Testimony
Committee on Energy and Public Works
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Update on the Latest Global Warming Science: Public Health

Statement of
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Good morning Chairman Boxer and other distinguished members of the Committee. I am Howard Frumkin, Director of the National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR). I am a physician with 27 years of experience in environmental and occupational medicine and epidemiology. I have been Director of NCEH/ATSDR since September 2005. Previously, I served as chairman of the Department of Environmental and Occupational Health at Emory University's Rollins School of Public Health and professor of medicine at Emory Medical School. I am here to speak on our emerging understanding of climate change and its potential impact on health, and to discuss steps needed to protect the public from these potential consequences.

CDC considers climate change a serious public health concern. An effective public health response to climate change can prevent injuries, illnesses, and death while enhancing overall public health preparedness. CDC's approach to climate change is based on the broad scientific consensus reflected in publications of the Intergovernmental Panel on Climate Change, the United States Climate Change Science Program's recent report, *Analyses Of The Effects Of Global Change On Human Health And Welfare And Human Systems* (Synthesis and Assessment Product 4.6 [SAP 4.6]), and the peer-reviewed literature, such as a recent special issue of the *American Journal of Preventive Medicine* that CDC supported. [http://www.ajpm-online.net/issues/contents?issue_key=S0749-3797(08)X0016-9] In this testimony, I will discuss the following dimensions of climate change and public health:

1) The likely public health threats of climate change,

2) The people most vulnerable to these threats, and

3) Public health actions needed to protect the public's health from these anticipated threats.

Climate Change Poses a Public Health Threat

Over the coming years and decades, climate change is likely to have a significant impact on health in the United States and globally. The United States and other developed countries with well-developed health infrastructure and the involvement of government and nongovernmental agencies in disaster planning and response will be better able to address the health effects from climate change than will be countries in the developing world. Nevertheless, Americans may experience difficult challenges, and different regions of the Country may experience these challenges at varying degrees.

The anticipated health impacts of climate change have been well-reviewed and articulated by the Intergovernmental Panel on Climate Change and by the United States Climate Change Science Program through their Synthesis and Assessment Products. While knowledge of the potential public health impacts of climate change will advance in the coming years and decades, these entities have identified the following, which are current best estimates of major anticipated health outcomes, each of which is described in more detail below:

- Direct effects of heat,
- Health effects related to extreme weather events,

- Air pollution-related health effects,
- Water- and food-borne infectious diseases,
- Vector-borne and zoonotic diseases,
- Emerging pathogens susceptible to weather conditions,
- Allergies, and
- Mental health problems.

Heat Stress and Direct Thermal Injury

With climate change, an increase in the severity, duration, and frequency of extreme heat waves is expected in the United States. Heat causes a range of health effects, from mild (heat cramps, heat exhaustion) to severe (such as heat stroke, which can be fatal). Certain populations are especially vulnerable to these effects, including the elderly, those with certain underlying medical conditions, those who are socially isolated, those without air conditioning, and those who are poor. Midwestern and northeastern cities are at greatest risk, as heat-related illness and death appear to be related to exposure to temperatures much hotter than those to which the population is accustomed. This illustrates the need for public health preparedness at the local level.

Extreme Weather Events

Climate change has effects on weather—effects that vary regionally. In some areas, such as the eastern United States, more frequent heavy precipitation events are projected, posing an increased risk of flooding and outbreaks of water-borne infectious diseases. In other areas, such as the southwest, reduced rainfall may be associated with severe drought, reducing availability and quality of water. Moreover, when rainfall

follows a period of drought, vector populations may explode, increasing the risk of infectious diseases such as hantavirus. Drought may increase the frequency and severity of wildfires, reducing air quality—an example of complex system interactions that affect health. Some evidence suggests that hurricanes could become more intense, potentially affecting states of the eastern seaboard and Gulf of Mexico regions.

The health effects of extreme weather events range from loss of life and acute trauma to indirect effects such as loss of home, large-scale population displacement and subsequent mental health effects, damage to sanitation infrastructure (drinking water and sewage systems), interruption of food production, and damage to the health-care infrastructure. Displacement of individuals often results in disruption of health care, of particular concern for those with underlying chronic diseases.

Air Pollution-Related Health Effects

Climate change may affect air quality by modifying local weather patterns and pollutant concentrations, affecting natural sources of air pollution, and promoting the formation of secondary pollutants. For example, higher surface temperatures, especially in urban areas, promote the formation of ground-level ozone. Ozone can irritate the respiratory system, reduce lung function, aggravate asthma, and inflame and damage cells that line the airways. In addition, it may cause permanent lung damage and aggravate chronic lung diseases. There is consistent evidence from models and observations that 21st-century climate change will worsen ozone pollution. Studies suggest that, in the absence of changes in precursor emissions, climate change will increase the frequency of high ozone events by 50% to 100% by 2050. Accordingly,

climate change represents a significant challenge to achieving ozone air quality goals and to preventing associated health impacts.

Water- and Food-borne Infectious Diseases

Altered weather patterns resulting from climate change could affect the distribution and incidence of food- and water-borne diseases. Changes in precipitation, temperature, humidity, and water salinity have been shown to affect the quality of water used for drinking, recreation, and commercial purposes. For example, outbreaks of *Vibrio* bacteria infections following the consumption of seafood and shellfish have been associated with increases in temperatures. Heavy rainfall has also been implicated as a contributing factor in the overloading and contamination of drinking water treatment systems in the U.S., leading to illness from organisms such as *Cryptosporidium* and *Giardia*. Storm water runoff from heavy precipitation events can also increase fecal bacterial counts in coastal waters as well as nutrient load, which, coupled with increased sea-surface temperature, can lead to increases in the frequency and range of harmful algal blooms (red tides) and potent marine biotoxins such as ciguatera fish poisoning. This illustrates the need for effective public health surveillance of water- and food-borne diseases.

Vector-borne and Zoonotic Diseases

Vector-borne and zoonotic diseases, such as Lyme disease, West Nile virus disease, malaria, plague, and hantavirus pulmonary syndrome have been shown to have a distinct seasonal pattern, and in some instances their incidence has been shown to be weather sensitive. Accordingly, climate change-driven ecological changes, such

as variations in rainfall and temperature, could significantly alter the range, seasonality, and incidence of many zoonotic and vector-borne diseases. For example, the range of *Ixodes scapularis,* the tick that transmits Lyme disease, is expected to expand in the United States by more than 200 percent by the 2080s, according to one report. In another example, a recent CDC study found a significant association between increased temperature and precipitation and increased incidence of dengue fever near the U.S.-Mexico border.

The role of climate in vector-borne and zoonotic disease incidence is complex and not fully understood, illustrating the need for further research. While factors such as housing quality, land-use patterns, vector control programs, and proliferation of certain wildlife species are particularly important for the spread of vector-borne and zoonotic disease, climate change could facilitate the establishment of new vector-borne diseases imported into the United States, or alter the geographic ranges of some of these diseases that already exist in this Country.

Emerging Pathogens Susceptible to Weather Conditions

In addition to vector-borne and zoonotic diseases, other pathogens sensitive to weather conditions have emerged. *Cryptococcus gattii,* an organism once restricted to subtropical and tropical environments, was identified within the last decade in the temperate climate zone of the Pacific northwest, where it has caused life-threatening disease of the central nervous system, lung, and skin in humans and animals.

Allergies

Warmer, wetter conditions and higher CO_2 concentrations promote the growth of some plants, including some that produce allergens. For example, ragweed growth is accelerated, and pollen counts are accordingly higher, and poison ivy growth and toxicity are enhanced under these conditions. Such effects could aggravate symptoms in those who suffer from allergies and asthma.

Mental Health Problems

The aftermath of disasters such as severe weather events may include post-traumatic stress and related problems. These may grow out of the experience of the disaster itself and/or elements of the recovery process such as disruption of social networks, economic loss, and displacement. After Hurricane Katrina, rates of severe mental illness (including depression, PTSD, anxiety disorder, panic disorder, and phobias) doubled from 6.1 percent to 11.3 percent among those living in affected regions. This illustrates the need for a comprehensive public health approach to climate change.

Climate Change Vulnerability

The effects of climate change will vary by geographic area and demographic group. With respect to geographic factors, urban centers in the west, southwest, mid-Atlantic, and northeast regions of the United States are expected to experience the largest increases in average temperatures; these areas also may bear the brunt of increases in ground-level ozone and associated airborne pollutants. Populations in midwestern and northeastern cities are expected to experience more heat-related

illnesses as heat waves increase in frequency, severity, and duration. Topography, wetlands destruction, and different rates of coastal erosion are expected to result in dramatically different regional effects of sea level rise. Distribution of animal hosts and vectors may change; in many cases, ranges could extend northward and increase in elevation. The West coast of the United States is expected to experience significant strains on water supplies as regional precipitation declines and mountain snow packs, an important source of summertime water, are reduced.

Some demographic groups are more vulnerable to the health effects of climate change than others. Children are at greater risk of worsening asthma, allergies, and certain infectious diseases. Those with underlying diseases and the elderly are at greater risk for health effects due to heat waves, extreme weather events, and exacerbations of chronic disease. People of lower socioeconomic status are particularly vulnerable to extreme weather events. Alaska Natives are also uniquely vulnerable to the environmental changes from climate change because of their close relationship to and dependence on the land and sea and natural resources for cultural, traditional social, economic and physical well being. The health effects of climate change on a given community depend not only on a community's exposures and demographics, but also on how these characteristics intersect. For example, heat waves are both more likely to occur in urban areas and more likely to affect certain populations: the home-bound, elderly, poor, and minority populations, and those living in areas with less green space and with fewer centrally air-conditioned buildings.

Given the differential burden of climate change health effects on certain populations, public health preparedness must include assessments to identify the most vulnerable populations and anticipate their risks. At the same time, health

communication targeting these vulnerable populations must be devised and tested, and early warning systems focused on vulnerable communities should be developed. With adequate notice and a vigorous response, adverse health effects of climate change may be reduced.

Protecting Public Health from Climate Change: A Strong Foundation

Climate change strategies are typically framed by two broad approaches. *Mitigation* corresponds to prevention—efforts to reduce climate change itself. *Adaptation* corresponds to public health preparedness—efforts to reduce harm from those effects of climate change that are inevitable despite mitigation efforts.

While *mitigation* efforts are generally carried out in other sectors "upstream" from public health, such as energy, transportation, and housing, the health sector has several important roles. First, policy choices such as energy strategies should be assessed to help identify health impacts and to help reach decisions that maximally protect health. By providing technical expertise and through the use of tools such as Health Impact Assessments, CDC can serve as an important health resource to agencies in these sectors. Second, the health sector can itself contribute to climate change mitigation by identifying and implementing energy conservation and related strategies. Third, health and risk communication techniques can be highly useful in informing the public about climate change. Effective communication can equip people to make behavioral choices and support policies that address climate change and protect health, while avoiding negative emotional impacts.

Adaptation (or public health preparedness) is highly consistent with traditional public health responsibilities. In fact, most of the health consequences of climate

changes are not new; they represent an intensification of existing, well recognized threats. Accordingly, existing public health tools provide a firm foundation for public health action on climate change. CDC has in place many of the building blocks needed to respond to climate change. Examples include:

- *Surveillance of Water-borne, Food-borne, Vector-borne, and Zoonotic Diseases:* CDC has a long history of surveillance of infectious, zoonotic, and vector-borne diseases. Examples of relevant tracking systems include the national arthropod-borne viral disease tracking system (ArboNet); FoodNet, PulseNet, and OutbreakNet, which rapidly identify and provide detailed data on cases of foodborne illnesses; and the National Outbreak Reporting System for Foodborne and Waterborne Diseases (NORS).

- *Environmental Public Health Tracking:* CDC's Environmental Public Health Tracking Program has funded several states to build a health surveillance system that integrates environmental exposures and human health outcomes. This system includes critical data on environmental trends and on the incidence, trends, and potential outbreaks of diseases, including those affected by climate change.

- *Geospatial Sciences:* CDC has applied Geographic Information Systems (GIS) technology in unique ways to a variety of public health issues, ranging from long-term disease trends to post-disaster applications. This technology represents an invaluable tool for the public health response to climate change. For example, it can provide critical information about short- and long-term climatologic consequences on land by analyzing remote sensing data derived from space.