funding for urban forestry plan recommendations.

Climate Action Plan

The Climate Action Plan (CAP) to eliminate greenhouse gas emissions by 2040. Led by the San Francisco's Environment Department (SFE),

the CAP proposes strategies to achieve net-zero emissions while addressing racial and social equity. Besides addressing the emissions that fuel climate change, many of the strategies will result in public health benefits that also support adapting the City's infrastructure and services to extreme heat and wildfire smoke events. HAQR will support strategies in the building operations chapter through data collection, evaluation, and connecting adaptation funding sources to support mitigation work where possible.

San Francisco Climate and Health Program

Funded through the Centers for Disease Control (CDC) Building Resilience Against Climate Effect (BRACE) Program, the San Francisco Climate and Health Program works to address the health impacts of climate change-related hazards. The San Francisco Climate and Health Program has developed the Extreme Heat Vulnerability Assessment, and Climate and Health Adaptation Framework.

Community-Based Initiatives

San Francisco's community-based organizations have planned and implemented many of San Francisco's most successful neighborhood- and community-level actions to address the health impacts of extreme heat and wildfire smoke. The Heat and Air Quality Implementation Plan will support these community initiatives so that they can expand with the increased frequency and severity of these impacts.

HAQR Objectives

The objective of the Heat and Air Quality Resilience Project is to increase San Francisco's resilience to the health impacts of climate change-related extreme heat and air quality hazards, with a particular focus on the resilience of disproportionately impacted frontline and BIPOC (Black, Indigenous, and People of Color) communities. The Heat and Air Quality Resilience Project will:

- **Facilitate the implementation and improvement of medium to long-term mitigation, preparedness, emergency response, and resilience strategies** by aligning plans and policies, leveraging resources, sharing data and best practices, and coordinating engagement.
- **Increase San Francisco's capacity to collaborate on both current and future extreme heat and air quality resilience initiatives** by creating a centralized space for City, regional, community, private, and academic stakeholders to share successes, identify barriers, propose solutions, and prioritize best practices.
- **Advance racial and social equity through the just distribution of risk reduction and resilience benefits** by increasing community involvement in the decision-making process and using data-driven analyses to ensure that resources are targeted to the frontline communities that carry the heaviest health burden of air quality and extreme heat-related hazards.
- **Increase funding for extreme heat and air quality strategies** by integrating extreme heat and air quality into the City's capital planning and budgeting process, working with departments to align funding priorities, and identifying outside revenue sources to supplement these investments.
- **Increase efficacy of resilience strategies** by coordinating research and evaluation activities to inform more effective implementation, measure benefits, and continuously improve strategies.
- **Increase community involvement in extreme heat and air quality** resilience efforts by increasing stakeholder engagement opportunities, aligning outreach and engagement processes, and communicating City activities.

HAQR Structure

HAQR Coordination Committee

The Coordination Committee acts as a landing space for high-level coordination, project updates, sharing best practices, and other activities that require collaboration across disciplines such as research and evaluation, grant tracking and funding, and outreach and engagement. The composition of the Coordination Committee includes various City departments, community-based organizations and academic institutions.

Between February 2021 and November 2022, the HAQR Coordination Committee met eight times, with over 120 combined attendees representing 23 departments, 11 community-based organizations, the University of California at San Francisco (UCSF), and University of California at Berkeley (UC Berkeley).

Coordination Committee Meetings

Date	Attendees	Main Topics
02/23/2021	No data	Background on heat and air quality, introductions, survey to co-create HAQR objectives
03/02/2021	No data	Analysis of survey results, facilitated activity to co-design of Implementation Teams
05/07/2021	No data	Identify community engagement opportunities, introductions to each Implementation Team, Implementation Team schedule and activities
07/30/2021	31	Review 2021 North American Heat Wave, Introduce UCSF Collaboration, Implementation Team Report Outs
09/22/2021	41	Review Work Plans from the Green Infrastructure and Existing Buildings Implementation Teams
12/07/2021	60	Spotlight on community resilience hubs with the Neighborhood Empowerment Network (NEN) and the Asian Pacific Environmental Network (APEN)
02/24/2022	46	Bridging the gap between climate adaptation and climate mitigation with the San Francisco Department of Environment (SFE)
05/03/2022	36	Weatherization best practices with Lawrence Berkeley National Labs Cool Building Solutions

HAQR Implementation Teams

While the Coordination Committee focuses on high-level coordination, the Implementation Teams are a space for technical planning, coordination, implementation, and improvement of the strategies identified in the HCR and other strategic planning documents. The Implementation Teams are organized by domain with the understanding that many projects in the same domain have similar stakeholders, objectives, community engagement strategies, funding mechanisms, and challenges to implementation. These Implementation Teams are:

Implementation Teams Overview

Implementation Team	Team Charge	Team Members
Existing Buildings	How do we reduce the health impacts of extreme heat and wildfire smoke through the mechanical and non-mechanical interventions of San Francisco's buildings?	• Office of Resilience and Capital Planning (Chair) • Mayor's Office of Housing and Community Development • Environment Department • Department of Public Works • Real Estate Department • Tenderloin Neighborhood Development Center • Department of Homelessness and Supportive Housing • Department of Public Health
Green Infrastructure	How do we use green infrastructure, albedo improvements, and other strategies to reduce urban heat islands and improve air quality?	• Department of Public Works (Chair) • Environment Department • Office of Resilience and Capital Planning • Recreation and Parks Department • San Francisco Public Utilities Commission
Community Readiness	How do we strengthen collaboration and communication between City and Community stakeholders?	**Community Based Organizations (CBOs)** • Golden Gate Regional Center • Chinatown Community Development Center • Literacy for Environmental Justice • Richmond Senior Center • Rafiki Coalition • SF Community Living Campaign • Curry Senior Center • Safer Together • Family Connections Center **City and County Agencies** • Department of Public Health (Chair) • Department of Emergency Management • Human Services Agency • Department of Homelessness and Supportive Housing • Mayor's Office on Disability • Environment Department
Emergency Response	How do we create the emergency response planning and policy infrastructure that underpins all actions?	• Focused Conversations with the Department of Emergency Management

HAQR Support: Research and Data Analysis

All extreme heat and wildfire smoke resilience actions are strengthened through unified research and analysis to measure exposure, project and track health impacts, and identify and evaluate best practices. Below represents some of HAQR's research and data analysis work:

Building Capacity for Research to Address Climate-Impacted Health Conditions

HAQR is partnering with the UCSF Partnerships for Research in Implementation Science for Equity (PRISE) Center to better understand community- and resident-level priorities for heat and air quality resilience actions. The "Building Capacity for Research to Address Climate-Impacted Health Conditions" project establishes and supports a community stakeholder group to develop and disseminate a resident-facing survey to identify which heat and air quality health impacts are most concerning and which possible actions best address those concerns. This project will elevate resident-level voices to guide the development of resilience actions that align with and are informed by community priorities.

Wildfire Smoke and Indoor Air Quality

HAQR is partnering with UCSF PRISE Center, Brightline Defense Project, and Lawrence Berkeley National Labs on a research project from the US Environmental Protection Agency (EPA) to understand the impact of wildfire smoke on indoor air quality and health, and especially in single room occupancy (SRO) hotels and affordable or supportive housing. This project works across three Bay Area jurisdictions towards the following objectives:

1. Estimate the health effects of sub-daily exposure to wildfire-specific PM2.5 in California, including across social vulnerability factors, with particular focus on effects within environmental justice communities;
2. Understand community recovery from short-term health effects following exposure;
3. Monitor the indoor infiltration of wildfire smoke and the mitigating effect of housing quality and behaviors on health effects; and,
4. Identify acceptable community-relevant mitigation interventions.

Health Benefits of Reducing Urban Heat Islands

HAQR is supporting analysis to connect urban heat islands, neighborhoods and communities with disproportionately high surface and air temperature, to health impacts. This analysis then uses the relationship between urban heat islands and health impacts to model the health benefits of strategies to reduce urban heat islands such as street trees and green infrastructure, or cool roofs and cool pavements, this analysis will help HAQR understand the local health benefits of these strategies, set objectives, and identify neighborhoods to prioritize investment.

SF Urban Heat Watch

HAQR, in partnership with SFE, DEM, NICOS Chinese Health Coalition and Brightline Defense Project, received funding from the National Oceanic and Atmospheric Administration (NOAA) and the National Heat Health Information System (NIHHIS) to carry out a volunteer-led campaign to map urban heat islands across San Francisco's neighborhoods and raise awareness of extreme heat as an issue.

The project team held two campaign days of action over 2022 Labor Day weekend where over 30 volunteers attached temperature sensors to their cars and drove pre-designed routes to collect temperature readings across the City. This data showed how San Francisco's built environment contributes to the development of heat islands. You can find the full report here.

SECTION 3:

Hazards, Impacts, and Vulnerable Populations

This section provides a summary of extreme heat and wildfire smoke events, climate projections, health impacts, and the populations most vulnerable to those health impacts.

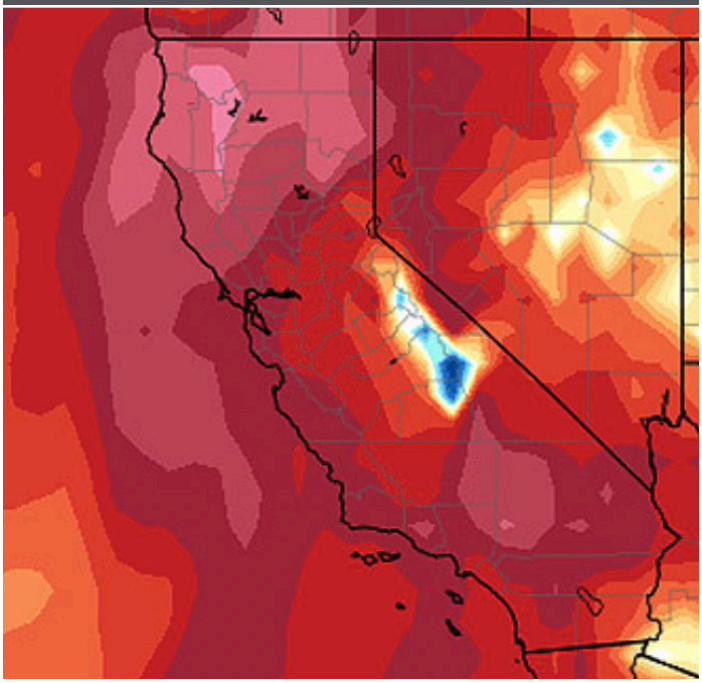
While extreme heat and wildfire smoke are separated here, these events are interrelated and often concurrent.

Extreme Heat

Extreme heat kills more Americans annually than all other weather events combined. The health impacts of extreme heat largely happen indoors and vulnerability to extreme heat is inequitable and varies from home to home, person to person, community to community.

According to an analysis of a 2006 California statewide heat wave, emergency department visits for heat-related causes increased across the entire state but this increase was greatest in the Bay Area Central Coast region. Older adults showed a greater risk of heat related hospitalizations particularly those with diabetes, cardiovascular disease, and respiratory illnesses.[1] San Francisco experienced similar health impacts during a 2017 Labor Day Heat Wave.

Labor Day Heat Wave (2017)



On Friday, September 1st, San Francisco's temperatures hit 106F°, the highest temperature ever recorded in the City. Temperatures reached 102F° on Saturday September 2nd, making it only the third time in recorded history that San Francisco's temperatures hit triple digits two days in a row. The impacts of this event were significant.

- 911 medical calls for service increased 51%.[2]
- Emergency department visits increased 12%.[3]
- Hospitalizations increased 15%.[3]

San Francisco Heat Events Are Becoming More Frequent and More Extreme

Climate change increases average temperatures and the frequency and severity of extreme heat events. An extreme heat event is defined as a day where the high temperature exceeds the top two percent of all temperatures for a given location between 1961- 1990. In San Francisco, an extreme heat event is officially any day over 85°F.[4] These events are expected to increase.

All Extreme Heat Days (over 85°F)					
Baseline Modeled Days per Year (1961 – 1990)		**Mid-Century Projected Days per Year (2035 – 2064)**		**End-Century Projected Days per Year (2070 – 2099)**	
Average	3	Average	7	Average	15
Maximum	10	Maximum	24	Maximum	51

Based on the Cal-Adapt High (RCP 8.5) modeling scenario.

San Francisco extreme heat events are expected to become more severe in addition to becoming more common. San Francisco temperatures only exceeded 95F° 12 times between 1980 and 2022, but may exceed this threshold a maximum of 10 times a year by the end of the century.[5]

All Extreme Heat Days (over 95°F)					
Baseline Modeled Days per Year (1961 – 1990)		**Mid-Century Projected Days per Year (2035 – 2064)**		**End-Century Projected Days per Year (2070 – 2099)**	
Average	0	Average	1	Average	2
Maximum	1	Maximum	7	Maximum	10

Based on the Cal-Adapt High (RCP 8.5) modeling scenario.

San Francisco Was Not Built for Extreme Temperatures

San Francisco is a historically temperate City with homes, businesses, schools, and municipal buildings largely built for a cool coastal temperature. During a heat wave, temperatures inside buildings are often higher than corresponding temperatures outside, and are likely to stay elevated for longer periods of time, which does not allow for building's residents to have a cool space to recover and avoid health impacts.[6]

San Francisco has the lowest rate of air conditioning anywhere in the country.[7] Air conditioning access is not equitable, and wealthier San Franciscans are more likely to have access to cooling. Older buildings, including single room occupancy hotels (SROs) may be especially vulnerable to overheating, and were built without the electrical load capacity to sustain many air conditioning and ventilation upgrades. These buildings are also likely built without passive interventions, such as shading, double-glazed windows, tinting, green or cool roofs, and insulation.

Extreme Heat Events Have Significant, Cascading, and Compounding Health Impacts

Because extreme heat events exacerbate pre-existing or underlying health conditions, the health impacts of an extreme heat event can present as many different diagnoses and are often underreported.

- Direct health impacts of extreme heat include: dehydration, heat stroke, heat exhaustion, and heat cramps.
- Health impacts exacerbated by extreme temperatures include: cardiovascular conditions, respiratory illnesses and chronic obstructive pulmonary disease (COPD), diabetes and renal failure, and mental health conditions. Older adults are among the most vulnerable to the health impacts of extreme heat, largely because of chronic physical or cognitive health conditions that come with the process of aging.[8]
- Indirect health impacts of extreme heat include: falls, drownings, and health impacts associated with power disruption. Power disruption can have particularly harmful effects on populations with mobility disabilities or who are dependent on durable medical equipment.

The Impacts of Extreme Heat Are Inequitable

Everyone is vulnerable to the impacts of extreme heat, but not everyone is impacted evenly. Factors that influence vulnerability include race, income, educational attainment, immigration status, language access, physical and cognitive disability. Additional factors include:

- **Renters** have limited ability to improve their housing resilience. Renters typically cannot control how their building is retrofitted for extreme heat or wildfire smoke.
- Some neighborhoods are **urban heat islands** due to having more pavement and less green space and fewer street trees. Due to discrimination in housing markets, these neighborhoods also tend to be where more people of color live.

- People who are **socially isolated** can also be more vulnerable. Social isolation can be a function of physical isolation (i.e. living alone), chronic health conditions, linguistic isolation, or other contributing factors. An analysis of a 1995 Chicago heat wave found that populations who lived alone were at increased risk for heat-related morbidity and mortality.[9]

Wildfire Smoke

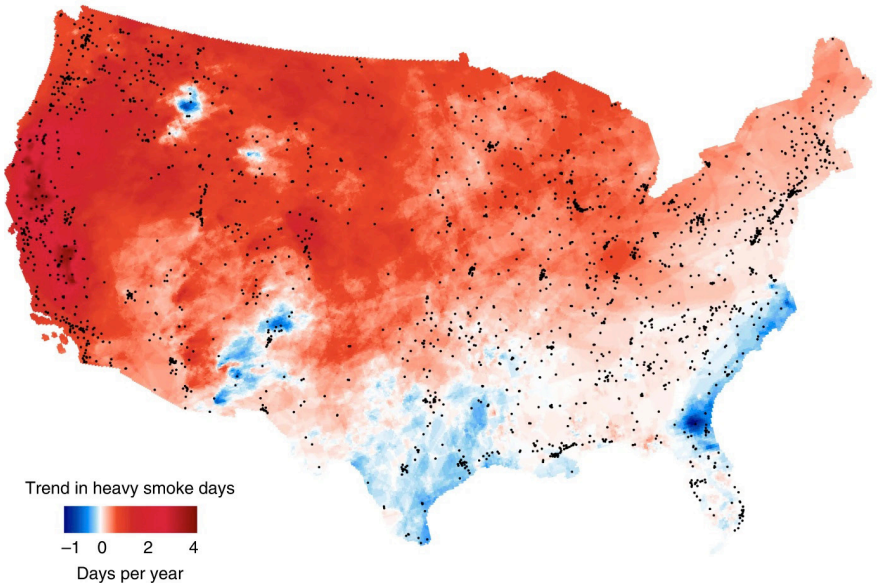
While wildfire remains a natural and essential part of California's forests, human-caused climate change increases wildfire frequency and intensity. Since 2015, California has experienced 12 of the 20 largest, 7 out of the 20 deadliest, and 15 out of the 20 most destructive wildfires in California's history. [10]

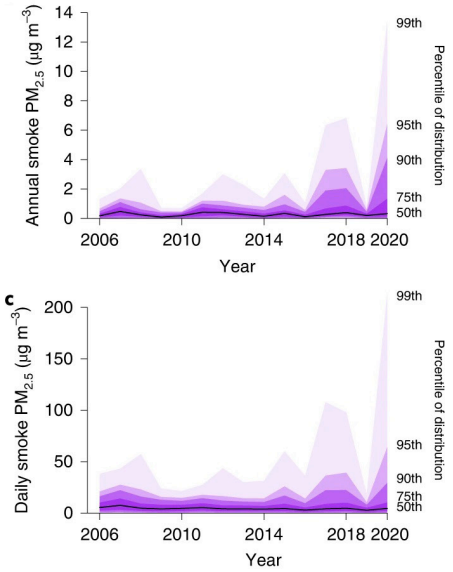
Although San Francisco is less likely to have a wildfire compared to communities in the urban wildland interface, the city is affected by wildfire smoke from fires statewide. Wildfire smoke is comprised of both gaseous and hazardous pollutants, water vapor, and particulate matter (PM).[11] Fine particulate matter, defined as particulate matter under 2.5 micrometers in size (PM2.5), is particularly harmful if inhaled. People experiencing homelessness, and populations with pre-existing respiratory or cardiovascular conditions are especially vulnerable to these impacts.

- Short-term health impacts of wildfire smoke include allergies, cough, eye-irritation, headaches, skin irritation, but can also include more severe impacts such as aggravation of respiratory illnesses and cardiovascular illness, especially for those with pre-existing health conditions.[12]
- Long-term impacts can include increases in adverse birth outcomes, exacerbated behavioral and cognitive conditions, and respiratory illnesses such as childhood asthma and lung function.

Wildfire smoke events are also disruptive and often force schools, businesses, and services to reduce operations or close entirely.

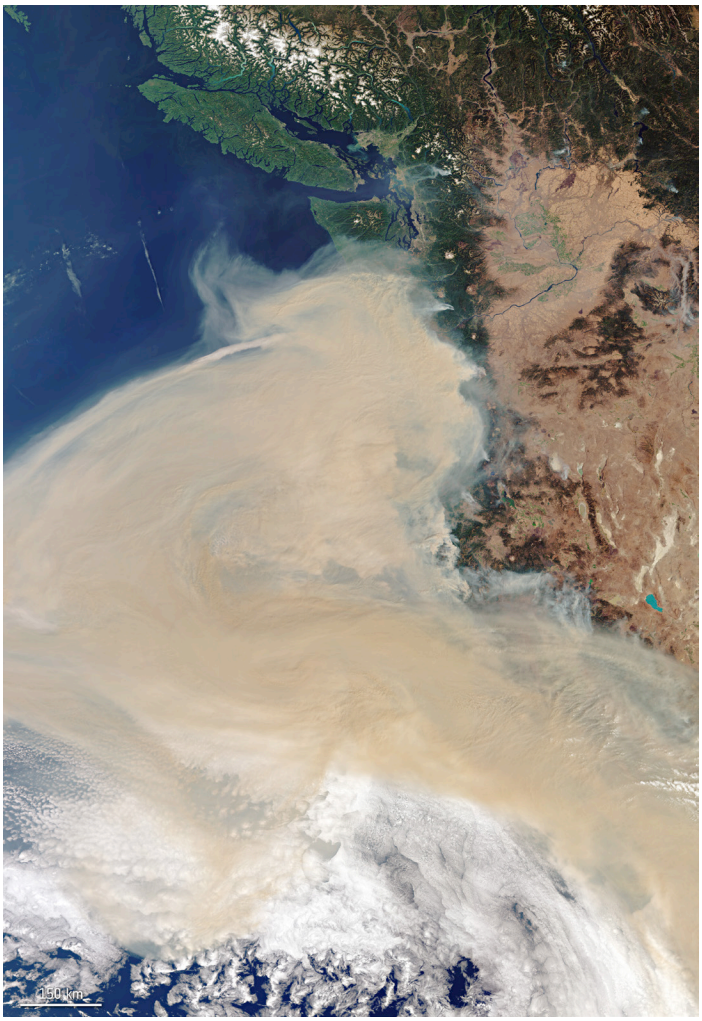
Climate Change Makes California Wildfires More Common

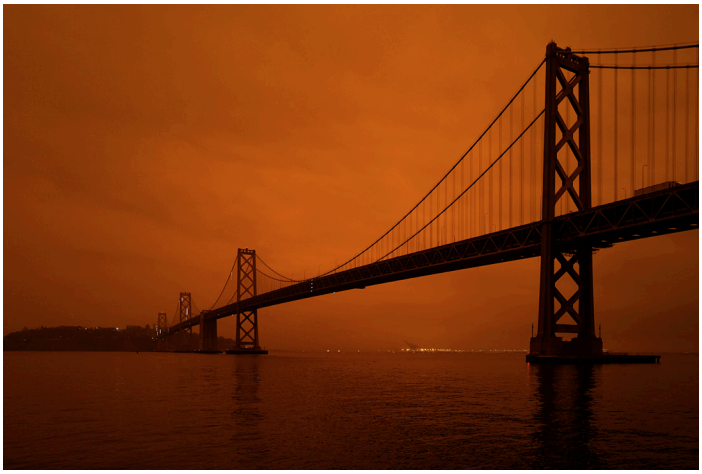




A warmer and more arid climate dries out vegetation, kills trees, and accelerates burning.[13,14] California's wildfire season is also expected to lengthen, beginning in late-Spring and ending in mid-Fall. Fall wildfires events may coincide with the Diablo Winds. Many of San Francisco's most severe wildfire smoke events, including the 1991 Oakland Hills Fire, 2017 Napa/Sonoma Wildfires, and 2018 Butte County Camp Fire all occurred during the Diablo Winds.

Lightning accounts for nearly 40% wildfires in the Western United States. and is also expected to increase.[15,16] In addition, the conditions that favor dry lightning, when the air is so hot and dry that water vapor evaporates before it reaches the ground, are more likely to occur as the climate warms.[17]





In Addition to Health Impacts, Wildfire Smoke is Disruptive

Wildfire and wildfire smoke are one of the leading causes of school closures in the Western United States and has significant negative impacts on academic performance.[18] School closures are also a significant burden to parents who are forced to miss work to meet unexpected child-care needs. This disproportionately impacts low-income households with limited ability to weather any lost wages.

Wildfire smoke also disrupts outdoor work including construction, affects businesses and organizations that operates in buildings without adequate ventilation, can limit tourism, and forces the cancelation of outdoor recreational activities. All these disruptions have cascading impacts on public health.

Adaptations to Protect Buildings Against Wildfire Smoke Have Co-Benefits

Although this document focuses on discrete wildfire smoke events, many San Franciscans are exposed to air pollution continuously, especially if they live, work, or play adjacent to freeways or other high-traffic roads, industrial facilities, or other point-sources emissions. The primarily Black and Brown residents in these environmental justice communities have borne the brunt of the environmental hazards that exacerbate racial health disparities. Adaptations to increase ventilation, and site green infrastructure will have co-benefits to these communities. Similarly, adaptations to ensure adequate ventilation in schools, businesses, and other facilities will protect against COVID-19 and other airborne illnesses.

SECTION 4:

Heat and Air Quality Implementation Strategies

State and Federal Extreme Heat and Wildfire Smoke Strategies

The state and federal government have increasingly worked to address the health impacts of climate-related extreme heat and wildfire smoke events. The specific strategies identified in the San Francisco Heat and Air Quality Implementation Plan reflect many of the best practices identified in these state and federal resilience plans. These include:

- The Inflation Reduction Act and the Infrastructure Investment and Jobs Act. These federal packages have injected billions of dollars into federal programs that either directly or indirectly fund actions that mitigate these issues. Between both bills, as much as $12.1 billion is available to fund weatherization and energy efficiency upgrades to homes which has significant impacts on exposure to these hazards.[19]
- The 2023-2024 California state budget, allocates $444 million for mitigating extreme heat in communities and represents a significant investment in addressing this issue. These funds will be essential in implementing the 2022 California Extreme Heat Action Plan will be largely allocated as grants from existing state agencies and programs like the California Strategic Growth Council and the California Office of Planning and Research.[20]
- There are many smaller heat-related and wildfire smoke-related actions coming out of the California State Assembly and California State Senate. These bills include Assembly Bill 1643, which creates an advisory committee to study the economic impacts of extreme heat, Assembly Bill 2238 that develops an extreme heat wave warning and ranking system, Assembly Bill 2420 that directs research into the perinatal health impacts of extreme heat, AB 2645 that invests in community resilience centers, and Senate Bill 852 that allows cities to create climate resilience districts.[21]
- Best practices from other jurisdictions, like Los Angeles County Board of Supervisors motion to investigate safe maximum indoor temperature thresholds.[22]
- There are many local, state, and federal actions to reduce or eliminate the greenhouse gas emissions that fuel climate change. Many of these actions similarly reduce the health impacts of climate-related hazards.

Strategy Development Methodology

Strategies were identified by the four HAQR Implementation Teams: Existing Buildings, Green Infrastructure, Community Readiness, and Emergency Response. The composition of these teams can be found on page 11. Each team followed parallel processes to identify strategies: 1) create objectives that articulate the programs, services, and structure of a San Francisco that is resilient to extreme heat and wildfire smoke, 2) identify the economic, political, and social barriers that impede that resilient San Francisco, 3) perform a landscape analysis to understand current actions, 4) brainstorm strategies to support current actions, and 5) prioritize strategies by efficacy and feasibility.

Strategy Glossary

Term	Definition
Resilience Pathway	The strategies are organized by Resilience Pathway. Resilience Pathways refer to the mechanism that connects the specific strategy to health benefits. The resilience pathways in this document are: 1. San Francisco's buildings are adapted to reduce exposure to extreme heat and poor air quality. 2. San Francisco's exterior built and natural environments are adapted to reduce exposure to extreme heat and poor air quality. 3. San Francisco is made more resilient to extreme heat and wildfire smoke through equitable emergency preparedness, response, and resilience actions. 4. San Francisco is made more resilient to both current and future extreme heat and wildfire smoke events through City services that can predict and adapt to climate-related stressors.
Objective	Each Resilience Pathway has objectives. These objectives are aspirational and forward-looking and reflect the objectives identified in each implementation team.
Key Actions	Key actions are specific actionable steps to guide the development of the strategy.
Key Agencies	Key agencies are main City stakeholders necessary to implement the strategy.
Strategy Status	The Heat and Air Quality Implementation Plan identifies actions expected to be implemented in the short-, medium-, and long-term. Strategy status clarifies the s trategy's development timeline. • **Ongoing** strategies are currently being implemented. • **Planned** strategies have not been implemented but are expected to be implemented in the near future. Planned strategies have political support, and resources identified. • **Needs Resourcing** identifies strategies that have political support but not the capacity for implementation. Implementation of these strategies may be dependent on staff capacity, program capacity, or other resource gaps. • **Needs Further Planning** identifies strategies that may have some support as best practices but need additional research to adapt the strategy to San Francisco, understand the resources required for implementation, or to consider downstream impacts.

Pathway 1: San Francisco's buildings are adapted to reduce exposure to extreme heat and poor air quality

Barriers and Opportunities

San Francisco's building stock is largely un-adapted to extreme heat and wildfire smoke. While new construction often addresses thermal comfort and air quality through passive and/or mechanical cooling and enhanced ventilation, there are fewer policy interventions and more costs associated with addressing heat and air quality in San Francisco's existing buildings. This often requires weatherization, physical improvements to the building envelope (I.e., Rooftop/wall insulation, air sealing exterior building envelope, fenestration sealing, etc.). These older buildings are less likely to have mechanical cooling or ventilation or non-mechanical interventions such as shading, double-glazed windows, tinting, green or cool roofs, or sufficient insulation. Many older buildings do not have the electrical load capacity to support adding cooling or ventilation. Un-adapted buildings are also most likely to disproportionately house residents vulnerable to the health impacts of extreme heat and air quality.

Operators of low-income housing are often severely constrained in their operating budgets, limiting their ability to take on more debt for the upfront costs of weatherization or to pay increased expenses related to providing enhanced air filtration or cooling. Currently, owners of affordable and supportive housing apply for funds through the Mayor's Office of Housing and Community Development for building maintenance and rehabilitation. These rehabilitation projects are often forced to eliminate heat and air quality improvements due to a lack of funding. Additionally, building owners attempting to make weatherization improvements can encounter regulatory or cost barriers that can make these projects significantly more costly, time-consuming, or infeasible.

Additionally, many established weatherization or rehabilitation programs service homeowners of single-family homes while the communities most vulnerable to the health impacts of extreme heat and wildfire smoke are largely renters, and often live in multi-unit apartment buildings or single-room occupancy hotels. These renters may not have the opportunity to advocate to their building owner for retrofits. Major retrofits may displace residents. Many available local, state, and federal weatherization and cost assistance services are maintained by different agencies and not adequately communicated to San Francisco's residents and building owners in order to improve access to these funds.

It's important that all actions are aligned with San Francisco greenhouse gas reduction goals. Weatherization programs are difficult to scale. Each building has unique constrains and may need to be studied to inform design. Many non-mechanical cooling methods such as albedo improvements have not been thoroughly researched in San Francisco's unique climate. However, one key overlap with current emission reduction efforts is to promote the replacement of existing gas heating systems with efficient, electric heat pumps, which provide both heating and cooling and eliminate natural gas use, which currently accounts for nearly 90% of total building sector emissions.

San Francisco must find pathways to concurrently address thermal comfort and air quality in new construction and existing buildings, and provide opportunities for tenants and community-based organizations to advocate for safe and healthy housing. Often the people most burdened by the health impacts of extreme heat and wildfire smoke are not the people who influence decisions about whether to weatherize a property.

Related Processes, Projects, and Policies

City

- San Francisco General Plan
  - Environmental Justice Framework
  - San Francisco Safety and Resilience Element
- San Francisco Climate Action Plan
  - Building Operators' Chapter
  - Equity Hub
- San Francisco Environmental Code, Chapter 7
- San Francisco Health Code, Article 38
- MOHCD Multifamily Capital Housing Finance Programs
- San Francisco International Airport (SFO/Airport) Sustainable Planning, Design and Construction (SPDC) Standards

Regional, State, and National

- California Green Building Code (CalGreen)
- BayREN (Bay Area Regional Energy Network)
- Low Energy Home Assistance Program (LIHEAP)

Objective 1: Planning and Research

Best practices to cool and ventilate San Francisco's buildings have been identified across a range of building types including multi-unit, affordable, and supportive housing.

Strategy 1: Identify Weatherization and Cooling Best Practices	
Strategy Status:	Needs Resourcing
Key Agencies:	Environment Department Office of Resilience and Capital Planning Planning Department
Key Actions:	Research safe, affordable, and practical options to weatherize and cool individual rooms in multi-unit housing, especially single-room occupancy hotels and other buildings that may be unable to support enhanced cooling or ventilation. • Compile information on low-cost, non-mechanical, cooling and ventilation improvements. • Document lessons learned from pilot projects in a range of different building types through the development of case studies including SFO's experience implementing SPDC Standards for HVAC and Air quality improvements. • Case studies will focus on funding and financing used, development of code change recommendations, building performance evaluation before and after renovations and resident preferences and uptake. • Blend weatherization practices with energy efficiency and/or noise mitigation-based incentives (such as those administered by SFO) to further extend government dollars.

Strategy 2: Pilot Cooling and Clean Air Adaptation Projects	
Strategy Status:	Needs Resourcing
Key Agencies:	Environment Department Mayor's Office of Housing and Community Development Office of Resilience and Capital Planning Homelessness and Supportive Housing
Key Actions:	Support cooling and clean air pilot projects to identify best practices across a range of building types, with a focus on critical/high priority building functions. • Seek funding to bolster existing MOHCD rehabilitation funding opportunities to include heat and air quality resilience criteria in at least 5 different buildings. For example, the existing Notice of Funding Allocation (NOFA) process. • Pilot projects will intentionally include a number of different weatherization approaches for analysis, including the exploring heat pumps as a solution where possible.

Objective 2: Policy and Regulations

Policy and regulations incentivize extreme heat and wildfire smoke adaptations.

Strategy 3: Reconcile Administrative Barriers	
Strategy Status:	Needs Further Planning
Key Agencies:	Department of Building Inspection Department of Environment Office of Resilience and Capital Planning Planning Department
Key Actions:	Identify administrative barriers, such as code conflicts that may slow the implementation of extreme heat and wildfire smoke adaptations. • Use insights from pilot programs to develop proposed changes. • Determine which policies, guidelines, or additional funding is required to implement solutions to administrative challenges. • Policies for review will include the environmental code, building code, health code among other policies. • Advocacy for supportive changes to state building codes (i.e., Title 24).

Strategy 4: Develop Heat and Air Quality Design Guidelines	
Strategy Status:	Planned
Key Agencies:	Airport Office of Resilience and Capital Planning Planning Department
Key Actions:	Develop heat and air quality design guidelines for both new buildings and retrofit/rehabilitation projects to help designers and project managers consider an array of mechanical and non-mechanical interventions. • Create consolidated toolkit with guidelines for integrating Heat and Air Quality into projects, with a focus on retrofit/rehabilitation projects specifically. • Determine impacts of applying Article 38 Health Code enhanced ventilation standard to different building types beyond new construction in the Air Pollutant Exposure Zone (APEZ).

Strategy 5: Investigate Impacts of a Thermal Comfort Policy	
Strategy Status:	Needs Further Planning
Key Agencies:	Department of Public Health
Key Actions:	Prepare for any statewide action by investigating the costs and benefits of codifying a maximum temperature threshold in the building code. • Determine impact of expanding Health Code provisions to include maximum heat standard in Healthy Housing Program and any associated administrative burdens. – Evaluate policy impact by estimating how many homes would be impacted and what resources would be necessary to bring homes into compliance. – Identify resources needed by agencies to accommodate policy change. – Create final report that outlines costs and benefits of the action.

Objective 3: Funding and Resources

New funding sources are developed, and existing sources are streamlined and/or leveraged to implement heat and air quality adaptations.

Strategy 6: Identify and Track New Funding Sources	
Strategy Status:	Planned
Key Agencies:	Environment Department Mayor's Office of Housing and Community Development Office of Resilience and Capital Planning
Key Actions:	Identify, track, and apply for extreme heat and wildfire smoke funding opportunities and develop new funding programs specific to buildings that serve vulnerable populations. • Increase capacity to apply for numerous state and federal grant opportunities recently created through the California Integrated Climate Adaptation and Resiliency Program (ICARP) and the Inflation Reduction Act. • Support the development of cross-organizational partnerships to increase collaboration on grant applications. • Advocate for California Public Utilities Commission (CPUC) sanctioned energy programs to support vulnerable communities and measures to improve adaptation.

Strategy 7: Seek Funding to Bolster Priority Building Rehabilitations	
Strategy Status:	Planned
Key Agencies:	Environment Department Mayor's Office of Housing and Community Development Office of Resilience and Capital Planning
Key Actions:	Seek funding to bolster MOHCD rehabilitation funding opportunities (NOFAs) and planned City-owned building improvements to include heat and air quality resilience criteria. • Identify resilience specific funding source for MOHCD rehab funding opportunities MOHCD, SFE, and ORCP will work together, with input from CBO partners, to develop an additional section for competitive rehab fund applications that can be used to specifically integrate resilience measures often value engineered out of project proposals due to lack of funding. • Seek funding sources for City-owned facilities serving vulnerable populations, such as community health clinics, to include HAQR related improvements.

Objective 4: Outreach and Engagement

Extreme Heat and wildfire smoke adaptations are accessible and highly used among all San Franciscans, but especially renters from the communities most vulnerable to climate impacts.

Strategy 8: Develop Weatherization Clearinghouse	
Strategy Status:	Needs Resourcing
Key Agencies:	Environment Department Department of Public Health Human Services Agency Public Utilities Commission
Key Actions:	Establish and communicate a public facing online tool that connects residents to local, state, and federal home weatherization and cost-assistance resources. • Connect heat and air quality mitigation with building sector emissions reductions efforts (i.e. in the CAP). • Compile a comprehensive resource that covers all local, state, and federal weatherization subsidies. • Develop a website that consolidates this information in a single location. • Develop targeted training opportunities for property owners, managers, community-based organizations, and other first points-of-contacts on how to access available resources.

Strategy 9: Evaluate Weatherization Programs	
Strategy Status:	Needs Further Planning
Key Agencies:	Environment Department Department of Public Health
Key Actions:	Develop a process to evaluate the use and effectiveness of City weatherization services. • Identify criteria to be tracked (i.e., socioeconomic indicators, geographic extent, number of buildings weatherized, function, etc.). • Determine targets (e.g, percentage of total for a given year) for prioritizing weatherization efforts based on racial and social equity criteria (I.e, Environmental Justice Communities Map). • Establish a data system for collecting various data sources on utilization across various programs. • Generate consistent, timely reporting on the utilization to inform future program development and adjustments to outreach efforts towards target.

Pathway 2: San Francisco's exterior built and natural environments are adapted to reduce exposure to extreme heat and poor air quality

Pathway Barriers and Opportunities

Exposure to extreme heat and wildfire smoke events is influenced by our natural and built environment. Pavement and other impervious surfaces absorb and retain heat. Trees and other green spaces can mitigate heat, provide shade, and reduce and filter particulate matter. This is often through the provision of green Infrastructure. Green infrastructure includes, but is not limited to: permeable pavements, bioretention features, rainwater harvesting, rain gardens, and vegetated roofs.[23] These interventions offer numerous benefits related to mitigating extreme heat and poor air quality impacts. However, not every San Francisco neighborhood is exposed to extreme heat and air quality evenly. San Francisco's tree canopy is disproportionately located in wealthier neighborhoods while the poorest neighborhoods with the highest health burdens often have the largest concentrations of pavement and the lowest tree coverage. Communities adjacent to industrial activities, freeways and other high-traffic roads, and other sources of pollution are disproportionately and continuously exposed to poor air quality not only during wildfire smoke events. American Indian, Black, and other communities of color have historically borne the brunt of these environmental burdens.

Additionally, trees and other green infrastructure are expensive to plant and, especially, maintain—and the heat or air quality benefits may not be realized until these trees are fully grown. The potential for additional sources (such as financing and grants) to be applied to this work is limited by the available capacity to effectively scope out projects and apply for grants. Additionally, projects can often underestimate costs for maintaining trees over their lifetime and therefore contribute to plantings being abandoned in the future.

Many agencies responsible for planting and maintaining trees have not used public health data and environmental exposure data when designing programs. Many large concentrations of pavement—such as parking lots, are owned by private companies or institutions, and the City has limited leverage to cool these spaces.

Executing green infrastructure projects also requires a significant amount of coordination, not only between public infrastructure agencies but also between the public sector and numerous community stakeholders. While there are resources available to support this coordination, it can often

be below the ideal amount to ensure that all parties are effectively integrated into the process of delivering projects. Creating additional plantings often requires moving curbs, utilities, or expanding sidewalks which can be expensive and time-consuming projects. Maintenance of sidewalks and walkways will also need to be a priority, as tree root growth causes damaged sidewalks which can become physical accessibility barriers to people with mobility impairments. Resources for sidewalk repair and maintenance will also need to correspondingly increase.

Public perceptions of tree plantings are mixed. For many, unmaintained street trees can burden people with mobility disabilities among other concerns. Much like traditional infrastructure projects, working to educate the community at large about the benefits of green infrastructure is an essential step in generating buy-in and engaging the public as stewards and partners of our urban tree canopy.

Related Processes, Projects, and Policies

- Urban Forestry Plan
- Biodiversity Resolution
- San Francisco Climate Action Plan, Healthy Ecosystems chapter
- San Francisco Public Utilities Commission (PUC) City-wide green stormwater infrastructure strategy, including the Green Infrastructure Grant Program and Watershed Stewardship Grant Program
- SF Planning Urban Design Guidelines
- SFPUC Stormwater Management Ordinance

Objective 1: Planning and Research

Best practices to reduce urban heat islands and reduce exposure to wildfire smoke have been identified throughout the City based on local exposure data and health data.

Strategy 1: Develop HAQR Green Infrastructure Priority Projects	
Strategy Status:	Ongoing
Key Agencies:	Department of Public Works Office of Resilience and Capital Planning San Francisco Public Utility Commission
Key Actions:	Establish a heat and air quality resilience-focused green infrastructure priority development zones using health, environment, and exposure data. • Using available information on heat, air quality, environmental justice communities, green infrastructure zones, and environmental information such as impervious surfaces to develop maps that communicate priority zones. • Review and augment existing tree planting policies to prioritize plantings in identified areas. • Create a menu of options and guidelines for inclusion at these sites, including guidelines for green infrastructure as well as shading structures. • Utilize SFO's Smart Surfaces Tool to identify locations with urban heat island mitigations and green infrastructure and select alternative surface materials to increase reflectivity to improve worker health and safety and building longevity.

Strategy 2: Collect Green Infrastructure Data	
Strategy Status:	Ongoing
Key Agencies:	Environment Department Department of Public Works Department of Technology Office of Resilience and Capital Planning Recreation and Parks Department
Key Actions:	Standardize the collection and dissemination of data necessary to support the development of green infrastructure that reduces urban heat islands. Data collection should emphasize connecting green infrastructure to health benefits. • Create interagency funding agreement for new imagery products. • Reform and/or cancel existing contracts and acquire recurring, yearly imagery product that includes 3D mesh dataset. • Ensure that LIDAR or other canopy relevant data is being collected at least every 5 years. • Establish an updated tree GIS-based inventory for the Department of Recreation and Parks and develop a consistent process for maintaining and updating this information at least every 5 years.

Strategy 3: Investigate Strategies to Cool Impervious Surfaces	
Strategy Status:	Needs Resourcing
Key Agencies:	Environment Department Department of Public Works Office of Resilience and Capital Planning Recreation and Parks Department
Key Actions:	Research effectiveness and feasibility of strategies to cool impervious surfaces. • Research albedo improvements to cool impervious surfaces, including cool pavement on roadways and parking lots. – Evaluate effectiveness in San Francisco climate. – Identify potential institutional partners. – Identify potential funding sources. • Research opportunities for pavement removal.

Objective 2: Policy and Regulations

Policies and regulations facilitate the implementation of climate-related green infrastructure.

Strategy 4: Review Tree Planting Policies	
Strategy Status:	Planned
Key Agencies:	Public Works Planning Department
Key Actions:	Review internal policies to facilitate tree canopy to address extreme heat and wildfire smoke. • Prioritize tree planting in empty tree basins in neighborhoods with disproportionate exposure or sensitivity to extreme heat and poor air quality. • Evaluate effectiveness through green infrastructure ability to reduce heat island disparities. • Protect existing trees from removal.

Objective 3: Funding and Resources

New funding sources are developed and existing sources are streamlined to implement adaptations.

Strategy 5: Develop Green Infrastructure Financing Strategy	
Strategy Status:	Ongoing
Key Agencies:	Department of Public Works Office of Resilience and Capital Planning
Key Actions:	Identify funding sources for extreme heat and wildfire smoke-related green infrastructure projects. • Identify potential funding sources such as bonds, state and federal grants, and other financial vehicles. • Match these funds to existing programs, particularly green connections plan, urban forest plan, Biodiversity Plan, Climate Action Plan, and coordinate with ClimateSF. • Ensure that climate health considerations are integrated into these existing programs. • Include adequate funding for sidewalk repair and maintenance to account for additional tree root damage.

Objective 4: Outreach and Engagement

The public understands how interventions are connected to benefits through clear communication.

Strategy 6: Integrate Climate Health into Existing Green Infrastructure Outreach Activities	
Strategy Status:	Planned
Key Agencies:	Department of Public Health Department of Public Works Office of Resilience and Capital Planning
Key Actions:	Develop public education initiatives to connect benefits of green infrastructure to public health and communicates the full range of benefits of tree canopy expansion. • Work with community partners to develop a public education campaign around green infrastructure benefit. • Assess the success of campaign on public perceptions of green space.

Pathway 3: San Francisco is resilient to extreme heat and wildfire smoke through equitable emergency preparedness, response, and resilience actions

Pathway Barriers and Opportunities

Vulnerability to the health impacts of extreme heat and wildfire smoke is largely influenced by the social determinants of health. The communities that carry the greatest health burden are often those who already face significant economic, political, and social barriers to accessing emergency preparedness and response resources.

Community-based initiatives are the backbone of the San Francisco's response infrastructure. These first points-of-contact are best able to evaluate the needs of residents and community-members, communicate preparedness messaging, and disseminate emergency resources. However, these organizations often are insufficiently engaged while emergency preparedness and response plans are being generated, or while emergency response services are being distributed. Many of these organizations need additional resources to increase their capacity so they can regularly participate in emergency preparedness and response actions.

Respite centers represent a tool to provide residents a safe place to shelter from extreme temperatures or poor air quality, although use of these centers is limited by transportation access, poor communication, and insufficient programming. Often residents will prefer to shelter-in-place when possible. While City-run respite centers may work for some specific populations, the City should also support CBOs managing specific building uses (senior housing complexes, supportive housing, etc.) to care for their clients, the vast majority of which are sheltering in place. Again, actions to support populations to shelter in place are resource intensive, and especially for community-based organizations with already limited capacity.

All emergency preparedness and response actions require consistent two-way communication and relationship-building between City and community partners. There is no one-size-fits-all strategy as certain communities regularly face linguistic or technological barriers to accessing information.

Related Processes, Projects, and Policies

- Extreme Heat Emergency Response Annex
- Air Quality Emergency Response Annex
- Neighborhood Empowerment Network
- Extreme Weather Resilience Program
- AlertSF
- SF72
- San Francisco General Plan, Safety and Resilience Element

Objective 1: Community Emergency Response Planning

CBO's and other local institutions are empowered to partner with the City before extreme heat and wildfire smoke-related emergencies to develop preparedness and response plans, understand best practices, and identify resources.

Strategy 1: Identify and Promote Involvement Pathways	
Strategy Status:	Planned
Key Agencies:	Department of Emergency Management Department of Public Health Human Services Agency
Key Actions:	Map City emergency preparedness and response actions to understand and visualize community touchpoints and cross-promote initiatives to understand the landscape of community engagement and avoid duplication of efforts. • Build upon current initiatives including Extreme Weather Resilience Program, Neighborhood Empowerment Networks' Resilience Hubs. • Define City roles and responsibilities. • Establish new partnerships with organizations that act as first-points-of-contact to vulnerable populations, such as hospitals and health care facilities, schools, building managers, private businesses, and non-profit organizations that serve specific populations.

Strategy 2: Offer Trainings and Technical Assistance	
Strategy Status:	Needs Resourcing
Key Agencies:	Department of Emergency Management Department of Public Health Human Services Authority
Key Actions:	Establish a program to assist local organizations as they develop and execute preparedness and response actions. • Hold bi-annual CBO-focused extreme heat and wildfire smoke meetings to review best practices and City response plans, identify resources, understand and address barriers, and highlight lessons learned. • Offer trainings to first points-of-contact including CBOs, building managers, faith leaders, home health nurses, and other first points of contact on climate health impacts and emergency response best practices. • Investigate opportunities to offer population, neighborhood or organization-specific technical assistance for the development of emergency response or continuity of operations plans, including identifying funding sources.

Objective 2: Extreme Weather Respite Center Strategy

The Extreme Weather Resilience Program and City-run Weather Respite Centers are accessible, culturally-competent, and provide the programmatic services necessary to protect the health of San Franciscans during extreme heat and wildfire smoke events.

Strategy 3: Identify Respite Facilities	
Strategy Status:	Ongoing
Key Agencies:	Department of Emergency Management Department of Public Health Human Services Agency Homelessness and Supportive Housing Mayor's Office on Disabilities Office of Resilience and Capital Planning
Key Actions:	Determine the City and community facilities that will comprise a network of short, medium, and long-term respite locations open to the public for a range of emergencies, including extreme heat and air quality events. • Support and expand the DEM Extreme Weather Resilience Program as it establishes and resources a network of community-serving locations equipped to maintain service levels during extreme weather. • Plan a long-term network of City-owned and community-owned respite centers based on geography, health equity, and, facilities for specific at-risk populations. • Develop guidance for on accessibility requirements, strategies and resources to ensure facilities and services will be equitably available to people with disabilities. • Use respite center plan to propose cooling or clean air retrofits necessary for facilities to serve as extreme heat or wildfire smoke respite centers. • Support initiatives in partnership with infrastructure agencies to prioritize funding for cooling or clean air retrofits.

Strategy 4: Address Programmatic Needs	
Strategy Status:	Planned
Key Agencies:	Department of Emergency Management Department of Public Health Human Services Agency Homelessness and Supportive Housing
Key Actions:	Facilitate a Citywide work group of agencies to identify the services necessary to support respite centers and facilitate their use, establish roles and responsibilities, and plans to scale services as activation thresholds. • Research the specific programmatic needs and staffing required to meet those programmatic needs for each respite center location based on the populations served, and duration and intensity of the hazard. • Establish City roles and responsibilities to implement the servicers necessary to address the barriers that limit the use of respite centers during extreme heat and wildfire smoke events. Addressed barriers will include language and disability accessibility. • Identify and pursue funding for these planned services. • Develop a training curriculum on best practices and roles and responsibilities for those who are staffing respite centers. • Evaluate use of respite centers.

Objective 3: Support for Sheltering in Place

Preparedness and response services are available to and used by homebound seniors and others for whom community respite sites are not a practical option.

Strategy 5: Establish a Citywide Wellness Check Program	
Strategy Status:	Planned
Key Agencies:	Department of Emergency Management Department of Public Health Human Services Authority Mayor's Office on Disability
Key Actions:	Pilot a wellness check program for CBOs and City Departments serving vulnerable populations including homebound seniors, and people with access and functional needs. • Wellness check program should include a multi-lingual template call script, guidance on activation thresholds, technical support to adapt the call script to a particular community or population, and training to CBO staff. • Identify opportunities to collaborate with adjacent counties to identify best practices to accommodate clients that may reside outside of San Francisco. • Develop an organizational tool to coordinate wellness checks to prevent duplicate calls. • Evaluate effectiveness.

Strategy 6: Support and Expand Community Hubs	
Strategy Status:	On-going
Key Agencies:	Department of Emergency Management
Key Actions:	Expand San Francisco's hub network to support neighborhood-centric relationships between residents, community organizations, businesses and resourcing locations. • Strategically expand San Francisco's hub network to new neighborhoods. • Identify funding opportunities to harden resilience centers to provide shelter and resources during climate hazards and other emergencies. • Support and expand programming and other local community-lead emergency response services. • Work with San Francisco neighborhoods to create and implement neighborhood-specific emergency mitigation, preparedness and response plans.

Strategy 7: Investigate Opportunities to Connect CBOs with Emergency Resources	
Strategy Status:	Needs Further Planning
Key Agencies:	Department of Public Health
Key Actions:	Explore approaches to offer emergency resources to CBOs in a sustainable, efficient manner that minimizes maintenance barriers. • Investigate opportunities to develop vendor contracts to be activated in times of need. • Create a written agreement with CBOs receiving resources to ensure extreme heat and poor air quality plan has been developed.

Objective 4: Emergency Communications

City and community engage in regular two-way communications to mediate conflict, identify risk, and design and improve resilience actions.

Strategy 8: Refine Emergency Messaging Strategy	
Strategy Status:	Planned
Key Agencies:	Department of Emergency Management Department of Public Health
Key Actions:	Continue to develop maintain, and implement and emergency communications strategy to reach vulnerable populations before and during extreme heat and wildfire smoke events. • Develop templates for the joint information center (JIC) coordinated public messaging strategy. • Establish and maintain an online clearinghouse of these emergency preparedness and response templates. • Work with local CBOs to identify best practices to support emergency communications during climate-related hazards. • Investigate opportunities to develop a centralized online, translated, communications tool that identifies where respite centers are around the City, hours of operation, and transportation options.

Strategy 9: Community Involvement in the Emergency Operations Center	
Strategy Status:	Ongoing
Key Agencies:	Department of Emergency Management Department of Public Health
Key Actions:	Activate the Community Branch Emergency Support Function (ESF) 16 in the emergency operations center (EOC) to be a conduit to Community partners during extreme heat and wildfire smoke events. • Support Safety and Resilience Element Policy 1.1.4 to establish a network of staff supporting the Equity Offer to advocate and advise on equitable response, recovery, and reconstruction during and after a disaster. • Coordinate with Racial Equity Officers.

Strategy 10: Create and Maintain 311 Call Script	
Strategy Status:	Needs Resourcing
Key Agencies:	311 Department of Emergency Management Department of Public Health
Key Actions:	Develop extreme heat and wildfire smoke-specific 311 call script for residents to access information on how to stay safe during extreme heat and wildfire smoke events, respite center locations and activation thresholds, and where to access more information. • Create call script with CBO and resident partners. • Update call script yearly to reflect current information. • Investigate use of the 311 app to support dissemination of preparedness and response information.

Strategy 11: Evaluate Communications Methods	
Strategy Status:	Needs Resourcing
Key Agencies:	Department of Emergency Management Department of Public Health
Key Actions:	Work with community partners to evaluate the breadth and effectiveness of emergency response communications, including 311, SF72, AlertSF, Wireless Emergency Alerts, Social Media Posts, and other actions. • Develop evaluation plan to understand gaps in dissemination (i.e. which communities are not getting information such as those with access and functional needs) and gaps in information (i.e. which information does the community need that is not being communicated). • Incorporate findings into new communications activities.

Pathway 4: San Francisco is made more resilient to both current and future extreme heat and wildfire smoke events through City services that can predict and adapt to climate-related stressors

Pathway Barriers and Opportunities

In San Francisco, extreme heat and wildfire smoke largely represent novel hazards. As extreme heat events and wildfire smoke events become more frequent and more extreme, San Francisco needs to build the internal research and governance infrastructure necessary to buttress each implemented strategy. While many of these strategies may be effective in the literature or successfully implemented in different cities with different climates, research is needed to ensure that these strategies will work in San Francisco, with our unique climate, among San Francisco's populations that may not be accustomed to extreme heat or wildfire smoke, and in San Francisco's specific and fluid political, economic, and social environment.

While San Francisco is particularly vulnerable to the health impacts of extreme heat when it happens, heat events are still expected to happen less frequently than many other Cities. Because of this, many strategies to address the health impacts of extreme heat or wildfire smoke may be either ineffective, less effective, or require specific alterations to be effective. Research, and especially research specific to San Francisco's climate and communities, is important to prioritize strategies and guide implementation. This research needs to be done with the community to ensure all strategies are feasible and culturally competent.

Currently, there is little specific, real-time, and downscaled data on local health impacts of extreme heat events and wildfire smoke events. Deaths, hospitalizations, and emergency department visits, as well as qualitative data, stratified by zip code, race, age, disability and functional limitations as well as other socioeconomic and demographic indicators, is important make sure all strategies address the health impacts of these hazards. Most of the health impacts of extreme heat happen indoors, and there is little internal temperature monitoring to associate specific building types and temperature thresholds with health impacts.

Lastly, many of the strategies identified in this document require significant resources to implement. Many departments are actively engaged in planning extreme heat and air quality resilience strategies, but without the staff to move these strategies from the planning to implementation. Because these hazards are so new, many programs are just beginning to engage, and still need to identify roles, responsibilities, and plan to scale services as need requires. As these events increase in frequency and intensity, and as new health impacts and implementation barriers are identified, it will be increasingly important that staff has capacity to address both current and future needs.

Related Processes, Projects, and Policies

- San Francisco Climate and Health Program
- Heat and Air Quality Resilience Plan

Objective 1: Research and Data Analysis

San Francisco establishes a research and data analysis framework to identify risk, track impacts, and evaluate interventions.

Strategy 1: Use Data to Identify Risk	
Strategy Status:	Ongoing
Key Agencies:	Department of Public Health Office of Resilience and Capital Planning Planning Department
Key Actions:	Work collaboratively to fund and implement research projects to collect qualitative and quantitative data that identify neighborhoods, communities, and populations with highest risk for the health impacts of extreme heat and air quality. • Maintain public-facing website that articulates drivers of climate-specific health impacts, and offers and neighborhood-by-neighborhood snapshot of those drivers. • Research prevalence of workplace exposures to extreme heat and air quality. • Investigate opportunities to use temperature and air quality sensors to measure conditions inside and outside buildings. • Pursue opportunities to partner with academic institutions and community-based initiatives to collect qualitative data that understands community perceptions of extreme heat and wildfire smoke, how residents are currently responding, and outstanding needs.

Strategy 2: Track Health Impacts	
Strategy Status:	Planned
Key Agencies:	Department of Emergency Management Department of Public Health
Key Actions:	Create a standardized process to collect hospitalizations, emergency department visits, emergency medical calls for service, and other health impacts of extreme heat and wildfire smoke. • Coordinate with State agencies, hospitals, and other academic institutions.

Strategy 3: Leverage Research to Plan and Evaluate Interventions	
Strategy Status:	Ongoing
Key Agencies:	Department of Public Health
Key Actions:	Develop capacity to support public agencies and community-based organizations to project and evaluate effectiveness of extreme heat and wildfire smoke interventions and incorporate findings. • Identify funding sources and create partnerships with institutions with technical evaluation experience, especially in health economics and cost-benefit analyses. • Provide technical assistance to help agencies and community-based organizations include evaluation actions as part of the implementation of extreme heat and wildfire smoke strategies.

Objective 2: Interdepartmental Coordination and Governance

San Francisco facilitates implementation of extreme heat and wildfire smoke adaptations through streamlined government collaboration and action.

Strategy 4: Offer Workforce Development Trainings	
Strategy Status:	Needs Further Planning
Key Agencies:	Department of Public Health
Key Actions:	Investigate opportunities to develop workforce training available to City staff on the health impacts of climate change.

Strategy 5: Facilitate Future Planning Actions	
Strategy Status:	Needs Further Planning
Key Agencies:	Department of Emergency Management Department of Public Health Office of Resilience and Capital Planning
Key Actions:	As need dictates, identify opportunities to increase the capacity of San Francisco Departments to address the health impacts of extreme heat and wildfire smoke. • Investigate opportunities to support HAQR to ensure continuity of operations. • Support departments to identify resources necessary to address the health impacts of extreme heat and wildfire smoke, including during emergency activations.

Footnotes

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