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Region 7 Climate Change Adaptation Implementation Plan

Publication Number:
EPA-100-K-14-001M

June 2014

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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.

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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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Program Vulnerability Assessment

I. Background

This assessment contains a discussion of EPA Region 7 and the climate change impacts affecting the four-state region, as well as an examination of the risks they pose to key Region 7 Programs. It builds on the work presented in Part 2 of EPA's Agency-wide Plan, as well as the individual assessments completed by various Program Offices. It is structured by the goals in EPA's FY 2011-2015 Strategic Plan, and includes a table that summarizes the programmatic vulnerabilities discussed in the narrative. These goals 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

Region 7 intends to fulfill its mission, despite the consequence of a changing climate. It will stay on course for meeting its goals, while building more resilient and climate-responsive programs. We will work with our partners to meet the challenges of climate change through frequent, effective coordination and decision-support.

II. Discussion of Climate Change Impacts in Region 7

Region 7 is located in the climate regions identified by the U.S. Global Change Research Program (GCRP): as the Great Plains and Midwest. The Region is bisected by the two climate regions along the state lines separating Nebraska from Iowa and Kansas from Missouri. The GCRP designates the states of Kansas and Nebraska as Great Plains, and the states of Iowa, and Missouri as the Midwest climate region.

EPA Region 7 is made up of two distinctly different sets of landscapes, as well as significant differences in population bases, and economic sectors making our response to climate change particularly challenging in its complexity. Our lands are managed by four states, nine tribal nations, and a host of federal agencies. These entities have diverse and often competing interests that include agriculture, energy development and production, environmental protection and stewardship, manufacturing, recreation, tourism, and commercial development. The roughly 13.8 million people in the region are concentrated in eight metropolitan areas including St. Louis, Kansas City, Des Moines, Wichita, Springfield, Omaha, Lincoln and Cedar Rapids. The remainder of the population is located in relatively isolated cities and towns often separated by large distances dominated by agricultural land-use.

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The Intergovernmental Panel on Climate Change (IPCC), in its Fourth Assessment report in 2007[i], 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, earlier timing of spring events, pole-ward and upward shifts in plant and animal ranges, drought, declining ecological health, heavy precipitation events, and habitat loss. One of the challenges in developing a climate change vulnerability assessment and priority actions is that the predictions (many of which are listed above) vary widely and so do the timeframes in which these impacts are predicted to occur. In the priority actions matrix, Region 7 briefly addresses and accounts for these variations. Nevertheless, climate change impacts are expected to intensify as greenhouse gases build up in the atmosphere, and continue to threaten our resources, agricultural, ecosystems and human health throughout the 21st century.

Because of the diversity and wide range of climate change impacts in Region 7, priority actions included in this are tailored to meet different needs based on eco-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 7 Programs are discussed in the sections below. They may be discussed individually, or in combinations based on the focus of the Strategic Plan Goal under consideration.

1. Increased tropospheric ozone pollution
2. Increased concentrations of particulate matter in the air
3. Increased degradation of indoor air
4. Increasing extreme temperatures
5. Increasing heavy precipitation events
6. Increased water temperatures
7. Decreasing precipitation days and increasing drought intensity
8. Increasing risk of floods
9. Earlier timing of spring events - define
10. Increase in and changing mix of pests*

*Includes weeds, insects, mold, fungus, and disease

III. Region 7's Known Vulnerabilities to Climate Change Impacts

1. Goal 1: Taking Action on Climate Change and Improving Air Quality

A. **Tropospheric ozone pollution is likely to increase in certain regions 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, controlled agricultural burning, and oil and gas production are some of the major sources of these pollutants in Region 7. High temperatures and regional air stagnation associated with climate change may lead to more ozone formation, even with the

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same level of emissions. Some estimates have these changes occurring now. While tropospheric ozone is higher in urban areas, some rural areas with oil and gas production activities in Region 7 may also have high levels based on recent experiences in Region 8 regarding this industry. .[ii] Additionally, Region 7 has observed increased ozone as a result of prescribed burning of rangeland in advance of the growing season. Controlled burn events release volatile organic compounds, oxides of nitrogen and carbon monoxide at low altitudes. Controlled burning of agriculture and rangeland is applied in advance of the growing season to prepare the land for spring agriculture growth. As growing season shifts are an effect of climate change, the shift has the potential to lengthen the ozone season by increasing the months of the year when conditions are conducive to the formation of troposphere ozone. Vulnerable populations may be at a higher risk for health effects from exposure to ozone.

Increases in tropospheric ozone due to climate change may require greater pollution controls to attain or maintain the ozone National Ambient Air Quality Standard (NAAQS**).** Region 7 works with partners at state, local, and tribal levels to meet this standard through State Implementation Plans (SIPs) and other measures. These efforts may need to be adjusted as climate change progresses. Although Region 7's adaptive capacity with respect to this impact is dependent on national standard setting efforts, there are some points of leverage and voluntary actions that can be utilized.

B. **Particulate Matter (PM) levels (both fine and course) are likely to be affected through changes in frequency and intensity of wildfires, controlled burns and high winds.** There is evidence indicating that climate change will affect PM levels through changes in the frequency or intensity of wildfires, [iii] and the effects of drought on the land. The Intergovernmental Panel on Climate Change (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. This could complicate EPA Region 7 efforts to protect public health and the environment from PM pollution. Vulnerable populations may be especially at risk from increased exposure to PM.

Certain areas of Region 7 utilize controlled burning of rangeland to reduce invasive vegetation and prepare the soil for new grass production for cattle grazing. Climate change has the potential to affect how prescribed burning is utilized in rangeland management necessitating changes in the timing of burning events to coincide with favorable conditions associated with precipitation, winds, temperature, and the spring growing season. Changes in climate will result in revised burning schedules and has the potential to impact air quality that effects vulnerable populations. Additionally, drought conditions associated with climate change can promote wind-borne dust or PM during high wind events. Wind-borne PM is principally associated with dry soil conditions and lack of adequate vegetative cover. Due to extensive agricultural activity in Region 7, the area is very susceptible to wind-borne PM in the early spring during the period between land preparation (tilling, fertilizing, and planting). During this period, the top soil is more susceptible to being distributed in the air during high wind events

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and the problem is exacerbated if the soil is dry as a result of low precipitation or elevated temperatures which can be associated with climate change.

Region 7's adaptive capacity with respect to this impact may be limited. Increases in PM as a result of wildfires, controlled burns, and high winds may be considered "exceptional events," which are exempt from certain regulatory actions under the Clean Air Act and the National Ambient Air Quality Standards (NAAQS). Additionally, the challenge of fire mitigation and firefighting falls on national, regional, and local agencies with authorities peripheral of EPA's jurisdiction. However, there may be air monitoring or risk communication opportunities that the Region can utilize to assist other agencies in adapting to this impact."

C. **Climate change may worsen the quality of indoor air and increase exposure to contaminants.** 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[iv]. This may lead to shifting patterns of indoor exposure to pesticides as occupants and building owners respond to new infestations.[v] 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.

Residents may weatherize buildings to increase comfort and indoor environmental quality in addition to saving energy. Although in general these actions should be encouraged, this may lead to a reduction in ventilation and an increase in indoor environmental pollutants unless measures are taken to preserve or improve indoor air quality. EPA has developed practical guidance for improving or maintaining indoor environmental quality during home energy upgrades or remodeling in single-family homes and schools. EPA's guidance and protocols may need to be revised to include state and local considerations for projected climatic changes. In addition, these programs may need to increase partnerships with other agencies to address training needs and workforce development for building owners, managers, and others, as well as develop new tracking mechanisms to assess the effectiveness of weatherization and remodeling techniques as they relate to indoor environmental quality.

Residents may also spend more time indoors, and become more prone to health risks from indoor environmental conditions. Public health risks, particularly for vulnerable populations, may increase[vi]. 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 7 can utilize various EPA programs, tools, resources, and partnerships to adapt to this impact. For example, Region 7's Radon Program, Healthy Homes, and Healthy Schools initiatives are avenues through which public education could occur.

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D. **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 (a natural process which makes mercury biologically available to fish and humans) and bioaccumulation. The potential impacts could have consequences for the effectiveness of ecosystem protection from Region 7's emissions reduction programs.

Because of current fish consumption advisory programs[vii], there is already heightened awareness of the issue of mercury contamination in lakes, rivers and streams in Region 7. This may present an opportunity to adapt to the impact through partnerships and public education. Region 7 may want to provide additional educational focus for populations where subsistence fishing is pervasive.

2. Goal 2: Protecting America's Waters

A. **Climate change may affect 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[viii]. 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 stream flows, 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, as well as increased evapotranspiration, may lead to reduced stream flow later in the summer, altering aquatic environments and increasing impairments. These impacts may also threaten certain aquatic ecosystems that are found the region, such as prairie potholes of Iowa, and floodplains of the Missouri and Mississippi Rivers, reducing the habitat they provide for plants and animals[ix].

These climate impacts may have adverse effects on Region 7's work to protect water quality, and the health of watersheds, aquatic ecosystems and wetlands. Additional water bodies may have trouble meeting water quality standards and may need to be listed as impaired. Nonpoint pollution control programs may need to be adjusted to reflect changing conditions. The scientific basis of water quality standard development and implementation could be threatened by shifting baselines. National Environmental Policy Act (NEPA) considerations may need to be

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expanded to provide greater protections. Finally, the economic and cultural practices of tribal communities 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 management of wetlands for storm water control purposes and to buffer the impacts of drought. Region 7's adaptive capacity with respect to this impact is varied, and there may be numerous points of leverage and opportunities that can be explored.

B. **Drinking water, wastewater and storm water 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 water bodies[x]. This could damage or overwhelm water infrastructure, and lead to releases of waterborne diseases and pathogens. In urban areas, storm water 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 (snowpack in the mountains and upstream effects summertime flows in rivers coursing across Region 7 including the Missouri River, both Platte Rivers, the Loup River, the Little Blue River and the Solomon River), and increased evapotranspiration may affect drinking water intakes and wastewater outfalls. Uncontrolled and controlled burning events also scorch soils, leading to more runoff and erosion. Drinking water and wastewater utilities will need to consider these climate change impacts and the concept of non-stationary[xi] in their planning activities. Additionally, vulnerable populations may have problems accessing safe drinking water due to these infrastructure challenges.

The Clean Water and Drinking Water State Revolving Funds (SRF) may be stressed as the need for additional investments in water infrastructure increases. Region 7 and its State 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 7's work to promote green infrastructure[xii] 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. Additional resources and funding may be required to address this significant impact in Region 7.

C. **The quality and availability of safe drinking water may be affected.** Drought, changing patterns of precipitation, and increased evapotranspiration may result in changes to the availability and demand for drinking water. Competing uses of water in the agriculture, industry, and energy production sectors may also increase. These factors may shift demand to underground sources of water, or prompt development of reservoirs or other water retention strategies.

Wildfires can foul water and challenge water-treatment facilities. Heavy precipitation events may exacerbate the problem, leading to more runoff of sediment and other

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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 7 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 storm water 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 7's work to promote voluntary actions through the Sustainable Water Infrastructure programs, Climate Ready Water Utilities initiatives, and WaterSense, may be more in demand. Adapting to this impact may be compromised by a lack of resources.

D. **Agricultural production demands on ground and surface water resources may increase.** Agriculture is the main economic activity and greatest sector user of water resources in Region 7 states. The agriculture industry relies heavily on precipitation, surface and ground water resources to maintain production of food and feed products. Drought and changing patterns of precipitation may result in farmers, ranchers, and land owners relying more heavily on water from surface runoff and the ground to maintain agriculture-related production. This increase demand will result in reduced stream flows and reduction in water table levels which could adversely affect water quality and availability for human consumption and ecosystems.

Ground and surface water resources are managed and controlled under a variety of state and federal oversight entities. These include state boards and regional cooperatives or districts that manage ground water with drawl and surface water diversion within the state that is used for crop irrigation and drinking water. At the federal level agencies, such as the Bureau of Land Management (BLM) and the US Army Corp of Engineers, manage land activities and navigable waters of the United States both of which have a significant impact on water availability to the regional agriculture sector and drinking water systems.

The eastern states of Region 7 (Iowa and Missouri) located in the climate region defined by the GCRP as the Midwest rely predominantly on precipitation and surface water to support agriculture production. As the quantity and timing of precipitation varies as a result of climate change, the agriculture industry may not be able to rely on precipitation to provide the water necessary to sustain crop production. In response, a greater reliance on surface water and ground water may occur which will reduce the ground water levels. As the industry relies more

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on ground water, there is greater potential for contamination and degradation of the resource due to the greater number of wells and decrease in ground water volume. Increased wells provide opportunities for surface contaminants to enter the resource, through poor well design or well completion. Ground water degradation also occurs as the resource is depleted and dissolved solids make up a greater percentage of the resource volume. In Missouri, where the majority of communities, and residents outside of municipalities, rely on ground water for drinking water, a reduction in ground water level and quality will negatively impact the public's access to affordable clean drinking water.

The western states of Region 7 (Kansas and Nebraska) located in the climate region defined by the GCRP as the Great Plains rely predominantly on ground water and to a lesser extent precipitation to support agriculture production. Nebraska ranks first nationally with over 8.5 million acres of irrigated land[xiii], and Kansas ranks 7th with over 2.7 million acres of irrigated land[xiv]. As the Great Plains region is more arid than the Midwest region, decreased precipitation is expected for this region under nearly all climate change modeling scenarios. Consequently, we anticipate that the agriculture sector in these two states will rely on groundwater resource to an even greater degree than currently to sustain current levels of agriculture production.

The main ground water resource in western Nebraska and Kansas is the Ogallala Aquifer, one of the largest aquifer systems in the world and the principal geologic unit of the High Plains Aquifer System. In 2005, the USGS estimated that total water withdraw from the aquifer amounted to approximately 9% since 1950, or 2.5 million acre feet of water from the aquifer's total water storage capacity of 2.9 billion acre feet[xv]. The Ogallala Aquifer, like most underground sources of water, depends on precipitation to recharge, and the rate of recharge does not match the rate of withdraw. In areas of western Nebraska, natural resource management districts have been put in place to regulate the number of wells and the amount of water than can be withdrawn from the aquifer as these areas have measured substantial reductions in the depth that fresh water can be accessed in the aquifer[xvi]. Like Missouri, communities located in Kansas and Nebraska depend almost entirely on ground water for public drinking water systems. In rural areas of both Nebraska and Kansas, we find that the vast majority of homes utilize ground water as the predominant source of water used in the home. As ground water resource are utilized more extensively (especially by the agriculture sector), the resource will become less available for use as a drinking and public water resource.

The Region 7 States and federal entities servicing the agriculture sector need to consider how greater reliance on ground and surface water resources will impact the resource as a result of climate change, as well as the impact on communities that share the ground water resource. We anticipate that Region 7's resources supporting public drinking water systems will be in greater demand as public utilities spend greater resources accessing clean water, and/or developing systems that reuse water. Additionally, the Agency may find it necessary to develop new programs to ensure the safety of ground

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water resources from contamination due to increased pumping and an increased number of wells.

3. **Goal 3: Cleaning Up Communities and Advancing Sustainable Development**

A. **Contaminated Sites and Waste Management may be threatened.** Heavy precipitation events, floods, and wildfires may threaten contaminated sites in Region 7 and the remedies put in place to cleanup and prevent releases of hazardous substances. Resource Conservation and Recovery Act (RCRA) activities to treat, store, or dispose of hazardous and non-hazardous waste may also be threatened. Extreme temperatures and 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 7's Superfund, 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 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. The adaptive capacity to this impact is largely dependent on available funding and resources, but there may be points of leverage or innovative technologies that could be utilized for site remediation or materials management.

B. **Climate change may lead to an increased need for emergency response**. Due to an increase in heavy precipitation events, floods, and wildfires, as well as other extreme weather events like severe winds and tornados that may be exacerbated by climate change, Region 7's emergency response and disaster recovery efforts may increase. Subsequently, this may lead to limitations in the Region's response capabilities due to staff and financial resource constraints. The adaptive capacity to this impact is dependent on available funding and resources and the occurrence frequency of natural disasters regionally and nationally.

4. **Goal 4: Ensuring the safety of Chemicals and Preventing Pollution**

A. **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[xvii]. Other climate impacts like drought, extreme temperatures, and heavy precipitation may lead to abandoned fields, 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

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

Region 7'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 handled by EPA Headquarters, but Region 7 monitors and supports them as appropriate to ensure a timely response. Additionally, Region 7's work to promote Integrated Pest Management and other sustainable agriculture practices may be more in demand. Region 7's adaptive capacity to this impact is largely dependent on available funding and resources.

5. <u>Goal 5: Enforcing Environmental Laws</u>

A. **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 that may be exacerbated by climate change, could cause damage to Region 7's environmental monitoring assets and prevent access. This impact could delay our efforts to ensure compliance with environmental requirements by regulated entities, and take effective enforcement action in case of violations. Adapting to this impact may require a shift in resources and funding.

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

A. **Operations of Region 7 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 7 facilities could also be affected by water shortages due to drought, electric power interruptions due to extreme weather events like heavy precipitation, tornadoes, and wildfires that affect local air quality and the health of personnel. Drought and extreme temperatures may also make it more difficult to maintain green infrastructure, upon which Region 7 relies for storm water management services, among other things, at its Regional Headquarters building in Lenexa, KS.

Region 7'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 vulnerabilities to the operation of Region 7 facilities.

7. <u>Vulnerable Populations</u>

Partnerships with Tribes. EPA values its unique government-to-government relationship with Indian tribes in planning and decision making. This trust responsibility has been established over time and is further expressed in the *1984 EPA Policy for the Administration of Environmental Programs on Indian*

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Reservations and the *2011 Policy on Consultation and Coordination with Indian Tribes*. These policies recognize and support the sovereign decision-making authority of tribal governments.

Supporting the development of adaptive capacity among tribes is a priority for the EPA. Tribes are particularly vulnerable to the impacts of climate change due to the integral nature of the environment within their traditional lifeways and culture. There is a strong need to develop adaptation strategies that promote sustainability and reduce the impact of climate change on Indian tribes.

EPA engaged tribes through a formal consultation process in the development of the Agency's *Climate Change 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 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 on an ongoing basis 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. Consistent with the principles in the 1984 Indian Policy, TEK 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 Region 7 Office of Tribal Affairs, the Institute for Tribal Environmental Professionals and the Indian General Assistance Program (IGAP). Additionally, efforts will be made to coordinate with other Regional and Program Offices in EPA, since climate change has many impacts that transcend media and regional boundaries. Transparency and information sharing will be a focus, in order to leverage activities already taking place within EPA Offices and tribal governments.

Vulnerable populations may be at a higher risk from climate change impacts. Certain parts of the population, such as children, the elderly, minorities and the poor, persons with underlying medical conditions and disabilities, those with limited access to information, and tribal and indigenous populations, can be especially vulnerable to the impacts of climate change. Also, certain geographic locations and communities are particularly vulnerable, such as those located in flood-prone areas. One of the principles guiding EPA's efforts to integrate climate adaptation into its programs, policies and rules calls for its adaptation plans to prioritize helping people, places and infrastructure that are most

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vulnerable to climate impacts, and to be designed and implemented with meaningful involvement from all parts of society.

This Implementation Plan identifies key programmatic vulnerabilities and the priority actions that will be taken to address those vulnerabilities over time. As the work called for in this Plan is conducted, the communities and demographic groups most vulnerable to the impacts of climate change will be identified. The Agency will then work in partnership with these communities to increase their adaptive capacity and resilience to climate change impacts. These efforts will be informed by experiences with previous extreme weather events (*e.g.,* Hurricane Katrina and Superstorm Sandy) and the subsequent recovery efforts.

Today, rural agriculture communities face an array of challenges. In 1950, 82 percent of the world's population was rural[xviii]. Rural communities now comprise 17 percent of the population and about 80 percent of the country's total land area[xix]. Such resource-based economies are vulnerable to the impacts of commodity prices, technological changes, land value dynamics, and other market influences. Many of these communities are experiencing unemployment, poverty, population loss, the aging of their workforces, and increasing demands for social services with fewer dollars to pay for them. In some rural areas, these are not new trends, but generations-old issues.

As a result of such economic impacts and challenges, estimates indicate a continued decline in our rural populations through 2050. Yet we have seen strength in agricultural production supports other parts of the economy, particularly in rural communities. Farms and ranches buy fertilizer and seed, invest in farm machinery, contract with custom operators, and support the many local businesses that come together to serve farms and farming families, including restaurants and health care service providers. High levels of production also benefit other businesses like grain elevators, bio-fuel refineries, and processed food manufacturers. According to the industry input-output accounts for 2010, every additional dollar of final output in the agriculture, fishing, and hunting industry raises gross output across all industries by approximately $2.20[xx].

Climate change has the potential to negatively influence the livelihood of our agriculture communities to a much greater extent than other vulnerable populations. Residents of remote communities have limited access to non-agriculture jobs and services. Alternative employment options can be limited due to long, expensive commutes. People who don't have access to personal vehicles or who do not drive, such as low-income residents and senior citizens, lack mobility and could have even less access to alternate jobs, healthcare, and other services.

Region 7 populations living with asthma are also a priority. For example, St. Louis is considered a national asthma "hot spot". Climate change, specifically with respect to air quality (i.e. ozone and particulate matter), indoor air quality, exposure to pests, and changes in heat and humidity will inevitably exacerbate complications associated with asthma. We will continue to monitor this vulnerable population and others like it as we adapt and respond to the challenges associated with climate change.

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Addressing these challenges is critical, particularly within the Midwest and Region 7, where agriculture plays such a vital role in our state economies

There may be other vulnerable populations (which may ultimately be defined by the spatial nature of climate change impacts) who have yet to be identified. This 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 ground water levels, or agricultural communities facing a threat to their livelihood due to extreme drought. Over time, the most vulnerable populations in Region 7 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. They will need to be defined in the context of climate change impacts, but also in terms of socioeconomic and natural resource considerations.

8. <u>Emerging Issues</u>

During Region 7's internal planning sessions on climate adaptation, a number of emerging issues were discussed that require additional scientific research before they can be considered risks to the work of Region 7 programs. They include the following:

- Wind and extreme wind events might be increasing, affecting air quality, and the migration and deposition of pesticides and other pollutants population areas and ecosystems
- The emergence of cyanobacteria toxins in surface waters might be increasing due to increased water temperature – this may affect drinking water, requiring more treatment by water utilities
- Tropospheric ozone pollution levels could increase in rural areas which could cause damage to crops- causing lost production and result in increasing efforts to use chemicals such as fertilizers and pesticides to compensate for such losses
- Unconventional energy production development might increase, placing greater demand on water resources, creating additional potential for groundwater contamination, and exacerbating climate change impacts
- Electric system reliability may decrease due to lack of cooling water availability as a result of low river water events
- Releases from industrial activities, rail cars, and on the road commercial truck traffic accidents associated with extreme weather events

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IV. Summary Table of Climate Change Vulnerabilities

Climate Change Impact	R7 Programmatic Impacts		
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions
	High = 3 Med. = 2 Low = 1		
1.1 Increased frequency and intensity of wildfires	3	Protecting the public health and the environment by approving state programs to meet NAAQS and respond to natural disasters	Continue to partner with local, state and tribal stakeholders to optimize fire contingency plans, including SMPs and a new National Fire Policy, to maximize prevention and minimize impacts
1.2 Increasing extreme temperatures	2	Protect public health by promoting healthy indoor environments through voluntary programs and guidance	Maintain and increase knowledge of increasing health risks in indoor environments as a result of climate change Promote energy efficiency and energy star products & renewable energy strategies
1.3 Increasing heavy precipitation events	3	Protecting the public health and the environment by approving state programs to meet NAAQS and implementing programs in Indian Country	Provide education on the dangers and stress to air quality from open burning of flood related debris and other natural disasters
1.4 Increased concentrations of tropospheric pollutants such as ozone and fine particulate matter	1	Protecting the public health and the environment by approving state programs to meet NAAQS	Continue to partner with local and state stakeholders to closely monitor changes in pollution in our most vulnerable areas (metropolitan centers) and take action early (Ozone/PM Advance) to mitigate new impacts and firm action through SIPs, when appropriate.
2.1 Increasing heavy precipitation events	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and storm water infrastructure - The quality and availability of safe drinking water	Work with USACE, Section 404 programs, to incorporate climate change impacts in permits, compensation plans and draft EIS documents. Work with state agencies, water and waste water stakeholders to identify and plan for climate change challenges by using Climate Ready Water Utility tools. Work with States, USDA, and other local partners to prioritize watersheds with improvements to the sources of drinking water impacted by nutrients and other contaminants. Assessments for improvement includes ground water and surface water sources

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Climate Change Impact	R7 Programmatic Impacts		
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions
	High = 3 Med. = 2 Low = 1		
2.2 Decreasing precipitation days and increasing drought intensity	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Increase public awareness of the role and importance of restoring and protecting watershed. Support adaptation in water resource planning efforts through collaborative dialogues with municipal officials, land-use planners, developers, water managers, and other stakeholders to protect long-term water availability and quality for all users Work within the region and outside agencies to incorporate water conservation practices, energy conservation and green infrastructure
2.3 Increased water temperatures	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Work with states, stakeholders and communities to incorporate climate change considerations into their water quality planning Work with state strategies such as state revolving loan fund intended use plans, capacity development strategies to promote sustainable practices such as energy efficiency, water resilience, and asset management. Work with states to better assess potential impacts from increased water temperatures and establish appropriate water quality standards (e.g., designated uses, criteria to protect those uses). Develop attainable, implementable, and protective permit conditions.
2.4 Earlier timing of spring events	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Work with stakeholders to protect drinking water, manage stormwater run-off planning, and manage consumptive water use from water ways

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Climate Change Impact	R7 Programmatic Impacts		
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions
	High = 3 Med. = 2 Low = 1		
3.1 Increasing heavy precipitation events	2	Cleaning up contaminated sites and waste -Use of Sustainable Materials Management and Pollution Prevention to prevent the generation of hazardous and solid waste	Promote the development and use of innovative(precipitation Neutral) technologies and practices for site remediation & materials management and emergency response Promote the principles of source reduction, reuse and recycle to make room for unexpected volume resulting from climate change events
4.1 – Decreasing precipitation days and increasing drought intensity	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Promote the use of best management practices to reduce pesticide runoff into surface water after precipitation events due to drought-induced soil impermeability
4.2 - Increasing extreme temperatures	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available
4.3 - Increasing heavy precipitation events	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Promote the use of best management practices to reduce pesticide runoff into surface water.
4.4 - Earlier timing of spring events	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits. Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process.

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Climate Change Impact	R7 Programmatic Impacts		
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions
	High = 3 Med. = 2 Low = 1		
4.5 - Increase in and changing mix of pests	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits. Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process. Provide states, Tribes and stakeholders with technical assistance and consultation to help them address emerging pesticide issues.
5.1 – Earlier timing of spring events	2	Conducting environmental sampling in various media to determine exposure and risk	Evaluate the Region's monitoring and sampling methods and strategies and make changes to accommodate shifts in seasons Maintain a situation awareness to identify any emerging pesticide enforcement issues Coordinate with the Region's state lead agencies to address pesticide misuse incidents
5.2 – Increased frequency and intensity of wildfires	2	Conducting environmental sampling in various media to determine exposure and risk	Focus on NAAQs and water standards compliance (increased run-off in fire areas)
6.1 – Decreasing precipitation days and increasing drought intensity	1	Continue to use the Region's EMS to promote staff water use efficiencies, monitor water availability through local provider, and work with Landlord to develop contingency plans for various levels of mandatory water use reductions if necessary	Continue to use the Region's EMS to promote sustainable business practices in energy and water efficiency
6.2 – Increasing extreme temperatures	1	Continue to use the Region's EMS to champion FMSD & SHEMD identified energy use reduction projects at the STC aimed at reducing air exchange rates in the laboratory spaces	Promote personal sustainable practices like fuel efficient transport and energy star product

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Climate Change Impact	R7 Programmatic Impacts		
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions
	High = 3 Med. = 2 Low = 1		
6.3 – Increasing risk of floods	1	Through the Region's COOP process, continue to train staff on need to prepare for emergency remote site work and advocate for better VPN continuity	Maintain the staff's capacity to work remotely

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Region 7 Priority Actions:

Region 7 is addressing climate change adaptation in a variety of its programmatic areas of responsibility. We will continue to integrate climate change adaptation into our existing programs and identify new opportunities to address climate change adaptation as regulations change and new initiatives and priorities are instituted and funding opportunities (i.e. grants, IAGs, etc) are identified.

As EPA Region 7 has finite resources and cannot address all climate change adaptation needs, we have adopted criteria to screen potential actions. We will target climate change adaptation work based on the following criteria:

- What is the likelihood of the Regional program being impacted?
- Does the action support and align with other Region 7 priorities and actions?
- Is this a priority action for our partners (federal/state/tribal/local/NGOs) and are they able to work with us towards a solution?
- Does the action reduce the risk?
- Does the action protect a critical resource/investment?
- Would the action leverage a larger effort outside of EPA?
- Does EPA have a unique role or capacity to address this issue?
- What is the timeframe of the problem that this action would be addressing?
- Could the action be accomplished within current budgets or would additional funds be necessary?
- Does this action have durability/sustainability/stability?

Using these criteria, priority actions were determined for each strategic goal. At the end of the priority action is a total **number** of points it scored. This value was developed through a workgroup evaluation discussed in more detail in Appendix A. This information will help the Region as it determines how to focus its activities on program vulnerabilities given the finite resource and time. The work group will continue to revisit these values into the future.

Priority Actions:

Goal 1: Taking Action on Climate Change and Improving Air Quality

1.1: Continue to partner with local and state stakeholders to optimize fire contingency plan, including SMPs to maximize prevention and minimize impacts **(30)**

1.2: (a) Maintain and increase knowledge of increasing health risks in indoor environments as a result of climate change **(17)**

(b) Work with EPA programs to target climate adaptation efforts in the most vulnerable communities, including tribes **(29)**

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1.3: Provide education on the dangers and stress to air quality from open burning of flood related debris **(24)**
1.4: Continue to partner with local and state stakeholders to closely monitor changes in pollution in our most vulnerable areas (metropolitan centers) and take action early (Ozone/PM Advance) to mitigate new impacts and firm action through SIPs, when appropriate. **(27)**

Goal 2: Protecting America's Waters

2.1: (a) Work with USACE Section 404 programs to incorporate climate change impacts in permits, compensation plans and draft EIS documents **(30)**

(b) Work with state agencies, water and waste water stakeholders to identify and plan for climate change challenges by using Climate Ready Water Utility Tools **(28)**

(c) Work with States, USDA and other local partners to prioritize watersheds with improvements to the sources of drinking water impacted by nutrients and other contaminants. Assessments for improvement includes ground water and surface water sources **(28)**

2.2: (a) Increase public awareness of the role and importance of restoring and protecting watersheds **(28)**

(b)Support adaptation in water resource planning efforts through collaborative dialogues with municipal officials, land-use planners, developers, water managers, and other stakeholders to protect long-term water availability and quality for all users **(27)**

(c) Work within the Region and outside agencies to incorporate water conservation practices, energy conservation and green infrastructure **(25)**

2.3: (a) Work with states, stakeholders and communities to incorporate climate change considerations into their water quality planning **(25)**

(b) Work with state strategies such as state revolving loan fund intended use plans, capacity development strategies to promote sustainable practices such as energy efficiency, water resilience an asset management **(30)**

(c) Work with states to better assess potential impacts from increased water temperatures and establish appropriate water quality standards (e.g. designated use criteria to protect those uses). Develop attainable, implementable, and protective permit conditions **(29)**

2.4: Work with stakeholders to protect drinking water, manage stormwater run-off planning, and manage consumptive water use from water ways **(27)**

Goal 3: Cleaning Up America's Communities and Advancing Sustainable Development

3.1: (a) Promote the development and use of innovative technologies and practices for site remediation & materials management **(23.5)**

(b) Promote the principles of source reduction, reuse and recycle to make room for unexpected volume resulting from climate change events **(25)**

Goal 4: Ensuring the Safety of Chemicals and Preventing Pollution

4.1: (a) Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available **(19)**

(b) Promote the use of best management practices to reduce pesticide runoff into surface water after precipitation events due to drought-induced soil impermeability **(22)**

4.2: Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available **(19)**

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4.3: (a) Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available **(19)**

(b) Promote the use of best management practices to reduce pesticide runoff into surface water **(22)**

4.4: (a) Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available **(19)**

(b) Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations and Emergency Use permits **(22)**

(c) Provide relevant information to Headquarters to be used during the pesticide registration/ re-registration process **(18)**

4.5: (a) Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available **(19)**

(b) Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations and Emergency Use permits **(22)**

(c) Provide relevant information to Headquarters to be used during the pesticide registration/ re-registration process **(18)**

(d) Provide States, Tribes and stakeholders with technical assistance and consultation to help them address emerging pesticide issues **(22)**

Goal 5: Enforcing Environmental Laws

5.1: (a) Evaluate the Region's monitoring and sampling methods and strategies and make changes to accommodate shifts in seasons **(16)**

(b) Maintain a situation awareness to identify any emerging pesticide enforcement issues **(18)**

(c) Coordinate with the Region's state lead agencies to address pesticide misuse incidents **(23)**

5.2: Focus on NAAQs and water standards compliance (increased run-off in fire areas) **(29)**

Facilities and Operations

6.1: Continue to use the Region's EMS to promote staff water use efficiencies, monitor water availability through local provider, and work with Landlord to develop contingency plans for various levels of mandatory water use reductions if necessary **(16)**

6.2: Continue to use the Region's EMS to champion FMSD & SHEMD identified energy use reduction projects at the STC aimed at reducing air exchange rates in the laboratory spaces **(17)**

6.3: Through the Region's COOP process, continue to train staff on need to prepare for emergency remote site work and advocate for better VPN continuity **(16)**

Other Priority Actions

Actions Related to 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.[xxi] 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

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major scientific models or decision-support tools used in implementing Agency environmental management programs.

A. Integrate Adaptation Planning into Rulemaking Processes

- Explore opportunities to incorporate climate adaptation considerations into regional rulemaking processes such as SIPs and TMDLs, as well as related data collection and analyses, policy statements and guidance documents

B. 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

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Region 7 Monitoring and Evaluation of Priority Actions

Region 7 will bi-annually evaluate its climate change adaptation activities to assess progress toward mainstreaming climate change adaptation into programs, policies, rulemaking processes, and operations. Some metrics exist that will enable the Region to measure the results of its activities - others will need to be developed over time. Climate vulnerabilities and impacts will likely change over time. Consequently, the priority actions and the metrics we use to measure progress on their implementation may need to be revised or changed as the knowledge and understanding of the effects of climate change increases.

	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
Goal 1	1.1 Increased frequency and intensity of wildfires	Protecting the public health and the environment by approving state programs to meet NAAQS and implementing programs in Indian Country	Continue to partner with local, state and tribal stakeholders to optimize fire contingency plans, including SMPs and a new National Fire Policy, to maximize prevention and minimize impacts	Fire prevention and contingency plans developed and shared.	NAAQS standards met
	1.2 Increasing extreme temperatures	Protect public health by promoting healthy indoor environments through voluntary programs and guidance	a) Maintain and increase knowledge of increasing health risks in indoor environments as a result of climate change b) Work with EPA programs to target climate adaptation efforts in the most vulnerable communities, including tribes	a) outreach events that reach public to increase knowledge of health risks in indoor environments b) number of people reached during outreach events, increase in energy star products purchased	Improved pro-active management of respiratory diseases and fewer emergency room visits.
	1.3 Increasing heavy precipitation events	Protecting the public health and the environment by approving state programs to meet NAAQS and implementing programs in Indian Country	Provide education on the dangers and stress to air quality from open burning of flood related debris and other natural disasters	Education of state and local officials and the general public	NAAQs standards met

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	1.4 Increased concentrations of tropospheric pollutants such as ozone, fine particulate matter and course particulate matter	Protecting the public health and the environment by approving state programs to meet NAAQS	Continue to partner with local and state stakeholders to closely monitor changes in pollution in our most vulnerable areas (metropolitan centers) and take action early (Ozone/PM Advance) to mitigate new impacts and firm action through SIPs, when appropriate.	Number of partners educated Number of partners participating in Ozone/PM Advance initiatives	Protecting public health and environment by meeting NAAQs standards.
Goal 2	2.1 Increasing heavy precipitation events	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and storm water infrastructure - The quality and availability of safe drinking water	Work with USACE, Section 404 programs, to incorporate climate change impacts in permits, compensation plans and draft EIS documents. Work with state agencies, water and waste water stakeholders to identify and plan for climate change challenges by using Climate Ready Water Utility tools. Work with States, USDA, and other local partners to prioritize watersheds with improvements to the sources of drinking water impacted by nutrients and other contaminants. Assessments for improvement includes ground water and surface water sources	Meets and events with stakeholders discussing agricultural and natural resource plans , climate ready planning tools. Plans developed, watershed prioritized with focus on nutrients, permits incorporating provisions for climate readiness.	Drinking water, wastewater, and water infrastructure is designed to withstand heavy precipitation events Reduced soil erosion/improved water quality/protection of agricultural soils and natural resources Impaired waterbodies removed from 303d lists

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	2.2 Decreasing precipitation days and increasing drought intensity	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Increase public awareness of the role and importance of restoring and protecting watershed. Support adaptation in water resource planning efforts through collaborative dialogues with municipal officials, land-use planners, developers, water managers, and other stakeholders to protect long-term water availability and quality for all users Work within the region and outside agencies to incorporate water conservation practices, energy conservation and green infrastructure	Implementation of agriculture funding programs encouraging adoption of water conservation practices Conduct meetings and participate in events with stakeholders on a regular basis focused on water use, energy, conservation practices and green infrastructure	Ecosystems, drinking water, wastewater, and water infrastructure are designed and operated to withstand severe droughts Protection of long-term water availability and quality for all uses Stablized Ground water reduction trend

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	2.3 Increased water temperatures	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Work with states, stakeholders and communities to incorporate climate change considerations into their water quality planning Work with state strategies such as state revolving loan fund intended use plans, capacity development strategies to promote sustainable practices such as energy efficiency, water resilience, and asset management. Work with states to better assess potential impacts from increased water temperatures and establish appropriate water quality standards (e.g., designated uses, criteria to protect those uses). Develop attainable, implementable, and protective permit conditions.	Partnerships with water treatment facilities, developers and urban planners established or maintained Conduct stakeholder meetings on a regular basis Increased conservation program participation implementing riparian buffers State plans incorporating sustainable practices	Protection of long-term water quality for all uses Decreased stream water temperatures

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	2.4 Earlier timing of spring events	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Work with stakeholders to protect drinking water, manage stormwater run-off planning, and manage consumptive water use from water ways	Partnerships with stakeholders established or maintained Conduct stakeholder meetings on a regular basis Development of early season varieties	Protection of long-term water quality for all uses Drinking water, wastewater, and water infrastructure are designed to accommodate shifts in seasons Improved or sustained crop production yields
Goal 3	3.1 Increasing heavy precipitation events	-Cleaning up contaminated sites and waste -Use of Sustainable Materials Management and Pollution Prevention to prevent the generation of hazardous and solid waste	Promote the development and use of innovative(precipitation Neutral) technologies and practices for site remediation & materials management and emergency response Promote the principles of source reduction, reuse and recycle to make room for unexpected volume resulting from climate change events	Design, communicate and implement innovative technologies and practices at remediation sites to minimize precipitation impacts Increases in participation in SMM and P2 programs and challenges	Contaminated sites cleaned up designed and implemented in a way that effectively withstands heavy precipitation events Overall increase in national diversion rate of solid waste to landfill and increase in P2 metrics

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	3.2 Changes in temperature	Cleaning up contaminated sites and waste Increase in promotion of Green Chemistry, Design for the Environment and E3 (Energy, Economy and Environment) and SMM focus areas	Identify points of leverage or external funding sources to build adaptive capacity Shift in focus of regional P2 program to promote SMM participation	Design, communicate and implement innovative technologies and practices at remediation sites to minimize temperature impacts Increase number of successful grant proposals including focus areas	Contaminated sites cleaned up designed and implemented in a way that effectively withstands temperature changes Emergency response efforts incorporate sustainability Flooding events are not further complicated by contamination
Goal 4	4.1 – Decreasing precipitation days and increasing drought intensity	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Promote the use of best management practices to reduce pesticide runoff into surface water after precipitation events due to drought-induced soil impermeability	Outreach conducted on IPM when new agriculture practices/products are available	Human health is protected
	4.2 - Increasing extreme temperatures	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available	Outreach conducted on IPM when new agriculture practices/products are available	Human health is protected

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	4.3 - Increasing heavy precipitation events	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Promote the use of best management practices to reduce pesticide runoff into surface water.	Outreach conducted on IPM when new agriculture practices/products are available	Human health is protected
	4.4 - Earlier timing of spring events	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits. Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process.	Outreach conducted on IPM when new agriculture practices/products are available	Human health is protected

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	4.5 - Increase in and changing mix of pests	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits. Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process. Provide states, Tribes and stakeholders with technical assistance and consultation to help them address emerging pesticide issues.	Outreach conducted on IPM when new agriculture practices/products are available	Human health is protected

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
Goal 5	5.1 – Earlier timing of spring events	Conducting environmental sampling in various media to determine exposure and risk	Evaluate the Region's monitoring and sampling methods and strategies and make changes to accommodate shifts in seasons Maintain a situation awareness to identify any emerging pesticide enforcement issues Coordinate with the Region's state lead agencies to address pesticide misuse incidents	Modify monitoring and sampling methods and strategies to address areas of weakness or vulnerability associated with seasonal shifts	Compliance monitoring remains an effective strategy for protecting human health and the environment.
	5.2 - Increasing heavy precipitation events and risk of floods	Conducting environmental sampling in various media to determine exposure and risk	Focus on NAAQs and water standards compliance (increased run-off in fire areas)	Increase the number of SEPs that support energy efficiency/ renewable energy and sustainable practices	Compliance monitoring remains an effective strategy for protecting human health and the environment.
Facilities & Operations	6.1 – Decreasing precipitation days and increasing drought intensity	Water use reductions at Regional Office and Science & Technology Center	Continue to use the Region's EMS to promote staff water use efficiencies, monitor water availability through local provider, and work with Landlord to develop contingency plans for various levels of mandatory water use reductions if necessary	Outreach to staff, management, and stakeholders (i.e. building owner, contractors, etc)	Sustained low water and energy usage at EPA facilities
	6.2 - Increasing extreme temperatures	Energy use reductions within the HVAC system at the STC	Continue to use the Region's EMS to champion FMSD & SHEMD identified energy use reduction projects at the STC aimed at reducing air exchange rates in the laboratory spaces	Identification and implementation of STC energy reduction projects	Reduction in overall energy usage rates

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	Climate Change Impact	Focus of Associated Region 7 Program	Priority Actions	Evaluation Output	Evaluation Outcome
	6.3 – Increasing risk of floods	Continue to promote telework and improve remote secure access to the Region's/Agency's networks	Through the Region's COOP process, continue to train staff on need to prepare for emergency remote site work and advocate for better VPN continuity	Staff are able to work remotely	Routine Agency functions are sustained in a flood emergency situation

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Conclusion

In R7 and elsewhere across the United States, predictions regarding climate change impacts vary widely and as a consequence so do the resulting vulnerabilities, making planning difficult. However, priority actions identified by the programs within the Region have the following common threads.

(1) Priority actions were constructed within the legal bounds of our existing environmental statutes.

(2) Priority actions are primarily extensions of existing or planned program actions which are tailored to address specific climate change vulnerabilities.

(3) Priority actions rely heavily on partnerships with R7 state, local and tribal environmental programs.

(4) Priority actions focus on communication, education and outreach intended to modify behavior and consumption patterns.

(5) To a certain extent, priority actions could be implemented through work re-prioritization without substantial supplemental resources.

Because of the diverse nature of the predictions and our constantly evolving environment, close monitoring of climate trends and program readiness are essential if we are to address our vulnerabilities in a timely, effective, and relevant way.

Region 7 will bi-annually review its segment of the plan. This review will incorporate determinations about climate conditions, weather impacts, regional vulnerabilities and vulnerable populations that will enable the Region to update the plan, if needed, and to give consideration to the sequence of priority action implementation.

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[xi] 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.

[xii] 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 storm water management, but also urban heat island mitigation, air quality management, and more.

[xiii] 2007 Census of Agriculture Report, US Department of Agriculture, National Agricultural Statistics Service, Washington DC., USA, 2009., pp 280

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Appendix A

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Region 7 Actions Matrix: Workgroup members used their best professional judgment to determine values for different vulnerabilities. When applying the criteria, offices did not evaluate vulnerabilities in relation to each other, but instead considered each vulnerability independently. These tables are not intended as a definitive ranking, but rather as a useful and informative exercise for the region as it determines how to focus its activities on program vulnerabilities. The workgroup will continue to revisit these values into the future."

	Climate Change Impact	R7 Programmatic Impacts			Regional Priority Actions Ranking Criteria									
	Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions	Support & Align with other R7 priorities & actions	Action is a priority action for our partners	Impact Action would have in reducing risk	Action Protects a critical resource/ investment	Action Leverages a larger effort outside of EPA	EPA has a unique role or capacity to address action	Timeframe when risk likely to occur:	Action can be accomplished within current budgets	Action has durability/ sustainability/ stability	Composite Score
		High = 3 Med. = 2 Low = 1			High = 3 Med. = 2 Low = 1	Yes = 3 No = 1	High = 3 Med. = 2 Low = 1	Yes = 3 No = 1	Yes = 3 No = 1	Yes = 3 No = 1	0-10 yrs = 3 11-30 yrs = 2 31 – 100 yrs = 1	Yes = 3 No = 1	Yes = 3 Somewhat = 2 No = 1	
Goal 1: Taking Action on Climate Change & Improving Air Quality	1.1 Increased frequency and intensity of wildfires	3	Protecting the public health and the environment by approving state programs to meet NAAQS and respond to natural disasters	Continue to partner with local, state and tribal stakeholders to optimize fire contingency plans, including SMPs and a new National Fire Policy, to maximize prevention and minimize impacts	3	3	3	3	3	3	3	3	3	30
	1.2 Increasing extreme temperatures	2	Protect public health by promoting healthy indoor environments through voluntary programs and guidance	Maintain and increase knowledge of increasing health risks in indoor environments as a result of climate change Work with EPA programs to target climate adaptation efforts in the most vulnerable communities, including tribes	1 3	1 3	1 3	3 3	3 3	1 3	2 3	1 3	2 3	17 29

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Climate Change Impact	R7 Programmatic Impacts			Regional Priority Actions Ranking Criteria									
Climate Change Impact	Likelihood Regional Program would be Impacted	Focus of Associated Region 7 Program	Priority Actions	Support & Align with other R7 priorities & actions	Action is a priority action for our partners	Impact Action would have in reducing risk	Action Protects a critical resource/ investment	Action Leverages a larger effort outside of EPA	EPA has a unique role or capacity to address action	Timeframe when risk likely to occur:	Action can be accomplished within current budgets	Action has durability/ sustainability/ stability	Composite Score
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1.3 Increasing heavy precipitation events	3	Protecting the public health and the environment by approving state programs to meet NAAQS and implementing programs in Indian Country	Provide education on the dangers and stress to air quality from open burning of flood related debris and other natural disasters	2	2	2	3	3	1	3	3	2	24
1.4 Increased concentrations of tropospheric pollutants such as ozone, fine particulate matter and course particulate matter	1	Protecting the public health and the environment by approving state programs to meet NAAQS	Continue to partner with local and state stakeholders to closely monitor changes in pollution in our most vulnerable areas (metropolitan centers) and take action early (Ozone/PM Advance) to mitigate new impacts and firm action through SIPs, when appropriate.	3	3	3	3	3	3	2	3	3	27

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		High = 3 Med. = 2 Low = 1			High = 3 Med. = 2 Low = 1	Yes = 3 No = 1	High = 3 Med. = 2 Low = 1	Yes = 3 No = 1	Yes = 3 No = 1	Yes = 3 No = 1	0-10 yrs = 3 11-30 yrs = 2 31 – 100 yrs = 1	Yes = 3 No = 1	Yes = 3 Somewhat = 2 No = 1	
Goal 2: Protecting America's Waters	2.1 Increasing heavy precipitation events	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands	Work with USACE, Section 404 programs, to incorporate climate change impacts in permits, compensation plans and draft EIS documents.	3	3	3	3	3	3	3	3	3	30
			- Drinking water, wastewater and storm water infrastructure	Work with state agencies, water and waste water stakeholders to identify and plan for climate change challenges by using Climate Ready Water Utility tools.	3	3	3	3	3	3	3	1	3	28
			- The quality and availability of safe drinking water	Work with States, USDA, and other local partners to prioritize watersheds with improvements to the sources of drinking water impacted by nutrients and other contaminants. Assessments for improvement includes ground water and surface water sources	3	3	3	3	3	3	3	1	3	28

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2.2 Decreasing precipitation days and increasing drought intensity	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands	Increase public awareness of the role and importance of restoring and protecting watershed.	3	3	3	3	3	3	3	1	3	28
		- Drinking water, wastewater and stormwater infrastructure	Support adaptation in water resource planning efforts through collaborative dialogues with municipal officials, land-use planners, developers, water managers, and other stakeholders to protect long-term water availability and quality for all users	3	3	3	3	3	3	3	1	2	27
		- The quality and availability of safe drinking water	Work within the region and outside agencies to incorporate water conservation practices, energy conservation and green infrastructure	2	1	3	3	3	3	3	1	3	25

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	2.3 Increased water temperatures	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure - The quality and availability of safe drinking water	Work with states, stakeholders and communities to incorporate climate change considerations into their water quality planning Work with state strategies such as state revolving loan fund intended use plans, capacity development strategies to promote sustainable practices such as energy efficiency, water resilience, and asset management. Work with states to better assess potential impacts from increased water temperatures and establish appropriate water quality standards (e.g., designated uses, criteria to protect those uses). Develop attainable, implementable, and protective permit conditions.	2 3 2	1 3 3	3 3 3	3 3 3	3 3 3	3 3 3	3 3 3	1 3 3	3 3 3	25 30 29
	2.4 Earlier timing of spring events	3	- Restoring and protecting watersheds, aquatic ecosystems and wetlands - Drinking water, wastewater and stormwater infrastructure	Work with stakeholders to protect drinking water, manage stormwater run-off planning, and manage consumptive water use from water ways	2	3	3	3	3	3	3	1	3	27

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			- The quality and availability of safe drinking water											
Goal 3: Cleaning Up Communities and Advancing Sustainable Development	3.1 Increasing heavy precipitation events	2	Cleaning up contaminated sites and waste	Promote the development and use of innovative(precipitation Neutral) technologies and practices for site remediation & materials management and emergency response	3	3	2	2	3	3	1.5	1	3	23.5
			-Use of Sustainable Materials Management and Pollution Prevention to prevent the generation of hazardous and solid waste	Promote the principles of source reduction, reuse and recycle to make room for unexpected volume resulting from climate change events	3	3	1	2	3	3	2	3	3	25

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Goal 4: Ensuring the Safety of Chemicals	4.1 – Decreasing precipitation days and increasing drought intensity	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available Promote the use of best management practices to reduce pesticide runoff into surface water after precipitation events due to drought-induced soil impermeability	2 3	1 3	2 2	3 3	3 3	1 1	2 2	1 1	2 2	19 22
	4.2 - Increasing extreme temperatures	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available	2	1	2	3	3	1	2	1	2	19

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4.3 - Increasing heavy precipitation events	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available	2	1	2	3	3	1	2	1	2	19
			Promote the use of best management practices to reduce pesticide runoff into surface water.	3	3	2	3	3	1	2	1	2	22

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4.4 - Earlier timing of spring events	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available	2	1	2	3	3	1	2	1	2	19
			Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits.	1	3	2	1	3	3	2	3	2	22
			Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process.	1	1	2	1	1	3	2	3	2	18

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	4.5 - Increase in and changing mix of pests	2	Protecting human health and ecosystems from chemical risks	Continue to promote Integrated Pest Management (IPM) and other sustainable agriculture practices as new products and strategies become available	2	1	2	3	3	1	2	1	2	19
				Coordinate with the Region's State Lead Agencies to ensure the availability and proper use of Section 18 Emergency Exemption registrations, Section 24(c) Special Local Need registrations, and Emergency Use Permits.	1	3	2	1	3	3	2	3	2	22
				Provide relevant information to Headquarters to be used during the pesticide registration/re-registration process.	1	1	2	1	1	3	2	3	2	18
				Provide states, Tribes and stakeholders with technical assistance and consultation to help them address emerging pesticide issues.	2	3	1	1	3	3	2	3	2	22
Goal 5: Enforcing Environmental Laws	5.1 – Earlier timing of spring events	2	Conducting environmental sampling in various media to determine exposure and risk	Evaluate the Region's monitoring and sampling methods and strategies and make changes to accommodate shifts in seasons	2	1	1	2	1	1	2	1	3	16
				Maintain a situation awareness to identify any emerging pesticide enforcement issues	1	1	2	1	1	3	2	3	2	18

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				Coordinate with the Region's state lead agencies to address pesticide misuse incidents	2	3	2	3	3	1	2	3	2	23
	5.2 – Increased frequency and intensity of wildfires	2	Conducting environmental sampling in various media to determine exposure and risk	Focus on NAAQs and water standards compliance (increased run-off in fire areas)	3	3	3	3	3	3	3	3	3	29
Facilities & Operations	6.1 – Decreasing precipitation days and increasing drought intensity	1	Water use at R7 RO and STC	Continue to use the Region's EMS to promote staff water use efficiencies, monitor water availability through local provider, and work with Landlord to develop contingency plans for various levels of mandatory water use reductions if necessary	2	1	2	1	1	1	2	3	2	16

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6.2 – Increasing extreme temperatures	1	Water and energy usage at EPA facilities	Continue to use the Region's EMS to champion FMSD & SHEMD identified energy use reduction projects at the STC aimed at reducing air exchange rates in the laboratory spaces	2	1	2	3	1	1	3	1	2	17
6.3 – Increasing risk of floods	1	- Operations of Agency facilities, personnel safety, physical security and emergency communications - Emergency management, mission support (protective gear acquisition)	Through the Region's COOP process, continue to train staff on need to prepare for emergency remote site work and advocate for better VPN continuity	2	1	2	1	1	1	2	3	2	16