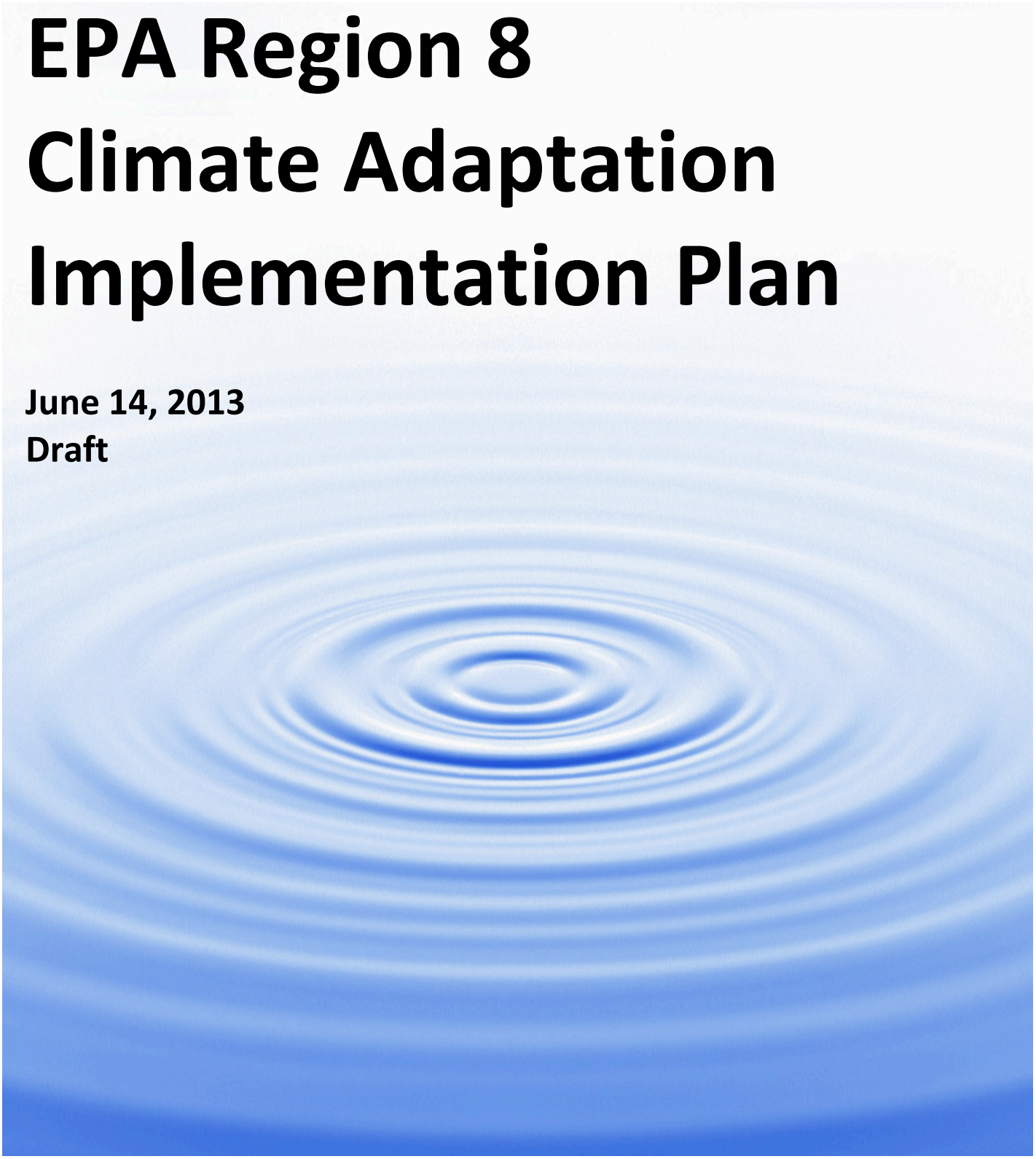
EPA Region 8 Climate Adaptation Implementation Plan

June 14, 2013
Draft



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Preface

The U.S. Environmental Protection Agency (EPA) is committed to identifying and responding to the challenges that a changing climate poses to human health and the environment.

Scientific evidence demonstrates that the climate is changing at an increasingly rapid rate, outside the range to which society has adapted in the past. These changes can pose significant challenges to the EPA's ability to fulfill its mission. The EPA must adapt to climate change if it is to continue fulfilling its statutory, regulatory and programmatic requirements. The Agency is therefore anticipating and planning for future changes in climate to ensure it continues to fulfill its mission of protecting human health and the environment even as the climate changes.

In February 2013, the EPA released its draft *Climate Change Adaptation Plan* to the public for review and comment. The plan relies on peer-reviewed scientific information and expert judgment to identify vulnerabilities to EPA's mission and goals from climate change. The plan also presents 10 priority actions that EPA will take to ensure that its programs, policies, rules, and operations will remain effective under future climatic conditions. The priority placed on mainstreaming climate adaptation within EPA complements efforts to encourage and mainstream adaptation planning across the entire federal government.

Following completion of the draft *Climate Change Adaptation Plan*, each EPA National Environmental Program Office, all 10 Regional Offices, and several National Support Offices developed a *Climate Adaptation Implementation Plan* to provide more detail on how it will carry out the work called for in the agency-wide plan. Each *Implementation Plan* articulates how the office will integrate climate adaptation into its planning and work in a manner consistent and compatible with its goals and objectives.

Taken together, the *Implementation Plans* demonstrate how the EPA will attain the 10 agency-wide priorities presented in the *Climate Change Adaptation Plan*. A central element of all of EPA's plans is to build and strengthen its adaptive capacity and work with its partners to build capacity in states, tribes, and local communities. EPA will empower its staff and partners by increasing their awareness of ways that climate change may affect their ability to implement effective programs, and by providing them with the necessary data, information, and tools to integrate climate adaptation into their work.

Each Program and Regional Office's *Implementation Plan* contains an initial assessment of the implications of climate change for the organization's goals and objectives. These "program vulnerability assessments" are living documents that will be updated as needed to account for new knowledge, data, and scientific evidence about the impacts of climate change on EPA's mission. The plan then identifies specific priority actions that the office will take to begin addressing its vulnerabilities and mainstreaming climate change adaptation into its activities. Criteria for the selection of priorities are discussed. An emphasis is placed on protecting the most vulnerable people

and places, on supporting the development of adaptive capacity in the tribes, and on identifying clear steps for ongoing collaboration with tribal governments.

Because EPA's Programs and Regions and partners will be learning by experience as they mainstream climate adaptation planning into their activities, it will be essential to evaluate their efforts in order to understand how well different approaches work and how they can be improved. Each *Implementation Plan* therefore includes a discussion of how the organization will regularly evaluate the effectiveness of its adaptation efforts and make adjustments where necessary.

The set of *Implementation Plans* are a sign of EPA's leadership and commitment to help build the nation's adaptive capacity that is so vital to the goal of protecting human health and the environment. Working with its partners, the Agency will help promote a healthy and prosperous nation that is resilient to a changing climate.

Bob Perciasepe
Deputy Administrator

September 2013

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Introduction

The U.S. Environmental Protection Agency (EPA) is committed to identifying and responding to the challenges that a changing climate poses to human health and the environment. EPA's *Policy Statement on Climate Change Adaptation*, issued in June of 2011, calls for the Agency to anticipate and plan for future changes in climate, and incorporate considerations of climate change into its activities. In response, the EPA drafted an agency-wide Climate Adaptation Plan in June 2012.[i] This document recognized that climate change can pose significant challenges to EPA's ability to fulfill its mission. It also directed every Program and Regional Office within the EPA to develop an Implementation Plan detailing how they will integrate climate adaptation into their work, and address the priorities identified in the agency-wide plan. To promote consistency, the Implementation Plans have common areas of focus, as outlined below:

1. Program vulnerability assessment
2. Priority actions to address program vulnerabilities
3. Actions related to agency-wide strategic measures
4. Legal and enforcement issues
5. Training and outreach
6. Partnerships with tribes
7. Monitoring and evaluating performance

They are meant to be complimentary and work in conjunction with the Agency's Strategic Plan and Sustainability Plan, as well as the climate change strategies of various Program Offices, such as the Office of Water's *National Water Program 2012 Strategy: Response to Climate Change*.

Region 8 Program Vulnerability Assessment

I. Background

The Region 8 Program Vulnerability Assessment discusses some of the major climate change impacts affecting EPA Region 8, and examines the risks they pose to key Region 8 Programs. It builds on the work presented in Part 2 of the EPA's agency-wide Climate Adaptation Plan, as well as the individual vulnerability assessments completed by various national program and Regional Offices. The assessment is based on the goals in the EPA's FY 2011-2015 Strategic Plan, which include:

Goal 1: Taking Action on Climate Change and Improving Air Quality
Goal 2: Protecting America's Waters
Goal 3: Cleaning Up Communities and Advancing Sustainable Development
Goal 4: Ensuring the Safety of Chemical s and Preventing Pollution
Goal 5: Enforcing Environmental laws

The assessment also considers "Facilities and Operations," "Vulnerable Populations," and "Emerging Issues" that may or may not become vulnerabilities in the future. A summary table on page 15 of this document provides an overview of the programmatic vulnerabilities in the narrative.

Vulnerable populations are mentioned throughout the document. This term may refer to children, the elderly, minorities, the poor, the young, persons with underlying medical conditions and disabilities, those with limited access to information, indigenous populations, overburdened populations that live in environmental justice communities, and the homeless and outdoor workers who may have more exposure to heat and air pollution.[ii] Certain geographic locations may also contribute to vulnerability. The EPA's places a priority on helping people, places and infrastructure that are the most vulnerable to climate impacts, and seeks meaningful involvement from all parts of society. As the work of this Implementation Plan is conducted, the communities and demographic groups most vulnerable to the impacts of climate change will be identified. Region 8 will then work in partnership with these communities to increase their adaptive capacity and resilience to climate change impacts.

Region 8 intends to fulfill its mission, even in the face of a changing climate. It will stay on course for meeting its goals, while building more resilient and climate-responsive programs. We will also assist our partners in meeting the challenges of climate change through effective coordination and decision-support.

II. Overview of Climate Change Impacts in Region 8

Region 8 straddles two different climate regions identified by the U.S. Global Change Research Program: the Great Plains and Southwest. The Great Plains region includes the Region 8 States of North and South Dakota, Wyoming, Montana, and the eastern half of Colorado. The Southwest region includes the western half of Colorado, including the Rocky Mountains, and the State of Utah.

Region 8 is made up of a diverse set of landscapes, population bases, and economic sectors making our response to climate change particularly challenging in its complexity. Our lands are governed by six states, 27 tribal nations, and a host of federal agencies, with over one-third of our land area publicly-owned.[iii] These entities have diverse and often competing interests that include agriculture, energy development and production, environmental protection and stewardship, industry, recreation, tourism, and urbanization. The roughly 10 million people in the region are concentrated in two main urban corridors, Salt Lake City and Denver, with the remainder located in relatively isolated cities and towns often separated by large distances.

The Intergovernmental Panel on Climate Change (IPCC), in its Fourth Assessment report in 2007,[iv] concluded that global warming due to human activities since 1750 is unequivocal. The report also indicates that climate variability and warming over the past century has already had measurable effects in the Region, including increased temperatures, melting glaciers, reduced snowpack[1], earlier timing of spring events including snowmelt, latitude and elevation shifts in plant and animal ranges,

[1] Additional factors related to reduction in snowpack that have been observed in the past century include a greater proportion of winter precipitation falling as rain rather than snow, a decrease in the duration and extent of snow cover, and a decrease in mountain snow water equivalent.

drought, an increase in the frequency and intensity of wildfires, declining forest health, an increase in heavy precipitation events, and habitat loss. These effects are expected to intensify as greenhouse gases build up in the atmosphere, and continue to threaten our water resources, agricultural production, forests, wildlife habitats, alpine ecosystems, and human health throughout the 21st century.

Because of the diversity and wide range of climate change impacts in Region 8, implementers of this Plan will need to tailor their actions to meet different needs based on climate regions, other geographic considerations, population, economic activity, a specific impact, or a vulnerable population. The following suite of climate change impacts and their affects on Region 8 Programs are discussed in the sections below. They may be discussed individually, or in combination with one or more of the other impacts based on the focus of the Strategic Plan Goal under consideration.

1. Increased tropospheric ozone pollution in certain areas[v]
2. Increased frequency and intensity of wildfires[vi]
3. Increasing extreme temperatures[vii]
4. Increasing heavy precipitation events[viii]
5. Effects on the stratospheric ozone layer[ix]
6. Effects on response of ecosystems to atmospheric deposition of sulfur, nitrogen, and mercury[x]
7. Increased water temperatures[xi]
8. Decreasing precipitation days and increasing drought intensity[xii]
9. Increasing risk of floods[xiii]
10. Reduction in snowpack[xiv xv]
11. Earlier timing of spring events[2] [xvi]
12. Increased pest pressure and changing mix of pests[3] [xvii]

III. Examination of Region 8 Program Vulnerabilities

A. Improving Air Quality

1. Tropospheric ozone pollution is likely to increase in certain areas due to the effects of climate change. Tropospheric, or ground-level ozone, is created by photochemical reactions of short-lived pollutants in the atmosphere. Emissions from industrial facilities, electric utilities, motor vehicles, chemical solvents, and oil and gas production are some of the major sources of these pollutants in Region 8. Higher temperatures and regional air stagnation associated with climate change may lead to more ozone formation, even with the same level of emissions[xviii]. While tropospheric ozone is higher in urban areas, some rural areas with oil and gas production activities in Region 8 may also have high levels. Additionally, there is some evidence to suggest that background levels of tropospheric ozone are increasing, particularly at higher elevations, due to atmospheric transport.[xix] Climate change also

[2] Includes earlier snowmelt, runoff, and biological life cycle events, such as the emergence of leaves, flowers, and pollinators.

[3] Pest pressure refers to an increased number of existing pests, new pests, and invasive species; as well as an increased susceptibility of crops to pests. Pests include weeds, insects, rodents, mold, fungus and disease.

has the potential to lengthen the ozone season by increasing the months of the year conducive to the formation of troposphere ozone. Vulnerable populations may be at a higher risk for health effects from exposure to ozone.

While there is consensus that tropospheric ozone levels will increase due to a changing climate, there are varying estimates of the magnitude of those increases. To the extent that it becomes apparent that a changing climate is preventing attainment of the ozone National Ambient Air Quality Standard (NAAQS)**,** Clean Air Act (CAA) provisions will require identification of additional control measures to reduce ozone precursor emissions. Region 8 will work with EPA Headquarters to determine appropriate actions if and when such control measures are needed. Additionally, Region 8 will continue to work with its partners at the state, local, and tribal level to meet the ozone NAAQS through State, Tribal or Federal Implementation Plans and other measures.

2. Particulate matter (PM) levels are likely to be affected through changes in the frequency and intensity of wildfires. There is evidence indicating that climate change will affect PM levels through changes in the frequency or intensity of wildfires.[xx] The IPCC has reported with very high confidence that in North America, disturbances such as wildfires are increasing and are likely to intensify in a warmer future with drier soils and longer growing seasons. Forest fires are likely to increase in frequency, severity, distribution and duration in the Intermountain West and the West due to climate change. This, in addition to the recent pine beetle outbreak in the Rocky Mountains, is changing the fire regime in the area and complicating EPA Region 8 efforts to protect public health and the environment from PM pollution. Vulnerable populations may be especially at risk from increased exposure to PM.

Region 8's capacity to adapt to this impact is related to the approval of "exceptional events," which allows states and tribes to exempt elevated levels of PM due to wildfires and avoid regulatory actions under the CAA NAAQS. Additionally, even though the challenge of fire mitigation and firefighting falls on national, regional, and local efforts outside of the EPA's jurisdiction, the Region's National Environmental Policy Act (NEPA) Program has a role to play in terms of the review of forest vegetation management plans. There may also be air monitoring or risk communication opportunities that can help the Region adapt to this impact.

3. Climate change may worsen the quality of indoor air and increase exposures. Climate change may worsen existing indoor environmental problems, and introduce new ones due to temperature increases and an increased frequency or severity of extreme weather events. For example, warmer temperatures may affect the emergence, evolution and geographic ranges of pests, infectious agents and disease vectors.[xxi] This may lead to shifting patterns of indoor exposure to pesticides as occupants and building owners respond to new infestations. Additionally, heavy precipitation events may contribute to increases in indoor dampness and building deterioration, increasing occupants' exposure to mold and other biological contaminants, as well as emissions from building materials.

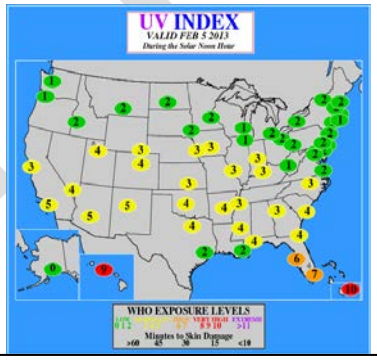
As homes and buildings are constructed or renovated to achieve greater energy efficiency, exposure to radon and its decay products could increase if careful attention is not paid to factors such as

ventilation rates. EPA's ENERGY STAR® program as well as the Department of Energy's Better Buildings Initiative and organizations such as the U.S. Green Building Council (USGBC), Building Performance Institute (BPI) and Residential Energy Services Network (RESNET) are keenly aware of this issue and prescribe adequate ventilation rates for both new construction and renovated existing homes so that healthy indoor quality and energy efficiency can go hand in hand.

Residents may also spend more time indoors to avoid the heat and increased levels of certain air pollutants, and become more prone to health risks from indoor environmental conditions. Public health risks, particularly for vulnerable populations, may increase.[xxii] For example, more people may be exposed to indoor air contaminants in homes in low-income areas because they have access to fewer resources to make adjustments to their dwellings, and because these homes tend to have greater occupant density.

Region 8 can utilize various EPA programs, tools, resources, and partnerships to adapt to this impact. For example, Region 8's Radon and ENERGY STAR® Programs, and Green and Healthy Homes and Clean, Green and Healthy Schools initiatives are avenues through which public education could occur.

4. Climate change may alter the effects of and strategic priorities within the EPA's regulatory and voluntary programs to help restore the stratospheric ozone layer. The interactions between climate change and the stratospheric ozone layer are complex. Climate change affects the stratospheric ozone layer through changes in chemical transport, atmospheric composition, and temperature. In turn, changes in stratospheric ozone can have implications for the climate of the troposphere. Additionally, climate change may exacerbate the health effects of ozone layer damage at some latitudes and mitigate them at others. Ozone depletion and climate change are also linked because ozone-depleting substances (ODS) are significant greenhouse gases.



U.S. Environmental Protection Agency
UV Index Forecast
http://www.epa.gov/sunwise/uvindex.h

If climate change influences the stratospheric ozone layer over Region 8, there may be an increased risk to public health and the environment from increasing levels of ultraviolet (UV) radiation. Because Region 8 already has relatively high UV radiation levels due to its elevation, there is already heightened public awareness of the issue. Existing tools and resources could be utilized to communicate any increased risks. Additionally, climate change may lead to an increased use of cooling devices in commercial, residential, and transportation applications, as well as an increased use of insulation foams - many of which contain ODS or their substitutes. Such a shift in demand might impact how Region 8 plans and operates its programs concerned with the production and use of ODS. Adapting to this impact may require a shift in resources.

5. Climate change may affect the response of ecosystems to the atmospheric deposition of sulfur, nitrogen, and mercury. While there is limited scientific evidence on this topic, additional research is underway to better understand how patterns in the atmospheric deposition of sulfur, nitrogen, and

mercury with projected changes in the climate and carbon cycle will affect ecosystem growth, species changes, surface water chemistry, and mercury methylation and bioaccumulation. The potential impacts could have consequences for the effectiveness of ecosystem protection from Region 8's emissions reduction programs.

Because of current fish consumption advisory programs,[xxiii] there is already heightened awareness of the issue of mercury contamination in lakes, rivers and streams in Region 8. This may present an opportunity to adapt to the impact through partnerships and public education.

B. <u>Protecting America's Waters</u>

1. Climate change may affect the EPA's ability to protect and restore watersheds, aquatic ecosystems and wetlands. Warmer air temperatures will result in warmer water, potentially leading to low oxygen levels and hypoxia, harmful algal blooms, and changes in the toxicity of some pollutants. Aquatic life may be replaced by other species better adapted to the warmer water, and this process may occur at an uneven pace disrupting aquatic system health and allowing non-indigenous and/or invasive species to become established.[xxiv] Additionally, temperature increases may lead to water losses from increased evapotranspiration rates.

Heavier precipitation may increase flood risk, expand floodplain areas, increase the variability of streamflows, and increase erosion from high water velocity. An increase in storm event frequency and intensity can result in more nutrients, pathogens, and toxins being washed into water bodies, especially if they result in sewer overflows and wastewater bypasses.

Drought, changing patterns of precipitation, reduced snowpack, earlier spring runoff, and increased evapotranspiration, may lead to reduced streamflow later in the summer, altering aquatic environments and increasing impairments. Certain aquatic ecosystems that are unique to the region may also be threatened, such as prairie potholes, reducing their water recharge function and the habitat they provide for plants and animals.[xxv]

The Prairie Pothole region in North and South Dakota. *U.S. Fish and Wildlife Service*

Additionally, the recent pine beetle outbreak in the Rocky Mountains has altered the hydrological functioning of these ecosystems by influencing snow distribution and snowmelt in complex ways. Other considerations that affect the timing of snowmelt include dust events and rain on snow.

These impacts may have adverse effects on Region 8's work to protect water quality, and the health of watersheds, aquatic ecosystems and wetlands, and recovery of threatened fish species like bull trout in western Montana. Additional water bodies may have trouble meeting water quality standards and may need to be listed as impaired, requiring a total maximum daily load (TMDL). Nonpoint pollution control programs may need to be adjusted to reflect changing conditions. The baselines used in water quality

standard development and implementation could shift, requiring new scientific analysis. Finally, certain economic and cultural practices of tribal communities related to water may be impacted.

These program vulnerabilities may require greater use of biological monitoring and assessment techniques, management techniques that build resilience into aquatic environments, and the increased management of wetlands for stormwater control purposes and to buffer the impacts of drought. Region 8's capacity to adapt to this impact is varied, and there may be numerous points of leverage and opportunities that can be explored.

2. Drinking water, wastewater and stormwater infrastructure may be affected. Heavier precipitation may increase the risk of floods, expand floodplains, and cause more nutrients, pathogens, and toxins to be washed into waterbodies.[xxvi] This could damage or overwhelm water infrastructure, and lead to releases of waterborne diseases and pathogens. In urban areas, stormwater collection and management systems may need to be redesigned to handle the increased capacity. Low stream flows due to drought, earlier spring runoff, reduction in snowpack, and increased evapotranspiration may affect drinking water storage and distribution systems, intakes, and wastewater outfalls. Wildfires create ash and debris that ends up in water reservoirs, rivers, canals and pipelines, and ultimately into municipal water-treatment facilities. Fires also scorch soils, leading to more runoff and erosion. Drinking water and wastewater utilities will need to consider these impacts and the concept of non-stationarity[4] in their planning activities. Additionally, vulnerable populations may have problems accessing safe drinking water due to these infrastructure challenges.

Hayman Fire Impacts on Water Infrastructure

The Hayman Fire ignited on Saturday, June 8, 2002, in the mountains southwest of Denver, Colorado. It spread rapidly, driven by strong winds and drought conditions. By the time it was declared to be under control on July 18, it had burned nearly 138,000 acres – Colorado's largest wildfire in recorded history.

Since the fire, precipitation events have resulted in massive soil erosion and dumped enormous quantities of sediment into Denver Water's reservoirs and intake systems. The domestic water supplier to the City of Denver has expended tens of millions of dollars in water quality treatment, sediment and debris removal,
slope reseeding, and infrastructure projects as a result of the fire.

Smoke plume from the Hayman fire.
Photo: USDA Forest Service

Moriarty, K. and Cheng, T., 2012. Hayman Fire Research Summary, 2003--2012. Colorado Forest Restoration Institute and Colorado State University, Fort Collins, Colorado. Prepared for the Hayman Fire Science Symposium, June 21-22, 2012.

The Clean Water and Drinking Water State Revolving Funds (SRF) may be stressed as the need for additional investments in water infrastructure increases. Region 8 and its state and tribal partners may need to re-prioritize project requests due to increasing and changing needs at the local level. Tribes and other vulnerable populations may require special considerations with respect to climate change and water infrastructure challenges. Region 8's work to promote

[4] Non-stationarity in this context refers to the concept that past hydrologic and weather patterns may not be a good indicator of future conditions due to human-caused climate change.

green infrastructure[5] in urban areas may be more in demand to serve multiple purposes: manage storm water runoff, flood mitigation, air quality management, and urban heat island reduction. Region 8 has particular expertise in green roofs, and has just completed a multi-year scientific investigation into the use of this technology at its regional office in Denver, Colorado. Additionally, Region 8 is using the science of biomimicry to assist in developing stormwater management systems that will adapt and evolve over time. These tools, along with additional resources and funding, may be required to address this significant Region 8 impact.

3. The quality and availability of safe drinking water may be affected. Drought, changing patterns of precipitation and snowmelt, increased evapotranspiration, and reduced snowpack may result in changes to the availability and demand for drinking water. Competition for water for agriculture, industry, and energy production may also increase, especially in areas experiencing population growth. These factors may shift demand to underground aquifers, or prompt development of reservoirs or other water retention strategies.

Soil erosion and increased runoff following wildfires can foul water and challenge water-treatment facilities. Heavy precipitation events may exacerbate the problem, leading to more runoff of sediment and other contaminants into drinking water sources, requiring additional treatment. Drinking water intakes and wastewater outfalls could be overwhelmed or damaged, causing an increased incidence of waterborne diseases and pathogens. Increased water temperatures may also lead to an increased growth of algae and microbes that may affect drinking water quality.

Various Region 8 Programs protect drinking water quality, and are concerned with the availability of water supplies. National Pollutant Discharge Elimination System (NPDES) discharge permits for wastewater and stormwater from municipal and other facilities may need to be adjusted to maintain water quality. As the need for water retention grows, NEPA reviews of water supply and storage projects may increase. There may also be a need to enhance or construct wetlands, requiring permits. Limited water availability and drought in some regions may require drinking water providers to reassess the security of their water supplies, and consider alternative pricing, allocation, and water conservation options. Region 8's work to promote voluntary actions through the Sustainable Water Infrastructure and Climate Ready Water Utilities initiatives, and WaterSense, may be more in demand. Adapting to this impact may be compromised by a lack of resources.

C. <u>Cleaning Up Communities</u>

1. Contaminated sites and waste management may be threatened. Heavy precipitation events, floods, drought and wildfires may threaten contaminated sites in Region 8 and the remedies put in place to cleanup and prevent releases of hazardous substances. The treatment, storage and/or disposal of hazardous and non-hazardous waste may also be threatened. Extreme temperatures and

[5] Green infrastructure uses vegetation and soil to manage rainwater where it falls. By weaving natural processes into the built environment, green infrastructure provides not only stormwater management, but also urban heat island mitigation, air quality management, and more.

other weather events may lead to a loss of electrical power, affecting the operations of treatment and waste management facilities. Landfill capacity may be insufficient to handle surges in hazardous and municipal wastes from floods and other extreme weather events.

Region 8's Superfund, Resource Conservation and Recovery Act (RCRA), and Brownfield programs may need to alter chemical containment strategies to ensure protection of groundwater and adjacent sites. RCRA permitting activities may increase or permit requirements may need to be updated to reflect current and future climate impacts. Current scientific monitoring and sampling protocols on sites may no longer be effective and may require adjustments. Adapting to this impact will be largely dependent on available funding and resources, but there may be facility operational changes or innovative technologies that could be utilized for site remediation or sustainable materials management.

2. Climate change may lead to an increased need for emergency response and recovery. Due to an increase in heavy precipitation events, floods, drought, and wildfires, as well as other extreme weather events like severe winds and tornados that may be exacerbated by climate change, Region 8's emergency response and disaster recovery efforts may increase. The 2011 National Disaster Recovery Framework (NDRF)[xxvii] gives structure to, and expands, the nation's commitment to these activities. EPA is listed as a possible resource agency in five of the six NDRF Resource Support Function (RSF) areas. In recent years, Region 8 has been involved in response and recovery activities in several communities, including Windsor, Colorado (tornado), the Spirit Lake Nation (flooding), and Minot, North Dakota (flooding).

The most common program areas involved in recovery efforts include: remediation of indoor pollutants such as mold and asbestos, debris management, project permitting (for drinking water, waste water, and storm water management), Brownfield assessments, sustainable community design, and collaborative efforts with other federal, state and local entities.

Adapting to this impact will be dependent on effective disaster risk management and the availability of resources to respond to events when they happen.

D. <u>Ensuring the Safety of Chemicals</u>

1. **The ability to protect human health and ecosystems from chemical risks may be affected.** Climate change may affect exposures to a wide range of chemicals because of changing environmental conditions or use patterns. For example, it may lead to increased pest pressure and a changing mix of pests, affecting how, when, where, and what pesticides are used. The earlier timing of spring events, like increased temperatures and the emergence of leaves, flowers, and pollinators, may lead to a longer growing season and an increase in the quantity of pesticides used.[xxviii] Other climate impacts like drought, extreme temperatures, and heavy precipitation may lead to reduced crop yields, fields taken out of production, changes in crop mixes and farming methods, and increase runoff into streams and rivers, increasing exposures. There may also be an increase in spraying and other chemical use to control mosquitoes and rodents in response to certain health threats, as well as mountain pine

beetles. Vulnerable populations, particularly children, may be at a higher risk for health effects from exposure to pesticides.

Region 8's efforts to reduce exposures may be affected by these impacts. There may also be an increase in requests for emergency exemptions for unregistered pesticides, state/local special need registrations, as well as requests to approve additional or new end uses of registered products. These requests are mostly handled by EPA Headquarters, but Region 8 monitors and supports them as appropriate to ensure a timely response. Additionally, Region 8's work to promote Integrated Pest Management and other sustainable agriculture practices may be more in demand. Region 8's adaptive capacity to this impact is largely dependent on available funding and resources.

E. <u>Enforcing Environmental Laws</u>

1. Climate change may affect environmental monitoring and sampling in various media. Heavy precipitation events, floods, and wildfires, as well as other extreme weather events like severe winds and tornados, could cause damage to Region 8's environmental monitoring equipment and prevent access to sampling locations. Additionally, increased air and water temperatures, and the earlier timing of spring events like snowmelt and runoff, could affect data quality and the baselines on which they rely. Environmental sampling methods and strategies may also be compromised and require modifications. This impact may affect the Region's ability to ensure compliance with environmental requirements by regulated entities, and take effective enforcement action in case of violations. These impacts may also require monitoring for a suite of chemicals not typically analyzed. Adapting to this impact may require a shift in resources and funding.

2. Climate may lead to more claims of force majeure. Force majeure is a common clause in an enforcement mechanism, like a consent decree, that can free the responsible party from liability or obligation when an extraordinary event occurs. Such events may include heavy precipitation, floods, wildfires, severe winds, and tornados. With climate change causing more such events, we can expect more claims that the regulated community cannot meet obligations due to force majeure.

F. <u>Facilities and Operations</u>

1. Operations of Region 8 facilities, including water and energy use, may be affected. Increased temperatures may impact cooling requirements in the summer, but may decrease the need for heat in the winter. The operation of Region 8 facilities could also be affected by water shortages due to drought, electric power interruptions due to extreme weather events like heavy precipitation, and wildfires that affect local air quality and the health of personnel. Drought and extreme temperatures may also make it more difficult to maintain the viability of green roofs, upon which Region 8 relies for stormwater retention services, among other things, at its Headquarters building in Denver, CO. Region 8's adaptive capacity to this impact is reliant on resources to purchase available water and energy, and avoid the health impacts of reduced air quality. Personnel also have the capacity to work remotely for an extended period of time. Depending on the circumstances, this may alleviate some of the operational vulnerabilities of Region 8 facilities.

G. Vulnerable Populations

1. Vulnerable populations may be at a higher risk from climate change impacts. As stated above, populations vulnerable to climate change impacts may include children, the elderly, minorities, the poor, the young, persons with underlying medical conditions and disabilities, those with limited access to information, indigenous populations, overburdened populations that live in environmental justice communities, and the homeless and outdoor workers who may have more exposure to heat and air pollution.[xxix] Certain geographic locations may also contribute to vulnerability.

EPA Region 8's Green Roof

The green roof on the EPA Region 8 Headquarters building located in Denver, CO, has been the subject of a research study to compare its thermal and water management characteristics against a conventional roof. Results show that the green roof is cooler during hot weather and warmer during cold weather because the plant materials and growth medium enable thermal storage and evaporative cooling as moisture transitions between liquid, vapor and solid physical states. It also has significantly higher stormwater retention.

Slabe, T. and O'Connor, T. 2011. DRAFT - Thermal Characteristics of an extensive green roof and a gravel ballasted roof in high elevation, semi-arid, temperate Denver, Colorado, U.S.A. EPA/R-600/XXX-08. December, 2011.

The EPA Region 8 Headquarters' green roof with study plots and instrumentation. The solar panels provide beneficial shade during hot weather. Photo: EPA Region 8.

There may be other vulnerable populations who have yet to be identified. These populations may include metropolitan areas in harm's way due to an increasing risk of floods, rural towns that may be at risk of losing access to safe drinking water due to a reduction in snowpack, or agricultural communities facing a threat to their livelihood due to extreme drought. Over time, the most vulnerable populations in Region 8 may change as the impacts of climate change become more pronounced or shift. Identifying who the most vulnerable populations are at this time or may be in the future will be an ongoing challenge. These populations will need to be defined in the context of climate change impacts, but also in terms of socioeconomic and natural resource considerations.

Tribes are particularly vulnerable to the impacts of climate change due to the integral nature of the environment within their traditional lifeways and culture. Region 8 places a priority on the development of adaptation strategies that promote sustainability and reduce the impact of climate change on tribes.

The EPA values its unique relationship with tribes, and recognizes and supports the sovereign decision-making authority of tribal governments. A formal consultation process was used to engage tribes in the development of the EPA's agency-wide Climate Adaptation Plan. Tribes identified some of the most pressing issues as erosion, temperature change, drought, and various changes in access to and quality

of water. Tribes recommended a number of tools and strategies to address these issues, including improving access to data and information, supporting baseline research to better track the effects of climate change, developing community-level education and awareness materials, and providing financial and technical support. At the same time, tribes challenged the EPA to coordinate climate change activities among federal agencies so that resources are better leveraged and administrative burdens are reduced.

This Implementation Plan identifies specific steps that will be taken to partner with tribal governments to increase their adaptive capacity and address their adaptation-related priorities. These collaborative efforts will benefit from the expertise provide by our tribal partners and the Traditional Ecological Knowledge (TEK) they possess. TEK is a valuable body of knowledge in assessing the current and future impacts of climate change, and has been used by tribes for millennia as a valuable tool to adapt to changing surroundings. It is viewed as a complementary resource that can inform planning and decision-making.

Networks and partnerships already in place will be used to assist tribes with climate change issues, including Regional Tribal Operations Committees, the Institute for Tribal Environmental Professionals, and the Indian General Assistance Program. Additionally, efforts will be made to coordinate across the Agency to facilitate transparency and information sharing, since climate change has many impacts that transcend media and regional boundaries.

H. <u>Emerging Issues</u>

During Region 8's internal planning sessions on climate adaptation, a number of emerging issues were discussed that require additional scientific research before they can be considered potential risks to Region 8 programs. They include the following:

- Wind and extreme wind events might be increasing, affecting evapotranspiration and the migration and deposition of pesticides and other pollutants into ecosystems, and increasing public health risks;
- The emergence of cyanobacteria toxins in surface waters might be increasing due to increased water temperature and nutrients – this may affect the safety of drinking water, requiring more treatment by water utilities; and
- Tropospheric ozone pollution levels might be increasing in rural areas, and along with increased levels of CO2, may have negative effects on ecosystems (and consequences for ecosystem protection programs), and crops (potentially causing an increase in the use of agricultural chemicals such as fertilizers and pesticides).

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IV. Summary Table of Climate Change Vulnerabilities

Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
Improving Air Quality	• Increased tropospheric ozone pollution in certain regions	• Likely	• Protecting public health and the environment by approving state programs to meet the National Ambient Air Quality Standards (NAAQS) and implementing programs in Indian Country	• High	• Could become more difficult to attain NAAQS for ozone in many areas with existing ozone problems
	• Increased frequency and intensity of wildfires	• Likely	• Protecting public health and the environment by approving state programs to meet the National Ambient Air Quality Standards (NAAQS) and implementing programs in Indian Country	• High	• Could complicate Agency efforts to protect public health and the environment from risks posed by particulate matter (PM) pollution in areas affected by more frequent wildfires
	• Increasing extreme temperatures • Increasing heavy precipitation events	• Very Likely • Likely	• Protect public health by promoting healthy indoor environments through voluntary programs and guidance	• Medium	• Could increase public health risks in indoor environments, including risks for the young, the elderly, the chronically ill, and socioeconomically disadvantaged populations

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Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
	• Effects on the stratospheric ozone layer	• Likely	• Restoring the stratospheric ozone layer • Preventing UV-related disease • Providing an effective transition to safer alternatives	• Low	• Unable to restore ozone concentrations to benchmark levels as quickly at some latitudes
	• Effects on response of ecosystems to atmospheric deposition of sulfur, nitrogen, and mercury	• Likely	• Ecosystem protections from Agency emissions reduction programs	• Low	• Could have consequences for the effectiveness of ecosystem protections under certain programs
Protecting America's Waters	• Increasing heavy precipitation events • Decreasing precipitation days and increasing drought intensity • Increased water temperatures • Earlier timing of spring events • Reduction in snowpack • Increasing risk of floods	• Likely • Likely • Very Likely • Very Likely • Very likely • Likely	• Restoring and protecting watersheds, aquatic ecosystems and wetlands	• High	• Increased number of sewer overflows and wastewater bypasses, increased erosion, as well as increased pollutant loads in runoff, may foul streams and threaten public health • Could become more difficult to attain water quality standards in many areas, including the chemical, biological, and physical integrity of Waters of the U.S. • Could act as a threat to the institutional process of protecting water quality through water quality standard development and implementation • Runoff may shift to earlier in spring, resulting in reduced streamflow later in summer, altering aquatic environments and increasing impairments • Shifts in aquatic habitat and species may threaten the economic and cultural practices of tribal communities • Certain aquatic ecosystems (e.g., prairie potholes) may be threatened

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Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
	• Increasing heavy precipitation events • Increasing flood risk • Increased frequency and intensity of wildfires • Earlier timing of spring events • Decreasing precipitation days and increasing drought intensity • Reduction in snowpack	• Likely • Likely • Likely • Very Likely • Likely • Very likely	• Drinking water, wastewater and stormwater infrastructure	• High	• Water infrastructure could be overwhelmed or damaged, compromising the ability to treat, which may lead to an increased incidence of waterborne disease • Drinking water intakes and wastewater outfalls could be affected by both high and low flows • Drinking water and wastewater utilities will need an 'all hazards' approach to planning for emergencies and extreme weather events • Vulnerable and economically deprived communities may have problems accessing safe drinking water • Low flows could cause a drinking water system cross connection due to lack of water pressure, exposing potable water to unwanted contaminants
	• Increased water temperatures • Increasing heavy precipitation events • Decreasing precipitation days and increasing drought intensity • Reduction in snowpack • Increased frequency and intensity of wildfires • Earlier timing of spring events	• Very likely • Likely • Likely • Very likely • Likely • Very Likely	• The quality and availability of safe drinking water	• High	• High water temperatures and increased storm-water runoff may increase the need for drinking water treatment, raising costs • Water supplies may be affected, forcing communities to seek alternative sources • Water demand may shift to underground aquifers or prompt development of reservoirs or other water retention strategies • May need to expand monitoring to accommodate a shift in contaminants

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Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
Cleaning Up America's Communities	• Increasing heavy precipitation events • Increasing risk of floods • Increasing extreme temperatures • Increased frequency and intensity of wildfires	• Likely • Likely • Very likely • Likely	• Cleaning up Contaminated Sites and Waste Management	• Medium	• Increased risk of contaminant release from EPA CERCLA, RCRA and Brownfield Sites • May need to alter selected remedies to ensure protection • Current scientific monitoring and sampling protocols on sites may no longer be effective.
	• Increasing heavy precipitation events • Increasing risk of floods • Increased frequency and intensity of wildfires • Decreasing precipitation days and increasing drought intensity	• Likely • Likely • Likely	• Emergency Response and recovery	• Medium	• Increased need for emergency response and recovery assistance • Possible limitations to response and recovery assistance capabilities due to staff and financial resource constraints

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Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
Ensuring the Safety of Chemicals	• Decreasing precipitation days and increasing drought intensity • Increasing extreme temperatures • Increasing heavy precipitation events • Earlier timing of spring events • Increased pest pressure and changing mix of pests	• Likely • Very likely • Likely • Very likely • Very likely	• Protecting human health and ecosystems from chemical risks	• Medium	• Changes in planting timing or location may affect the volume and timing of agricultural chemical use, which could impact water quality and pesticide exposures to people and the environment • Weeds, diseases, and insect pests benefit from warming, and weeds also benefit from a higher carbon dioxide concentration, increasing stress on crop plants and requiring more attention to pest and weed control. • Emergency exemptions for unregistered pesticides, state/local special need registrations, as well as requests to approve additional or new end uses of registered products, may increase
Enforcing Environmental Laws	• Earlier timing of spring events • Increasing risk of floods • Increased frequency and intensity of wildfires • Increasing heavy precipitation events • Increased water temperatures	• Very likely • Likely • Likely • Likely • Very likely	• Conducting environmental monitoring and sampling in various media	• Medium	• Environmental sampling methods and strategies may be compromised and require modifications • Sampling locations and equipment may be compromised, making reliable data collection difficult or impossible • Claims of force majeure may increase

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Goal [a]	CLIMATE CHANGE IMPACTS [b]		EPA REGION 8 PROGRAMMATIC IMPACTS [c]		
	Climate Change Impact [d]	**Likelihood of Impact [e]**	**Focus of Associated Region 8 Program**	**Likelihood Region 8 Program will be Affected by Impact [f]**	**Example of Risks if Region 8 Program were Impacted**
Facilities and Operations	• Decreasing precipitation days and increasing drought intensity • Increasing extreme temperatures • Increasing heavy precipitation events • Increased frequency and intensity of wildfire	• Likely • Very likely • Likely • Likely	• Operations of Region 8 facilities, including water and energy use	• Low	• Increased temperatures may impact cooling requirements and lower heating needs • Facilities could be located in areas with water shortages or electric power interruptions • Wildfires could affect local air quality • Could be more difficult to maintain green roofs for storm-water retention services

Footnotes for Summary Table of Climate Change Vulnerabilities

[a] This table summarizes vulnerabilities by the five goals in the EPA's Strategic Plan. Please note that the table also summarizes vulnerabilities to EPA facilities and operations, which is not part of the EPA Strategic Plan goal structure but is an important element of the EPA's vulnerability assessment. Please see Section II of this document for a fuller discussion of impacts.

[b] Climate Change Impacts are based upon peer-reviewed scientific literature.

[c] Programmatic Impacts are based upon EPA best professional judgment at this time.

[d] Impacts can vary by season and location.

[e] In general, the sources cited in this section use Intergovernmental Panel on Climate Change (IPCC) likelihood of outcome terminology where the term 'very likely' means 90-100% probability and the term 'likely' means 66-100% probability. For some impacts in the table, the likelihood determination was made using EPA best professional judgment at the time.

[f] **High** assumes the program will be affected by the impact; **Medium** assumes the program could be affected under some conditions by the impact; **Low** assumes that there is a potential for the program to be impacted or uncertainty currently exists as to the potential nature and extent of the impact. This assessment is based on best professional judgment within Region 8 at this time. Please note, this column does not reflect several important considerations. For example, it does not distinguish timeframes (current, near-term, long-term). It also does not account for regional and local variations, and does not reflect the priority of actions the agency may undertake now or in the future.

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V. Conclusion

Region 8 intends to continue to fulfill its mission, despite a changing climate, by building more resilient and climate-responsive programs through effective coordination and decision-support with our partners. The vulnerability assessment of our programs will need to be updated as climate change advances, and programmatic focus areas and scientific information change over time.

Priority Actions to Address Program Vulnerabilities

The Region has proposed priority actions that can be accomplished concurrent with or as a part of its ongoing activities, or as additional resources become available. Some will require "national-level" action before the Region can address the priority – these are noted as such in the sections below. By listing an action as a priority, the Region is not making a budgetary commitment to take or complete that action, or to take or complete it by a particular point in time.

I. Introduction

The following priority actions address the program vulnerabilities discussed above.

A. Improving Air Quality

1. Tropospheric ozone pollution is likely to increase in certain areas due to the effects of climate change.

- Continue discussions related to the nexus of climate change and increased levels of tropospheric ozone pollution with state, local, and tribal partners, and proactive steps to address the issue based on innovation and sustainability.
- Region 8 will work with EPA HQ to determine appropriate actions if and when control measures are needed to reduce ozone precursor emissions.
- Promote urban heat island mitigation to reduce factors that contribute to tropospheric ozone formation.
- Continue to work with our state, tribal, local, and other federal agency partners to consider the impact of climate change on ozone monitoring in the context of broader monitoring plans and network design.

2. Particulate matter (PM) levels are likely to be affected through changes in the frequency or intensity of wildfires.

- Coordinate as requested with the Agency for Toxic Substances and Disease Registry (ATSDR), as well as state agencies and local health departments, to interpret data and communicate wildfire PM risks and adaptive measures to the public.
- Utilize the Region 8 Children's Health and Clean, Green and Healthy Schools Programs to communicate wildfire PM risks and adaptive measures to the public.
- Coordinate as requested with the Indian Health Service to communicate wildfire PM risks and adaptive measures to the Tribes.

3. Climate change may worsen the quality of indoor air and increase exposures.

- Continue to coordinate with Region 8's leads for Green and Healthy Homes Initiative, the Children's Environmental Health Coordinator, and the Clean, Green and Healthy Schools Initiative to provide information to the public regarding occupant exposure to indoor pollutants as a result of climate change.

4. Climate change may alter the effects of and strategic priorities within the EPA's regulatory and voluntary programs to help restore the stratospheric ozone layer.

- Stay informed via Headquarters on trends in Region 8 levels of ultraviolet (UV) radiation. [National-Level Action Required]
- Determine if the use of ODS is increasing due to climate change (e.g., through an increased use of cooling devices and insulation foams), and if such a shift in demand might impact Region 8 programs concerned with the proper handling of such materials. [National-Level Action Required]

B. <u>Protecting America's Waters</u>

1. Climate change may affect the EPA's ability to protect and restore watersheds, aquatic ecosystems and wetlands.

- Support evaluation of hydrologic assumptions associated with TMDLs with respect to a changing climate. [National-Level Action Required]
- Promote early collaboration among federal agencies/state/tribes on water supply projects and other water infrastructure to encourage the consideration of climate change impacts.
- Support organizations to characterize and map the type, distribution, and conditions of wetlands on a watershed scale.
- Host a headwaters protection discussion with key stakeholders to frame a discussion on climate adaptation, and to identify the Region's most vulnerable communities with respect to water resources.
- Consider that water quality standards might not be met, especially regarding sediments and nutrients, due to wildfires.

2. Drinking water, wastewater and stormwater infrastructure may be affected.

- Encourage water utilities to consider and plan for a full range of climate change scenarios in their disaster management and water infrastructure planning programs.
- Work with regulated federal facilities on construction of facilities with a footprint greater than 1 acre to ensure the facilities are designed, planned and constructed to manage storm water through low-impact procedures and vegetation to reduce pollutant loading and flow-related pollution.
- Continue education and outreach on the use of green infrastructure; actual implementation of green infrastructure in planning, design, and construction; the use of a systems approach such as biomimicry; and the results of Region 8's green roof pilot project.

3. The quality and availability of safe drinking water may be affected.

- Consider the potential impacts of emerging and unregulated contaminants.
- Continue education and outreach for the WaterSense program.

4. General

- Support the Office of Water's nine common climate adaptation actions for regional Water Programs through on-going and distinctive activities to the maximum extent practicable [with the exception of activity #7 related to the Climate Ready Water Utilities and Climate Ready Estuaries Programs].

C. <u>Cleaning Up Communities</u>

1. Contaminated sites and waste management may be threatened.

- Promote the development and use of innovative technologies and practices for site remediation and materials management.

2. Climate change may lead to an increased need for emergency response and recovery.

- Work with EPA Headquarters and other relevant agencies to encourage coordination between the National Response Framework (NRF) and the National Disaster Recovery Framework (NDRF) to take advantage of the short policy window for incorporating sustainability and climate adaptation into redevelopment considerations. [National-Level Action Required]
- Work with ATSDR, FEMA, and EPA Headquarters to identify where disaster exacerbated environmental problems intersect with known human health threats to help prioritize when EPA deploys limited recovery resources. [National-Level Action Required]
- Through EPA's working relationships with FEMA Region 8 and other EPA Regions, develop and implement best management practices to build community resiliency that consider sustainability and climate adaptation.
- Continue to emphasize the need to plan for and prioritize funding set asides for disaster afflicted communities in programs like Brownfields, the Partnership for Sustainable Communities, and other grant funding programs. [National-Level Action Required]

D. <u>Ensuring the Safety of Chemicals</u>

1. The ability to protect human health and ecosystems from chemical risks may be affected.

- Support states in their requests to EPA Headquarters (OPP) for emergency exemptions, special need registrations, and additional or new end uses of registered products. [National-Level Action Required]
- Encourage EPA Headquarters to make agriculture-related grants a priority to facilitate agricultural adaptation to climate change.
- Continue to promote Integrated Pest Management and other sustainable agriculture practices.

E. <u>Enforcing Environmental Laws</u>

1. Climate change may affect environmental monitoring and sampling in various media.

- Consider that environmental monitoring and sampling methods and strategies in Region 8 may be compromised due to the impacts of climate change.

F. <u>Facilities and Operations</u>

1. Operations of Region 8 facilities, including water and energy use, may be affected.

- Maintain the staff's capacity to work remotely.
- Work to reduce the physical footprint of Region 8 facilities.

G. Vulnerable Populations

1. Vulnerable populations may be at a higher risk from climate change impacts.

- Develop a methodology to identify the populations in Region 8 who are the most vulnerable to the impacts of climate change – utilize tools such as the Social Vulnerability Index,[xxx] the Water Supply Sustainability Risk Index,[xxxi] the Spatial Hazard Events and Losses Database for the United States,[xxxii] and relevant outputs of the global climate models.
- Explore opportunities to collaborate with tribes, other EPA regional offices, other federal agencies, non-governmental organizations, etc., to share information and experiences related to adaptation.
- Work with tribal partners and other relevant organizations (such as ITEP - Institute for Tribal Environmental Professionals) to provide climate information, tools and training, that would assist tribes in preparing for observed and expected climate changes, and meeting their environmental regulatory responsibilities.
- Embark on a process to include adaptation into the tribal grant making function.
- Periodically review and assess emerging scientific and TEK understanding on relevant climate vulnerabilities and projections, and incorporate into programmatic work, as appropriate. [National-Level Action Required]

Other Priority Actions

I. Introduction

The following priority actions aren't specifically tied to the program vulnerabilities discussed above, but are key elements of building adaptive capacity into Region 8 Programs, and those of our state and tribal partners. They are meant to be initiated and conducted within a 1 to 3 year period of time. Some actions will be on going, while others will be completed by the end of this timeframe.

A. Agency-Wide Strategic Measures

The *FY 2011-2015 EPA Strategic Plan* contains the Agency's first "strategic performance measures" for integrating climate adaptation into its activities.[xxxiii] These strategic performance measures commit the Agency to integrate adaptation planning into five major rulemaking processes and five major financial assistance mechanisms by 2015. They also call for the integration of adaptation planning into five major scientific models or decision-support tools used in implementing Agency environmental management programs.

1. Integrate Adaptation Planning into Rulemaking Processes

- Explore opportunities to incorporate climate adaptation considerations into regional rulemaking processes.

2. Integrate Adaptation Planning into Financial Assistance Mechanisms

- Explore opportunities to incorporate climate adaptation considerations into competitive funding announcements in accordance with the October 18, 2011, EPA guidance memo jointly issued by the Office of Policy and the Office of Grants and Debarment - this may include a climate adaptation criterion wherever it is relevant to the program's mission and outcomes.

3. Integrate Adaptation Planning into Models or Decision-Support Tools

- Explore opportunities to incorporate climate adaptation considerations into models or decision-support tools.

B. <u>Legal and Enforcement Issues</u>

The EPA derives its authority to act from the U.S. Constitution and the laws passed by Congress. The Agency is committed to ensuring that its actions are constitutional, authorized by statute, consistent with Congress's vision and intent, and otherwise legally supported. The 2011 *EPA Policy Statement on Climate-Change Adaptation* called on the Agency to "identify for the Office of General Counsel areas where legal analysis is needed to carry out agency actions called for in this policy statement." In certain circumstances, Region 8 may need to determine the extent of its legal authorities or responsibilities to incorporate adaptation measures into proposed actions.

- Address any legal and enforcement issues that may arise through the Office of Regional Counsel (ORC) and Legal Enforcement Program (LEP), in consultation with the Office of General Counsel (OGC) and the Office of Enforcement and Compliance Assurance (OECA), as necessary. [National-Level Action Required]

C. <u>Training and Partnerships</u>

A central element of the Region's efforts to adapt to a changing climate will be to increase staff's awareness of how climate change may affect their work by providing them with the necessary data, information, and tools. Additionally, states, tribes, and local communities share responsibility for protecting human health and the environment, and partnerships with the EPA are at the heart of this. Additionally, it will be important to work with EPA Headquarters and other Regional Offices on pilot projects that test climate adaptation approaches that are broadly applicable. These partnerships will be critical for efficient, effective and equitable implementation of climate adaptation strategies, which will evolve over time.

- Ensure that technical staff and their partners have access to training on the importance of climate adaptation, and how they can incorporate climate adaptation considerations into their work. [National-Level Action Required]
- Ensure that technical staff and their partners have access to specific approaches, data, and tools for integrating climate adaptation into decision-making processes.[6] [National-Level Action Required]
- Develop a Region 8 climate adaptation communication strategy, which may include state and tribal partners, municipalities, industry, the public, and other relevant parties.

[6] Tools include such things as the EPA's Climate Ready Water Utilities CREAT decision-support tool, the EPA Global Change Research Program's Integrated Climate and Land Use Scenarios (ICLUS), and community-based social marketing strategies.

- Work with partners, engage local stakeholders and the public, and use a diversity of approaches to build adaptive capacity and encourage climate adaptation planning depending upon state, local, and tribal needs and conditions.
- Work with other federal agencies and international partners to enhance understanding of climate change, and leverage collective knowledge about climate adaptation planning.
- Work with EPA Headquarters and other Regional Offices on pilot projects that test climate adaptation approaches that are broadly applicable to learn what works and why. [National-Level Action Required]

D. NEPA

- Through NEPA reviews, encourage consideration of long-term climate change impacts, and discuss how the lead agency could mitigate impacts on water supply and environmental resources. Climate change influences on the project may translate into modified design and operational assumptions for determining resource supplies, system demands, system performance requirements, and operational constraints.
- Through NEPA reviews, encourage energy development projects to disclose water quantity needs and impacts on sources (groundwater, surface water, reservoirs).
- Through NEPA reviews, encourage assessment of the risks of climate change (particularly flooding) to transportation systems and services.

Monitoring and Evaluating Performance

Region 8 will evaluate its climate change adaptation activities on an annual basis to assess progress toward mainstreaming climate change adaptation into programs, policies, rulemaking processes, and operations. Based on lessons learned about the most effective climate change adaptation strategies, Region 8 can make adjustments to its approach.

Some metrics exist that will enable Region 8 to measure the results of its activities - others will need to be developed over time. In general, these metrics will reflect:

- *changes in knowledge* (*e.g.,* number of staff/partners taking formal training to increase their awareness of the importance of adaptation planning)
- *changes in behavior* (*e.g.,* increases in the use of decision support tools to integrate climate adaptation planning into activities such as infrastructure planning decisions)
- *changes in state/condition* (*e.g.,* changes in the ability of communities to withstand more frequent and intense storm events and avoid, for example, combined sewer overflows)

Region 8 recognizes that the integration of climate adaptation planning will occur over time. This will happen in stages, and measures should reflect this evolution. The earliest changes in many programs may be changes in knowledge and awareness, followed by changes in behavior and the use of adaptation tools, and then implementation of projects that build adaptive capacity and lead to changes in state and condition.

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