Climate Change

Climate change refers to any significant change in climate variables including temperature, precipitation, or wind that lasts for decades or longer. It may include changes in variability of average weather conditions or extreme weather conditions. Both human activities and natural factors contribute to climate change. Human activities, such as burning fossil fuels; cutting down forests; and developing land for farms, cities, and roads, release heat-trapping greenhouse gases into the atmosphere. Natural causes, such as changes in the Earth’s orbit, the sun’s intensity, the circulation of the ocean and the atmosphere, and volcanic activity, contribute to climate change in a variety of ways.¹

Climate change may increase children’s exposure to extreme temperatures, polluted air and water, extreme weather events, wildfires, infectious disease, allergens, pesticides, and other chemicals. These exposures may affect children’s health in a number of direct and indirect ways. It is important to note that climate change will likely result in a mix of both positive and negative health impacts. For example, warmer summers may increase the number of heat-related injuries and deaths, while warmer winters may result in fewer cases of cold-related injuries and deaths.² The effects of climate change will also vary from one location to another and will likely change over time as climate change continues.²,³ Furthermore, the human health risks from climate change may be affected strongly by changes in health care advances and accessibility, public health infrastructure, and technology.²,⁴⁻⁶

Direct effects of extreme temperatures are one area of concern, as climate change is expected to increase the number and intensity of hot days, hot nights, and heat waves in the United States.⁵,⁷,⁸ Heat exposure can result in heat rashes, heat stroke, heat exhaustion, and even death; children may be especially at risk because they often spend more time outside than adults do.²,⁹ Children’s bodies are less effective at adapting to heat compared with those of adults.¹⁰ Also, children may not feel the need to drink as urgently, which can lead to severe dehydration and electrolyte imbalance.¹⁰,¹¹ Humidity can further exacerbate heat stress in children.¹⁰,¹¹ Infants may be especially vulnerable to heat events in part because they depend on adults for care and are unable to communicate thirst and discomfort.⁶,¹²,¹³ Caregivers can help protect children from heat-related health effects.¹⁴

Many factors can modify the impact of heat exposure, including geographic location, income level, and the built environment.¹⁵ Studies have shown that the temperature at which mortality and morbidity (e.g., respiratory hospital admissions) can occur from heat exposure varies based on location.¹⁶⁻¹⁸ Extreme heat exposure may have a greater impact on populations living in regions that experience high temperatures less frequently, such as the Northwest and Midwest United States. In warmer climates such as those in the South and Southwest United States, the population may be acclimated to heat and area infrastructure is better designed to accommodate high temperatures.¹³,¹⁹ A higher income allows families to adapt more easily to meet the challenges of climate change compared with lower-income families, because they can
afford the use of air conditioners and other cooling methods to create a more ideal and comfortable environment. ³

The urban built environment can both exacerbate and alleviate the effects of heat. For example, high concentrations of buildings in urban areas cause what is known as the urban heat island effect: generating as well as absorbing and releasing heat, resulting in urban centers that are several degrees warmer than surrounding areas. Expanding the area of parks and green spaces and increasing the density of trees in and around cities can help to reduce this effect. ⁶

Warmer winters may have the effect of decreasing the number of cold-related deaths and injuries. ²,15 It is difficult to estimate the net changes in mortality due to climate change; however, a recent assessment by the United States Global Change Research Program concluded that increases in heat-related mortality due to climate change are unlikely to be compensated by decreases in cold-related mortality. ⁸

High temperatures, heat waves, and associated stagnant air masses can increase levels of air pollution, specifically ground level ozone, fine particulate matter (PM₂.⁵), nitrogen oxides, and sulfur oxides. ²,⁶,⁸,⁹ These air pollutants can be harmful for children: they may contribute to the development of new cases of asthma, aggravate preexisting cases of asthma, cause decrements to lung function, increase respiratory symptoms such as coughing and wheezing, and increase hospital admissions and emergency room visits for respiratory diseases. ²⁰-³⁵ Because children may spend a lot of time outdoors, often while exerting themselves for sports or play, they can be especially vulnerable to the impacts of poor air quality. ⁸

Climate change is likely to change the timing, frequency, and intensity of extreme weather events, including heat waves, hurricanes, heavy rainfall, droughts, high coastal waters, and storm surges. ⁵,³⁶ These events can cause traumatic injury and death, as well as emotional trauma. Extreme weather events are also associated with increased risk of food- and water-borne illnesses as sanitation, hygiene, and safe food and water supplies are often compromised after these types of events. ² One study found that periods of heavy rainfall were associated with increased emergency room visits for gastrointestinal illness among children. ³⁷ Heavy rainfall may result in flooding, which can lead to contamination of water with dangerous chemicals, heavy metals, or other hazardous substances from storage containers or from preexisting chemical contamination already in the environment. ²,³⁶ Elevated temperatures and low precipitation are also projected to increase the size and severity of wildfires. This can lead to increased eye and respiratory illnesses and injuries, which include burns and smoke inhalation. ² Extreme weather events can be especially dangerous for children because they are dependent on adults for care and protection. ⁷

A number of infectious diseases may be affected by climate change. The combined effects of increased temperature and precipitation are projected to cause increases in some water-, food-, and vector-borne illnesses. In general, increased temperature results in higher replication, transmission, persistence, habitat range, and survival of bacterial pathogens (the effect on viral pathogens is less clear), and produces a greater number of water- and food-borne parasitic
Climate change is also expected to expand or shift the habitat and range of disease-carrying organisms, such as mosquitoes, ticks, and rodents. Changes in the geographic distribution of disease-carrying organisms may alter the spread of vector-borne diseases such as Lyme disease, West Nile virus and Dengue fever. Children may be at greater risk for these types of infectious diseases as they spend more time outdoors compared with adults, where they might contact disease-carrying organisms, and they have less-developed immune systems.

Climate change, including changes in carbon dioxide (CO₂) concentrations and temperature, may affect the growth and distribution of allergen-producing vegetation such as weeds, grasses, and trees. Climate change has already caused an earlier onset of the U.S. spring pollen season and a lengthened ragweed season. The aeroallergens (e.g., pollen) themselves might be changed in terms of production, distribution, dispersion, and allergic potency. Exposure to weed and grass pollen has been associated with exacerbation of children’s asthma, emergency room visits, and hospitalizations.

Through various indirect pathways, climate change may lead to increasing levels and/or frequencies of childhood exposure to harmful contaminants. Changes in temperature, rainfall, and crop practices related to climate change are likely to affect exposure to pathogens, pesticides, and other chemicals in a number of ways. Broader geographic distribution of pests and increased growth of invasive weeds will likely lead to greater use of pesticides. Increased precipitation and increased variability in precipitation are likely to increase pathogen and contaminant levels in lakes and other surface waters. The distribution of chemicals in the environment is likely to change: for example, an increase in ice melts caused by a warming climate may release some past emissions of globally transported chemicals, such as polychlorinated biphenyls (PCBs) and mercury, that have been trapped in polar ice. Increasing concentrations of these chemicals in the atmosphere, and subsequent deposition to land and water, have the potential to increase concentrations of these chemicals in fish and other foods derived from animals. Warmer water temperatures may also increase the release of chemical contaminants from sediments, increasing their uptake in fish.

Climate change may result in children spending more time indoors. Buildings that are tightly sealed in response to adverse weather conditions may result in increased exposure to contaminants from poor ventilation and higher concentrations of indoor pollutants such as radon, environmental tobacco smoke, and formaldehyde.

Children are expected to be especially sensitive to the effects of climate change for a number of reasons. Young children and infants are particularly vulnerable to heat-related illness and death. Compared with adults, children have higher breathing rates, spend more time outside, and have less developed respiratory tracts—all making children more sensitive to air pollutants. Additionally, children have immature immune systems, meaning that they can experience more serious impacts from infectious diseases. The greatest impacts are likely to fall on children in poor families, who lack the resources, such as adequate shelter and access to air conditioning, to cope with climate change.
EPA is currently developing a new children’s environmental health indicator for climate change. The new indicator will focus on the frequency of extreme heat events over time. EPA intends to complete development of this new indicator in 2014, and it will be made available at www.epa.gov/ace when completed.
**Environments and Contaminants**

**Climate Change**


Climate Change (continued)


Climate Change (continued)