

Public Health Sector Introduction:

The basic organizational structure and policy framework necessary to prepare for and respond to human health threats from climate change exists in Santa Clara County. The County has already adopted a plan to address the implications of natural hazards for human health (*Santa Clara County Local Hazard Mitigation Plan*), an emergency operations and guidance procedures plan (*Santa Clara County Operational Area Emergency Operations Plan*), and guidance for specific threats to health expected to worsen as a result of climate change (*Heat Emergency Plan* and *the Santa Clara County Mosquito-Bourne Virus Response and Operations Plan*), among others. Climate change and its future variability will impact all of these organizational structures and plans.

The threats to human health associated with climate change in Santa Clara County include an increase in extreme heat events, an increase in the intensity and frequency of wildfires and the worsening air quality associated with fires, rising sea levels and flooding, a potential increase in ozone levels, the spread of vector-borne diseases, and food insecurity.

The Silicon Valley 2.0 Regional Climate Preparedness Plan will provide guidance on specific strategies the County can take to reduce the impact of climate change on human health. These strategies will build on the structures and guidance already in place. In some cases, the Regional Plan may simply reference adopted plans or policy. In other cases, the Regional Plan will provide additional specificity, such as prioritization of specific hazards, approaches to assessing hazard vulnerability, or guidance on specific heat thresholds.

Subsequent sections in this section describe the various vulnerabilities faced by populations as a result of climate change, and the extent to which these vulnerabilities have been addressed within the County.

Climate Change Vulnerabilities in Public Health

Climate change is expected to impact many facets of human health in Santa Clara County as a result of more extreme weather, worsened air quality, increased transmission of infectious disease, and exposure to increased levels of allergens. These impacts will affect human health, health behaviors, and the socio-economic factors that influence health outcomes. The following table highlights some of the potential impacts of climate change on health, examples of populations vulnerable to the impacts, and the relative level of confidence in the impact occurring based on the existing literature.

Existing Efforts to Address Public Health Sector Vulnerabilities to Climate Change

This section provides an overview of efforts to prepare for the potential consequences of climate change and variability on public health. The section is organized by climate change variable. An overview of the asset vulnerability is provided, followed by descriptions of the existing effort(s), the level of

Silicon Valley 2.0 - Climate Preparedness Gap Analysis

implementation (i.e., vulnerability assessment, risk assessment, strategy development, or strategy implementation), and the relevant organizations.

Table 1: Climate Change Impacts to Human Health

Change in Climate Variable and Type of Health Effect	Confidence Based on Evidence¹	Examples of Vulnerable Populations	Examples of the Potential Impacts on Health
Direct Impacts from Extreme Weather Events and Sea Level Rise			
Extreme heat days and heat waves	Very high	Infants and children; seniors; individuals with cardiovascular disease, diabetes, and mental illness; neighborhoods with high levels of impervious surfaces and minimal tree cover; no vehicle access; race and ethnicity; education level; poverty; immigration status; profession	Increased heat-related mortality and morbidity including, cardiovascular-related mortality, respiratory mortality, heart attacks, and renal disease. Lower birth weight infants.
Flooding and sea level rise	Very high	Low income individuals living adjacent to waterways and the Bay; uninsured	Increased injuries, illnesses, or death associated with flooding, higher emotional stress
Indirect Impacts from Changes in Temperature and Precipitation			
Air pollution – increased ozone levels	Very high	Children; individuals with lung disease, cardiopulmonary disease, and asthma; African Americans; women	Diminished lung function, increased frequencies of asthma attacks, sensitivity to allergens, and premature mortality
Allergens	High	Individuals with asthma, respiratory disease, or cardiovascular disease; pregnant women; smokers	Increased allergic sensitivity and asthma episodes
Wildfires	Very high	Firefighters and first responders, households in the wildland urban interface zone, individuals with asthma, allergic rhinitis, or atopic eczema; children; seniors; the immunocompromised; uninsured	Increased respiratory and cardiovascular hospital emissions, asthma attacks
Vector-borne infectious disease	High	Children; seniors; immunocompromised individuals; pregnant women	Increased incidences of specific diseases such as Lyme disease and West Nile Virus
Food- and waterborne disease	Medium	Children; seniors; immunocompromised individuals; pregnant women	Contaminated drinking water, food-borne illness
Food insecurity	High	Children; families with lower-incomes; children of immigrants; farmworkers	Greater micronutrient malnutrition, obesity, and mental health problems

¹ The levels of confidence are drawn from the National Climate Assessment.

Efforts Addressing Extreme Heat

Description of the Effects of Extreme Heat on Public Health

The effects of extreme heat on human health are well documented.² Increased temperature or extended periods of elevated temperatures can increase heat-related mortality,³ cardiovascular-related mortality,⁴ respiratory mortality,⁵ and heart attacks,⁶ while increasing hospital admissions⁷ and emergency department visits.⁸ Extreme heat can also affect a person's ability to thermo-regulate, causing heat stress and sometimes leading to death.⁹ Exposure to extreme heat during pregnancy is related to lower birth weight, especially in the second and third trimesters.¹⁰ Higher temperatures may also impact human health by reducing outdoor physical activity. There is a very high level of confidence that a range of health conditions will be exacerbated by extreme heat events.¹¹

A number of factors contribute to the vulnerability of an individual to extreme heat. Intrinsic factors that contribute to heat-related risk include age (over 65 and infants and children)^{12, 13} and medical conditions (cardiovascular disease, diabetes, and mental illness).^{14, 15} Extrinsic factors, or those external to an individual, include neighborhoods with high levels of impervious surfaces and low tree cover,¹⁶ housing

² Duffy, P.B. and Tebaldi, C. (2012). Increasing Prevalence of Extreme Summer Temperatures in the U.S. *Climate Change*, 111: pp. 487-495.

³ Chestnut, L.G., et. al. (1998). Analysis of Differences in Hot-Weather-Related Mortality Across 44 U.S. Metropolitan Areas. *Environmental Science Policy*, 1(1): pp. 59-70.

⁴ Medina-Ramon, M.; Zanobetti, A.; Cavanagh, D.P.; and Schwartz, J. (2006). Extreme Temperatures and Mortality: Assessing Effect Modification by Personal Characteristics and Specific Cause of Death in a Multi-City Case-Only Analysis. *Environmental Health Perspectives*, 114: pp. 1331-1336.

⁵ Mastrangelo, G., et. al. (2007). Pattern and Determinants of Hospitalization During Heat Waves: An Ecologic Study. *BMC Public Health*, 7: p. 200.

⁶ Braga, A.; Zanobetti, A.; and Schwartz, J. (2002). The Effect of Weather on Respiratory and Cardiovascular Deaths in 12 U.S. Cities. *Environmental Health Perspectives*, 110: pp. 859-863.

⁷ Ostro, B.D., et. al. (2009). Estimating the Mortality Effect of the July 2006 California Heat Wave. *Environmental Research*, 109: pp. 106-112.

⁸ Dolney, T., and Sheridan, S. (2007). The Relationship between Extreme Heat and Ambulance Response Calls for the City of Toronto, Ontario, Canada. *Environmental Resources*, 101(1): pp. 94-103.

⁹ Lubner, G.; Sanchez, C.; and Conklin, L. (2006). Heat-Related Deaths—United States, 1999–2003. *Morbidity and Mortality Weekly Report*, 55(29): pp. 796-798.

¹⁰ Deschênes, O.; Greenstone, M., and Guryan, J. (2009). Climate Change and Birth Weight. *American Economic Review*, 99: pp. 211–217.

¹¹ Lubner, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

¹² Knowlton, K., et. al. (2009). The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits. *Environmental Health Perspectives*, 117(1): pp. 61-67.

¹³ Basu, R. and Ostro, B. (2009). A Multi-County Analysis Identifying the Vulnerable Populations for Mortality Associated with High Ambient Temperatures in California. White Paper for the California Climate Change Center.

¹⁴ Reid, C., et. al. (2009). Mapping Community Determinants of Heat Vulnerability. *Environmental Health Perspectives*, 117(11): pp. 1730-1736.

¹⁵ Poumadere, M., et. al. (2005). The 2003 Heat Wave in France: Dangerous Climate Change Here and Now. *Risk Analysis*, 25(6): pp. 1483-1493.

¹⁶ Shonkoff, S., et. al. (2009). Minding the Climate Gap: Environmental Health and Equity Implications of Climate Change Mitigation Policies in California. *Environmental Justice*, 2(4), pp. 173-177.

units that lack of air conditioning,¹⁷ or household access to a vehicle.¹⁸ Along with this intrinsic and extrinsic factors such as race and ethnicity, education level, poverty, immigration status, and profession (particularly individuals who work outside, such as farm and construction workers) may contribute to an individual's vulnerability to heat events.^{19, 20, 21}

People living in milder climates are often less prepared for the effects of extreme heat. California experienced a ten-day heat wave during July 2006, which broke temperature records around the state, causing at least 140 deaths and resulting in an estimated 16,166 excess emergency department visits and 1,182 excess hospitalizations (compared to a reference period).²² The Central Coast region, which includes Santa Clara County, contributed 28% of all excess emergency department visits (4,588) and 47% of all excess hospitalizations (550) for the state. This far exceeds the number and proportion of cases that would be expected for a region that houses 18% of the state's population.²³

However, the number of heat wave deaths, which are tabulated by county coroners, likely underestimate the full impact of heat waves. Reasons why underestimates occur include: deaths such as cardiovascular disease and respiratory disease that are exacerbated by heat may not be classified as heat-related; the coroner may not be alerted to consider heat-related deaths; and the coroner has to make some judgment as to the cause of death. As compared to a reference period, modeled estimates suggest the 2006 California heat wave may have contributed to between 215 to 505 heat wave deaths, significantly higher than the death certificates indicate.²⁴

An increase in the frequency of extreme heat events is likely to cause power failures around the county, endangering the health of vulnerable residents. More extreme events and higher average temperatures in Santa Clara are expected to result in an increase in electricity demand. Air conditioning can increase peak demand for energy, and a sudden increase in electricity demand for air conditioning can overload electric lines, transformers, and other equipment, leading to potential power outages and leaving

¹⁷ Reid, C., et. al. (2009). Mapping Community Determinants of Heat Vulnerability. *Environmental Health Perspectives*, 117(11): pp. 1730-1736.

¹⁸ Shonkoff, S., et. al. (2009). Minding the Climate Gap: Environmental Health and Equity Implications of Climate Change Mitigation Policies in California. *Environmental Justice*, 2(4), pp. 173-177.

¹⁹ Reid, C., et. al. (2009). Mapping Community Determinants of Heat Vulnerability. *Environmental Health Perspectives*, 117(11): pp. 1730-1736.

²⁰ Poumadere, M., et. al. (2005). The 2003 Heat Wave in France: Dangerous Climate Change Here and Now. *Risk Analysis*, 25(6): pp. 1483-1493.

²¹ Shonkoff, S., et. al. (2009). Minding the Climate Gap: Environmental Health and Equity Implications of Climate Change Mitigation Policies in California. *Environmental Justice*, 2(4), pp. 173-177.

²² Knowlton, K., et al. (2009). The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits. *Environmental Health Perspectives: Volume 117, Number 1*.

²³ Knowlton, K., et al. (2009). The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits. *Environmental Health Perspectives: Volume 117, Number 1*.

²⁴ Ostro, B.D., et. al. (2009). Estimating the Mortality Effect of the July 2006 California Heat Wave. *Environmental Research*, 109: pp. 106-112.

people exposed to higher temperatures.²⁵ During the 2006 heat wave, over 300,000 PG&E customers lost power in San Jose alone.²⁶

Existing Climate Change Preparedness Efforts

The Santa Clara County Local Hazard Mitigation Plan addresses the likely increase in climate change-related extreme heat and the associated impacts on public health in Santa Clara County.

Hazard Planning

- **Description:** Lead by the Santa Clara County Office of Emergency Services, a review draft of the Santa Clara County Local Hazard Mitigation Plan (LHMP) was completed in 2011. The LHMP planning team identified climate change as an “amplifier” of existing hazards, such as extreme weather events, coastal flooding, and heat waves. Where appropriate, the LHMP includes a discussion of how climate change might impact the frequency, intensity, and distribution of natural hazards. The LHMP planning team also recognized that climate change could be used as a parameter in prioritizing hazards in future updates of the plan (although it has yet to do so). The LHMP analyzes 20 natural and man-made hazards (profiles) and identifies mitigation priorities and actions shared across jurisdictional boundaries. Climate change considerations were incorporated directly into the flood, drought, and heat profiles, all of which would be expected to affect human health. These three hazards were ranked as moderate priorities for the County. No high ranking mitigation actions were identified for heat.
- **Implementation level:** Adaptation Strategy Development
- **Relevant agencies:** Lead by Santa Clara County Office of Emergency Services; County agencies; all cities except the Cities of Los Altos Hills and Milpitas; state and regional agencies; businesses.
- **Documentation:**
 - Santa Clara County Local Hazard Mitigation Plan (2011),
<http://www.sccgov.org/sites/oes/PlansPublications/Pages/LHMP.aspx>

Parallel Efforts with Climate Change Preparedness Benefits

While not explicitly focused on addressing climate change-related extreme heat, the following plans, policies, and programs are in place to address existing extreme heat events and their impacts on public health and could contribute to climate preparedness efforts.

Heat and Health Warning System

- **Description:** NOAA has an established Heat/Health Watch Warning System, and Santa Clara County is using this system as guidance for issuing excessive heat watches, excessive heat warnings, and heat advisories. The alert system notifies state OES and local governments of forecasted extreme heat periods allowing for the activation of appropriate plans.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** County; cities.

²⁵ Pacific Gas and Electric Company (2013). Heat Outages. Retrieved from <http://www.pge.com/myhome/edusafety/naturaldisaster/stormsoutagessafety/heatoutage/>

²⁶ City of San Jose. (2006). Study Session on July 2006 Heat Storm and Related Power Failures. Retrieved from http://www3.sanjoseca.gov/clerk/Agenda/101006/101006e_1.pdf

- Documentation:
 - Santa Clara County Operational Area Emergency Operations Plan (2008), http://www.sccgov.org/sites/oes/Documents/EOP_Complete.pdf
 - NOAA Press Release (2007), <http://www.publicaffairs.noaa.gov/releases2007/jun07/noaa07-r214.html>

Communication and Outreach

- Description: Santa Clara County creates media advisories, offers tips for hot weather safety, and publishes fact sheets on how to prevent/respond to heat-related illness. The information is published in three languages: English, Spanish, and Vietnamese.
Health officials in Santa Clara County can also activate the reverse 911 emergency alert system for heat-related emergencies. The system was activated in 2013 by the Santa Clara County Office of Emergency Services, contacting half a million homes with advice on how to stay cool.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County Emergency Medical Services (EMS) System, Santa Clara County Fire Chiefs Association, and the Public Health Department.
- Documentation:
 - Heat Prevention Packet (2013), <http://www.sccgov.org/sites/ems/Documents/Heat%20Prevention%20Packet%20June%202013.pdf>

Emergency Operations

- Description: The Santa Clara County Operational Area Emergency Operations Plan (EOP) is an all hazards document describing the County's Emergency Operations organization, guidelines, and critical components of the Emergency Response System. The EOP is activated during extraordinary emergency situations associated with large-scale disasters. The EOP establishes a County emergency management organizations, operational concepts, and flexible framework for planning and response for a variety of emergencies expected to be affected by climate change and variability, such as wildfires, floods, and heat waves. The EOP is currently in the update process.
The EOP does not currently address the impacts of climate change on specific threats facing Santa Clara County. However, the organizational structure and procedures may be sufficient under changing conditions.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County Office of Emergency Services; County agencies; cities
- Documentation:
 - Santa Clara County Operational Area Emergency Operations Plan (2008), http://www.sccgov.org/sites/oes/Documents/EOP_Complete.pdf
 - Santa Clara Operational Area Emergency Operations Plan Project. (2013), http://www.sccgov.org/sites/oes/Documents/EOP_Project_Information.pdf

Cooling Centers

- **Description:** The County and local partners operate cooling centers in response to excess heat watches issued by the National Weather Service. The location of cooling centers are publicized through the County's website, press releases, social media, and other sources. The County does not offer special transportation services to these cooling centers. However, most cooling centers are relatively close to public transit services.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Santa Clara County Office of Emergency Services; County agencies; cities
- **Documentation:**
 - For more information on countywide cooling centers, visit http://sccfd.org/pub_ed/heat.html

Efforts Addressing Climate Change-Exacerbated Air Pollution

Description of the Effects of Climate Change Induced Air Pollution on Public Health

Climate change is expected to exacerbate some forms of air pollution, which can lead to a number of health impacts. In particular, climate change is expected to increase ground-level ozone concentrations, the incidence of airborne allergens, and particulate matter from wildfire smoke.

Increases in Ozone

Warmer temperatures are projected to increase ozone concentrations,²⁷ resulting in a significant increase in the number of days that exceed the 8-hour regulatory standard for ozone concentrations.²⁸ Additional modeling of higher temperatures related to climate change showed that Bay Area maximum 8-hour ozone levels would increase by 8 ppb during ozone exceedance days, offsetting 10 years of ozone emissions control efforts in the Bay Area.²⁹

Between 2008 and 2010, Santa Clara County had 19 days with ozone levels that were unhealthy for sensitive groups and 1 day with ozone levels that were unhealthy for all people, earning an F grade from the American Lung Association.³⁰ Ozone concentrations have been shown to increase by as much as 10% in Santa Clara County without implementation of measures to mitigate pollutant emissions.³¹ High levels of ozone are associated with diminished lung function, increased frequencies of asthma attacks,

²⁷ EPA. (2009). Assessment of the Impacts of Global Change on Regional U.S. Air Quality: A Synthesis of Climate Change Impacts on Ground-Level Ozone. *An Interim Report of the U.S. EPA Global Change Research Program*.

²⁸ Bell, M.L., et. al. (2007). Climate Change, Ambient Ozone, and Health in 50 U.S. Cities. *Climatic Change*, 82: pp. 61-76

²⁹ Bay Area Air Quality Management District. (2010). Bay Area 2010 Clean Air Plan. Retrieved from <http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Clean-Air-Plans.aspx>

³⁰ American Lung Association. (2012). State of the Air. Retrieved from <http://www.stateoftheair.org/2012/states/california/santa-clara-06085.html>

³¹ Steiner, A., et. al. (2006). Influence of Future Climate and Emissions on Regional Air Quality in California. *Journal of Geophysical Research*, 111: pp. 1-22.

sensitivity to allergens, and premature mortality.^{32 33 34} There is a very high level of confidence that a range of health conditions will be exacerbated by ozone concentrations.³⁵

Changes in Allergens

Changes in temperature and humidity related to climate change are expected to affect the timing and severity of the allergens. Warmer temperatures and increased precipitation is linked to increased pollen production for many types of tree and grass species.³⁶ For example, pollen counts from oak trees in the San Francisco Bay Area are related to precipitation in the previous year,³⁷ and ragweed pollen counts rise with increasing temperature and carbon dioxide.^{38 39}

Rising pollen levels and longer pollen seasons increase allergic sensitivity and asthma episodes,^{40 41} decreasing economic productivity, and increasing the number of school days missed each year.⁴² Rising pollen concentrations may also increase the number of individuals who have allergic asthma, which is triggered by a reaction to pollen or other allergens. Exposure to increased levels of air pollution also increases the risk and severity of asthma attacks.⁴³ Extreme precipitation events and higher temperatures may also encourage growth of indoor mold and fungi, which may increase respiratory and asthma issues.⁴⁴ There is a high level of confidence that climate change will affect allergens, resulting in a range of health issues.⁴⁵

³² Kampa, M. and E. Castanas. (2008). Human Health Effects of Air Pollution. *Environmental Pollution*, 151: pp. 362-367.

³³ Kinney, P. (2008). Climate Change, Air Quality, and Human Health. *American Journal of Preventive Medicine*, 35: pp. 459-467.

³⁴ Post, E., et. al. (2012). Variation in Estimated Ozone-Related Health Impacts of Climate Change due to Modeling Choices and Assumptions. *Environmental Health Perspectives*, 120(11): pp. 1559-1564.

³⁵ Luber, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

³⁶ Pinkerton, K., et. al. (2012). An Official American Thoracic Society Workshop Report: Climate Change and Human Health. *Proceedings of the American Thoracic Society*, 9(1): pp. 3-8.

³⁷ Weber, R. (2003). Meteorologic Variables in Aerobiology. *Immunology and Allergy Clinics of North America*, 23(3): pp. 411-422

³⁸ Wan, S., et. al. (2002). Response of an Allergenic Species, *Ambrosia Psilostachya* (Asteraceae), to Experimental Warming and Clipping: Implications for Public Health. *American Journal of Botany*; 89(11): pp. 1843-1846.

³⁹ Ziska, L., and Caulfield, F. (2000). Rising CO₂ and Pollen Production of Common Ragweed (*Ambrosia Artemisiifolia*), A Known Allergy-Inducing Species: Implications for Public Health. *Australian Journal of Plant Physiology*, 27(10): pp. 893-898.

⁴⁰ EPA. (2008). A Review of the Impact of Climate Variability and Change on Aeroallergens and Their Associated Effects.

⁴¹ Schmier, J., and Ebi, K. (2009). The Impact of Climate Change and Aeroallergens on Children's Health. *Allergy Asthma Proceedings*, 30(3): pp. 229-237.

⁴² Staudt, A., et. al. (2010). Extreme Allergies and Global Warming. National Wildlife Federation and Asthma and Allergy Foundation of America.

⁴³ D'amato, G., et. al. (2010). Urban Air Pollution and Climate Change as Environmental Risk Factors of Respiratory Allergy: An Update. *Journal of Investigational Allergology and Clinical Immunology*, 20: pp. 95-102.

⁴⁴ Institute of Medicine. (2011). *Climate Change, the Indoor Environment, and Health*. Washington, DC: The National Academies Press.

⁴⁵ Luber, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

The population most vulnerable to allergic illnesses are those with asthma, allergic rhinitis, or atopic eczema. These groups are already sensitized to allergic illness and are more likely to be affected by increased concentrations of allergens in the air. Children, seniors, the immunocompromised, and the uninsured are also vulnerable to the impacts of climate change on allergens.⁴⁶

Increases in Wildfire Frequency and Extent

Regional wildfire frequency and extent is also projected increase under changing climate conditions. Along with the risk of fatalities and injuries to those living in the wild-urban interface zone and to firefighters and first responders dealing with a fire, smoke from wildfires may reduce air quality and exacerbate chronic public health problems.^{47, 48} Smoke contains particulate matter, PM 2.5- PM 10, which can increase respiratory and cardiovascular hospital emissions.^{49, 50} There is a very high level of confidence that a range of health conditions will be exacerbated by climate change.⁵¹

A range of factors contribute to the vulnerability of an individual to ozone. Children,⁵² individuals with existing medical conditions, such as lung disease,⁵³ cardiopulmonary disease,⁵⁴ and asthma⁵⁵ are particularly vulnerable to ozone. African Americans and women have also been shown to be more vulnerable to ozone.⁵⁶ Those vulnerable to wildfire smoke include individuals with asthma, respiratory disease, or cardiovascular disease, pregnant women, and smokers.⁵⁷

Existing Climate Change Preparedness Efforts

No explicit climate change preparedness initiatives relevant to public health and climate change-exacerbated air pollution have been identified.

⁴⁶ Reid, C., and Gamble, J. (2009). Aeroallergens, Allergic Disease, and Climate Change: Impacts and Adaptation. *EcoHealth*, 6(3): pp. 458–470.

⁴⁷ Jaffe, D., et. al. (2008b). Interannual variations in PM_{2.5} due to wildfires in the western United States. *Environmental Science & Technology*, 12(42): pp. 2812-2818.

⁴⁸ Dennekamp, M. and M.J. Abramson. (2011). The Effects of Bushfire Smoke on Respiratory Health. *Respirology*, 16: pp. 198-209.

⁴⁹ Delfino, R., et. al. (2009). The Relationship of Respiratory and Cardiovascular Hospital Admissions to the Southern California Wildfires of 2003. *Occupational Environment Medicine*, 66(3): pp. 189-97.

⁵⁰ Lipsett, M. and Materna, B. (2008). Wildfire Smoke: A Guide for Public Health Officials. Retrieved from http://oehha.ca.gov/air/risk_assess/wildfirev8.pdf

⁵¹ Luber, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

⁵² EPA. (2013). Ground-level Ozone Standards Designations. Retrieved from <http://www.epa.gov/ozonedesignations/>

⁵³ EPA. (2013). Ground-level Ozone Standards Designations. Retrieved from <http://www.epa.gov/ozonedesignations/>

⁵⁴ Jerrett, M., et. al. (2009). Long-Term Ozone Exposure and Mortality. *The New England Journal of Medicine*, 360: pp. 1085-1095

⁵⁵ EPA. (2013). Ground-level Ozone Standards Designations. Retrieved from <http://www.epa.gov/ozonedesignations/>

⁵⁶ Medina-Ramón, M., and Schwartz, J. (2008). Who is more vulnerable to die from ozone air pollution? *Epidemiology*, 19(5): pp. 672-9

⁵⁷ Lipsett, M. and Materna, B. (2008). Wildfire Smoke: A Guide for Public Health Officials. Retrieved from http://oehha.ca.gov/air/risk_assess/wildfirev8.pdf

Parallel Efforts with Climate Change Preparedness Benefits

While not explicitly focused on addressing climate change-exacerbated air pollution issues, the following plans, policies, and programs in place to address the effects of worsening air quality on public health and can contribute to climate preparedness efforts.

Air Quality Monitoring and Forecasts

- **Description:** Using the Air Quality Index developed by the U.S. EPA to give information about air pollution levels, the Bay Area Air District issues air quality forecasts each day. The forecasts divide Santa Clara into two reporting zones: South Central Bay and Santa Clara Valley. The Bay Area Air Quality Management District also established Spare the Air program to reduce air pollution and provide advance notices when the air quality is forecast to be unhealthy.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Bay Area Air District; County agencies; cities
- **Documentation:**
 - Air Quality Forecasts (2013), <http://sparetheair.org/Stay-Informed/Todays-Air-Quality/Five-Day-Forecast.aspx>
 - Air Quality Forecast Reporting Zones (2013), <http://sparetheair.org/Stay-Informed/Todays-Air-Quality/Reporting-Zones.aspx>
 - Spare the Air Every Day (2013), <http://sparetheair.org/Make-a-Difference/Spare-the-Air-Every-Day.aspx>

Education and Communication

- **Description:** Santa Clara residents can receive information about air quality from local newspapers, radio, TV, and the internet. Residents can receive AirAlerts via email. The alerts inform the public the day before a Spare the Air Alert is declared. The alerts also encourage individuals to modify their behavior to reduce air pollution and gives advance notice to people with respiratory sensitivities. The Bay Air Area District also provides tools and resources to local employers to introduce Spare the Air concepts in the work place.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Bay Area Air District; County agencies; cities
- **Documentation:**
 - Spare the Air Notifications (2013), <http://sparetheair.org/Stay-Informed/Subscribe-and-Share/Air-Alerts.aspx>
 - Employer Program (2013), <http://sparetheair.org/Get-Involved/For-Employers.aspx>

Regional Air Quality Planning and Regulation

- **Description:** The Bay Air 2010 Clean Air Plan provides a comprehensive plan to improve air quality and protect public health. The plan outlines a control strategy to reduce emissions and decrease ambient concentrations of pollutants, protect public health, and reduce greenhouse gas emissions. The plan recognizes the potential impacts of climate change on ozone levels and particulate matter emissions from wildfires.

The Bay Area Air Quality Management District prepared an Ozone Strategy for the region. The strategy shows how the region will achieve compliance with the California one-hour air quality standard for ozone. The strategy articulates how higher temperatures increase precursor volatile organic compound (VOC) emissions and how air pollution control regulations may result in co-benefits.

- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Bay Area Air Quality Management District; regional agencies; County agencies; cities
- **Documentation:**
 - Bay Area 2010 Clean Air Plan (2010), <http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Clean-Air-Plans.aspx>
 - Bay Area 2005 Ozone Strategy (2006), http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/Plans/2005%20Ozone%20Strategy/adoptedfinal_vol1.ashx
 - Spare the Air Every Day (2013), <http://sparetheair.org/Make-a-Difference/Spare-the-Air-Every-Day.aspx>

Emergency Operations for Wildfires

- **Description:** The Santa Clara County Operational Area Emergency Operations Plan (EOP) is an all hazards document describing the County's Emergency Operations organization, guidelines, and critical components of the Emergency Response System. The EOP establishes a County emergency management organizations, operational concepts, and flexible framework for planning and response for a variety of emergencies including wildfires. The EOP is currently in the update process.
Santa Clara County also has a mutual aid plan in place. The plan provides guidelines on fire dispatch, available resources, fire station locations, and multiple patient management plans, among other things.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Santa Clara County Fire Department; Santa Clara County Office of Emergency Services; County agencies; cities
- **Documentation:**
 - Santa Clara County Operational Area Emergency Operations Plan (2008), http://www.sccgov.org/sites/oes/Documents/EOP_Complete.pdf
 - Santa Clara Operational Area Emergency Operations Plan Project. (2013), http://www.sccgov.org/sites/oes/Documents/EOP_Project_Information.pdf
 - Santa Clara County Mutual Aid Plan (2013), <http://santaclaracounty-xsc.org/map/index.php>

Education and Communication

- **Description:** The Bay Area Air Quality Management District releases smoke advisories during wildfires. AlterSCC sends emergency warnings directly to cell phone, mobile device, email, or landline for residents in Santa Clara County during wildfires.

- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Bay Area Air District; County agencies; cities
- Documentation:
 - AlertSCC (2013), <http://www.sccgov.org/sites/alertscc/Pages/home.aspx>

Efforts Addressing Climate Change-Exacerbated Spread of Infectious Disease

Description of the Effects of Climate Change on the Spread of Infectious Disease

An indirect effect of climate change may be an increased incidence of infectious disease, particularly related to vector-, water-, and food-borne illness. While uncertainty still exists about the influence of climate change on the distribution of diseases carried by insects and rodents,⁵⁸ climate change and variability may result in changes to the geographic range of some insects or pathogens,⁵⁹ which can increase the incidences of specific diseases.⁶⁰ This includes risk from Lyme disease and West Nile Virus,⁶¹ both of which are tracked by the Santa Clara County Vector Control District. There is a high level of confidence that climate change will affect vector-borne diseases.⁶³

Water-borne disease may also present an increased risk in the future. Extreme precipitation events may affect human health by contaminating drinking water. Heavy rainfall can carry household, industrial, transportation, and agricultural chemicals, sewage, and animal waste into drinking water supplies. This runoff may also contaminant shellfish and contributes to food-borne illness.⁶⁴

Children and seniors are vulnerable to the spread of infectious disease, particularly viral encephalitis, which may be carried by ticks and mosquitos, among other agents.⁶⁵ Other vulnerable populations include immunocompromised individuals and pregnant women.⁶⁶

Existing Climate Change Preparedness Efforts

No explicit climate change preparedness initiatives relevant to public health and climate change-exacerbated infectious disease were identified.

⁵⁸ Luber, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

⁵⁹ Lafferty, K. (2009). The Ecology of Climate Change and Infectious Diseases. *Ecology*, 90: pp. 888-900.

⁶⁰ Rosenthal, J. (2009). Climate Change and the Geographic Distribution of Infectious Diseases. *EcoHealth*, 6: pp. 489-495.

⁶¹ Mills, J.; Gage, K.; and Khan, A. (2010). Potential Influence of Climate Change on Vector-borne and Zoonotic Diseases: A Review and Proposed Research Plan. *Environmental Health Perspectives*, 118: pp. 1507.

⁶² Morin, C., and Comrie, C. (2010). Modeled Response of the West Nile Virus Vector *Culex Quinquefasciatus* to Changing Climate Using the Dynamic Mosquito Simulation Model. *International Journal of Biometeorology*, 54: pp. 517-529.

⁶³ Luber, G., et. al. (2013). Human Health. Chapter for the National Climate Assessment.

⁶⁴ Rose, J., et. al. (2001). Climate Variability and Change in the United States: Potential Impacts on Water- and Foodborne Diseases Caused by Microbiologic Agents. *Environmental Health Perspectives*, 109: pp. 211-221.

⁶⁵ Intergovernmental Panel on Climate Change. (1997). *The Regional Impacts of Climate Change: An Assessment of Vulnerability*. Cambridge University Press, U.K.

⁶⁶ Gerba, C.; Rose, J.; and Haas, C. (1996). Sensitive Populations: Who is at the Greatest Risk? *International Journal of Food Microbiology*, 30: pp. 113-123.

Parallel Efforts with Climate Change Preparedness Benefits

While not explicitly focused on addressing climate change-exacerbated infectious disease, the following plans, policies, and programs are in place to address existing risks and could contribute to climate preparedness efforts.

Vector-Borne Diseases & Disease Surveillance Programs

- **Description:** The Santa Clara County Vector Control District conducts disease surveillance activities and vector studies for such vector-borne diseases. Lyme disease and West Nile Virus are the two main vector-borne diseases in Santa Clara County. Annual reports are published with information on sentinel species.

The Mosquito-Borne Virus Response and Operations Plan provides a list of procedures and strategies for surveillance and operational response to mosquito-borne virus in the county. The plan also outlines the roles and responsibilities of the agencies involved in virus surveillance and response. The current plan does not discuss the impact of climate change on mosquito-borne viruses, but it does provide the organization and surveillance structures to address future change.

- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Santa Clara County Vector Control District
- **Documentation:**
 - Vector-Borne Diseases & Disease Surveillance Programs (2012), <http://www.sccgov.org/sites/vector/Vector-Borne%20Diseases%20-%20Disease%20Surveillance%20Programs/Pages/Vector-Borne-Diseases---Disease-Surveillance-Programs.aspx>
 - Annual Report (2012), <http://www.sccgov.org/sites/vector/Vector-Borne%20Diseases%20-%20Disease%20Surveillance%20Programs/Documents/2011-Santa-Clara-County-Vector-Control-District--Surveillance-Report.pdf>
 - Mosquito-Borne Virus Response and Operations Plan (2011), [http://www.sccgov.org/sites/vector/West%20Nile%20Virus/The%20District's%20Mosquito-borne%20Virus%20Response%20and%20Operations%20Plan%20\(MVROP\)/Documents/Approved-WNV-Response-Plan.pdf](http://www.sccgov.org/sites/vector/West%20Nile%20Virus/The%20District's%20Mosquito-borne%20Virus%20Response%20and%20Operations%20Plan%20(MVROP)/Documents/Approved-WNV-Response-Plan.pdf)
 - Action Plan for Ground Fogging in Santa Clara County (2012), [http://www.sccgov.org/sites/vector/West%20Nile%20Virus/The%20District's%20Mosquito-borne%20Virus%20Response%20and%20Operations%20Plan%20\(MVROP\)/Documents/Action-Plan-For-Ground-Fogging.pdf](http://www.sccgov.org/sites/vector/West%20Nile%20Virus/The%20District's%20Mosquito-borne%20Virus%20Response%20and%20Operations%20Plan%20(MVROP)/Documents/Action-Plan-For-Ground-Fogging.pdf)

Infectious Disease Surveillance

- **Description:** The Public Health Department monitors various areas of infectious disease and publishes data and statistics and quarterly bulletins on conditions in Santa Clara County. This documentation includes diseases such as West Nile Virus and environmental testing on water quality.

- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County Public Health Department
- Documentation:
 - Infectious Disease Statistics (2013), <http://www.sccgov.org/sites/sccphd/en-us/Partners/Data/Pages/Infectious-Diseases.aspx>
 - Infectious Disease Bulletins (2013), <http://www.sccgov.org/sites/sccphd/en-us/HealthProviders/DiseaseReporting/Pages/QuarterlyReports.aspx>

Communication

- Description: Santa Clara residents can receive information on infectious diseases through AlertSCC. The system sends emergency warnings directly to cell phone, mobile device, email, or landline for residents in Santa Clara County during wildfires.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County
- Documentation:
 - AlertSCC (2013), <http://www.sccgov.org/sites/alertsc/Pages/home.aspx>

Efforts Addressing Sea Level Rise and Climate Change-Exacerbated Flooding

Description of the Effects of Sea Level Rise and Flooding on the Public Health

The impacts of flooding on public health can be significant. Businesses may be destroyed and people may be displaced from their homes. These events may result in injury, illness, or death, while also causing severe emotional stress. The frequency of extreme precipitation events has been increasing and is expected to increase in the future. There is a very high level of confidence that a range of health conditions will be exacerbated by extreme weather events.

Storm surges (which will be exacerbated by sea level rise) and flooding, often related to extreme weather events, have the potential to cause injury and loss of life. Estimates suggest that over 14,000 acres of land in Santa Clara County will be at risk to inundation in 2100, placing 31,000 people at risk to flood during a 100- year storm event.

The combination of sea level rise and coastal flooding are likely to place a range of different types of infrastructure at risk, which may affect human health. Two health care facilities are located in areas likely to be inundated by sea level. Furthermore, there were already 41 sites containing hazardous materials at risk of flooding during a 100-year storm event. This number increases to 53 with 1.4 meters of sea level rise. Similarly, three wastewater treatment plants, processing a total of 145 million gallons each day, are at risk to rising sea level in Santa Clara County. Flooding at these facilities may result in hazardous materials entering the water supply and contaminating drinking water.

Extreme weather events can affect mental health in a number of ways. After disasters, mental health issues are common, and individuals have been found to have increased levels of anxiety and post-traumatic stress disorder following floods, extreme heat events, and wildfires. All of which are likely to increase in frequency in the future.

Existing Climate Change Preparedness Efforts

No explicit climate change preparedness initiatives relevant to public health and climate change-exacerbated flooding were identified.

Parallel Efforts with Climate Change Preparedness Benefits

While not explicitly focused on addressing climate change-exacerbated flooding, the following plans, policies, and programs are in place to address existing risks and could contribute to climate preparedness efforts.

Flood Hazard Planning

- **Description:** Lead by the Santa Clara County Office of Emergency Services, a review draft of the Santa Clara County Local Hazard Mitigation Plan (LHMP) was completed in 2011. The LHMP planning team identified climate change as an “amplifier” of existing hazards, including flood. The plan ranked floods as a moderate risk for the County and recommended that the County build a GIS layer of localized flooding “hot spots” throughout the County. Note this document is also mentioned under ‘hazard planning’.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Lead by Santa Clara County Office of Emergency Services; County agencies; all cities except the Cities of Los Altos Hills and Milpitas; state and regional agencies; businesses.
- **Documentation:**
 - Santa Clara County Local Hazard Mitigation Plan (2011), <http://www.sccgov.org/sites/oes/PlansPublications/Pages/LHMP.aspx>

Emergency Operations

- **Description:** The Santa Clara County Operational Area Emergency Operations Plan (EOP) is an all hazards document describing the County’s Emergency Operations organization, guidelines, and critical components of the Emergency Response System. The EOP is activated during extraordinary emergency situations associated with large-scale disasters. The EOP establishes a County emergency management organizations, operational concepts, and flexible framework for planning and response for a variety of emergencies expected to be affected by climate change and variability, such as wildfires, floods, and heat waves. The EOP is currently in the update process. The EOP does not currently address the impacts of climate change on specific threats facing Santa Clara County. However, the organizational structure and procedures may be sufficient under changing conditions. Note this document is also mentioned under ‘hazard planning’.
- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Santa Clara County Office of Emergency Services; County agencies; cities
- **Documentation:**
 - Santa Clara County Operational Area Emergency Operations Plan (2008), http://www.sccgov.org/sites/oes/Documents/EOP_Complete.pdf
 - Santa Clara Operational Area Emergency Operations Plan Project. (2013), http://www.sccgov.org/sites/oes/Documents/EOP_Project_Information.pdf

Flood Warnings and Watches

- Description: The National Weather Service issues flash flood watches and warnings. A flash flood watch is issued when flash flooding is possible within the designated watch area but the occurrence location, and/or timing is still uncertain, indicating all persons should be alert. A flash flood warning indicating all persons should take necessary precautions is issued when a flash flood has been reported, is in progress, is imminent, or highly likely.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: County Emergency Management Agencies

Communication

- Description: Santa Clara residents can receive information infectious disease through AlertSCC. The system sends emergency warnings directly to cell phone, mobile device, email, or landline for residents in Santa Clara County during flooding and evacuations. Santa Clara Valley Water District also provides notifications about heavy storms and flooding.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County
- Documentation:
 - AlertSCC (2013), <http://www.sccgov.org/sites/alertsc/Pages/home.aspx>
 - Text alerts for heavy storms and flooding (2013), <http://www.valleywater.org/Services/SMSAlert.aspx>

Reporting

- Description: Flood reports are prepared after severe storms in Santa Clara County. The reports analyze the circumstances behind the flood and summary of the damages associated with the flooding, which can provide valuable information about planning for potential future flood events.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District
- Documentation:
 - Flood Reports (2013), <http://www.valleywater.org/Services/FloodReports.aspx>

Other Efforts to Address Multiple Climate Change Variables Related to Public Health

The following section lists programs currently underway in Santa Clara County which are likely to increase community and public health resiliency to the impacts of climate change. These programs include:

Santa Clara Department of Public Health Strategic Plan

- Description: The Santa Clara Department of Public Health Department's Strategic Plan represents a roadmap for the Department. The Strategic Plan includes six goals and associated

objectives to address health priorities affecting County residents and to expand capacities of the Department.

Goal 3 of the Strategic Plan “Establish[es] a Departmental focus on environmental health issues related to climate change and sustainability.” The Department calls for increasing community awareness and preparedness for the public health effects of climate change and global warming, providing a broad umbrella to pursue implementation across a broad range of climate variables and exposures.

Currently, the Department is undergoing a process to update the climate change goals and objectives for next iteration of the Strategic Plan. Draft goals include:

- Inform larger community and public health partners about the health effects of climate change and actions that can be taken to reduce greenhouse gas emissions
- Establish assessment, surveillance, investigation, and monitoring activities to inform climate change mitigation and adaptation efforts
- Partner with county agencies and local jurisdictions on local planning, transportation, housing, water, and energy policies that reduce greenhouse gas emissions and support the design of healthy, sustainable, resilient communities
- Expand disaster response plans to address health impacts of climate change with a specific focus on extreme heat and air quality
- Develop public health department knowledge and expertise relating to the health impacts of climate change

After refining the goals, objectives will be developed for each goal and a Departmental implementation plan will be developed. The implementation plan will outline the necessary steps to achieve these goals and objectives. These documents will provide a blueprint for Departmental action during the next three years.

- **Implementation level:** Parallel Effort with Climate Preparedness Benefits
- **Relevant agencies:** Santa Clara County Public Health Department
- **Documentation:**
 - Roadmap to a Healthier Future: A Strategic Plan 2012 - 2015 (2012), http://www.sccgov.org/sites/sccphd/en-us/AboutUs/Documents/SCCPHD_StrategicPlan.pdf

County General Plan

- **Description:** In conjunction with the Santa Clara County Public Health Department, the County Planning Department is developing a new chapter or element of its General Plan.⁶⁷ The Health Element will address a wide range of topics related to health and wellness affecting County residents, including greenhouse gas emissions and climate change impacts. The Health Element will likely address the direct and indirect health impacts to humans and the environment, impacts on the health care system, and adaptive actions. The Health Element is expected to be complete by the end of 2014.

⁶⁷ To learn more about the Health Element, visit <http://www.sccgov.org/sites/planning/PlansPrograms/GeneralPlan/Health/Pages/HealthElement.aspx>

- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County Planning and Public Health
- Documentation:
 - County Health Element (2013),
<http://www.sccgov.org/sites/planning/PlansPrograms/GeneralPlan/Health/Pages/HealthElement.aspx>

Neighborhood Profiles/Assessment

- Description: The Santa Clara Department of Public Health's Assessment, Planning, and Health Policy Division develops data, conducts analysis and reporting, and creates policy, among other things. Currently, the PHD is developing a series of neighborhood profiles that summarize health and demographic conditions at the sub-city level (aggregations of census tracts). The neighborhood profiles are expected to include several types of morbidity and mortality associated with the health impacts of climate change. These include cardiovascular and respiratory disease mortality; cardiovascular disease, respiratory disease, heat stress, and renal disease morbidity. The County also plans to monitor vulnerable populations, such as children, the elderly, and low-income households. The Epidemiology and Data Management Unit will continue working to better understand the health impacts of climate change.
- Implementation level: Parallel Effort with Climate Preparedness Benefits
- Relevant agencies: Santa Clara County Public Health Department

Summary of Existing Efforts to address Vulnerabilities

Santa Clara County has a strong disaster planning system even without addressing climate change. Guidance documents such as the LHMP provide a strong technical assessment and prioritization of disasters for the County while the EOP provides guidance for multiple agencies on their roles and responsibilities in a disaster. While climate change and the effects of climate change on public health will need to be incorporated into these documents, these plans will not need to be created from scratch. Modifying existing documents, prioritizing natural hazards impacted by climate change, or clarifying existing organizational structures for extreme heat events will begin to address these future challenges.

The following list provides a summary of gaps in the existing policy and operational framework to adapt to the potential impacts of climate change and variability.

- **Knowledge and capacity**: In order to begin addressing the public health impacts of climate change, the County must build knowledge and capacity among public health, emergency services, and planning professionals. The County Public Health Department has begun to do this and continuing to build internal capacity over time will allow practitioners to identify the most effective and efficient ways to incorporate climate change into existing planning and emergency operations.
- **Disease monitoring and surveillance**: The Public Health Department maintains an active disease and environmental factor surveillance system. The Public Health Department should begin to monitor specific health outcomes impacted by climate change as well as changes in the

populations vulnerable to climate change. These monitoring and surveillance efforts can help inform future policy and planning changes to better address changing climate conditions.

- **Climate change in all hazards planning and emergency management documents:** While the County has incorporated a discussion of climate change into some planning documents, e.g. LHMP, the County should begin to incorporate the potential impacts of climate change into all documents. Over time, climate change, as an amplifier of existing hazards, should be incorporated in to the discussion of existing hazards and into the prioritization of policies and actions.
- **Vulnerable communities and health equity:** Within the public health field and Santa Clara County, there is recognition that social and economic inequities that persist in our society and that these inequities contribute to poor health outcomes. Climate change is expected to have a disproportionate and unequal impact on individuals who are least able to anticipate, cope with, and recover from natural hazards. Future planning and program implementation needs to address these persist inequities that contribute to poor health and target implementation in those communities. Most policies and programs reviewed during this gap analysis do not explicitly make this connection.
- **Program evaluation:** As noted, Santa Clara County has an extensive disaster management framework, which will aid in the County's adaptation efforts. However, the County, along with regional partners, need to continuously evaluate the efficiency and effectiveness of existing emergency management programs. For example, an increase in wildfires, both regionally and around the California, may tax emergency response efforts, including the allocation of firefighters, resulting in the need for additional funding and resources for state and regional wildfire protection. The dynamic nature of climate change, and its somewhat uncertain amplification properties, will make this program evaluation and assessment critical to the long-term success of emergency management, disaster preparedness, and mass care programs.
- **What is known versus what is written down:** The County maintains a strong institutional structure for disaster preparedness and planning. However, much of the knowledge is not written down. Rather, it resides with key emergency managers and public health professionals. Developing and recording clear structures, trigger points, and roles and responsibilities will aid future planning and preparedness.
- **Public health fact sheets:** The County already publishes several fact sheets for heat-related events. The County should consider preparing additional fact sheets to address the health related impacts of change
- **Triggers for alert levels:** The County should review, monitor, and revise as necessary the heat and air quality alert levels to make the triggers reflect important thresholds for County residents. In the U.S., the NOAA Heat Index is a commonly used for communicating heat-health risks. However, the Heat Index does not account for air pollution or other environmental variables. The California Department of Public Health is in the process of developing alert thresholds which combine heat and air quality, and a combined index may provide some addition health benefits.

- **Extreme heat communications plan:** The County should develop a communications plan with a consistent message and talking points for each use during extreme heat / heat watch days. Messages should be targeted to specific groups: the elderly, children, and people with chronic diseases, among others.
- **Heat island reductions:** To prevent urban heat islands, the County should work with local jurisdictions to prioritize tree planning, cool roofs and other measures in areas with the highest heat vulnerabilities.
- **Air quality programs:** As the County monitors short- to long-term changes in air quality, it should consider working with the Bay Area Air District to tighten air quality regulations and implement local programs to reduce emissions. The County already supports numerous regional and local initiatives to reduce driving and increase active transportation, and these efforts may need to be expanded as climate change impacts regional air quality.