U.S. Environmental Protection Agency

Office of Land and Emergency Management

2022-2023 Climate Adaptation Implementation Plan

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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DEPUTY ADMINISTRATOR

Preface

Climate change is threatening communities across the nation. Millions of Americans feel the destructive effects of climate change each year when the power goes down, rivers and lakes go dry, homes are destroyed by wildfires and communities are flooded by hurricanes. Underserved communities are especially vulnerable to the climate crisis and are more likely to experience the negative health and environmental effects of extreme weather events.

The Biden-Harris Administration is actively confronting the climate crisis while also advancing environmental justice. As part of a whole-of-government approach, the U.S. Environmental Protection Agency is strongly committed to taking the actions necessary to protect human health and the environment and to increase the resilience of the entire nation, even as the climate changes.

The EPA's commitment to action is reflected in its FY 2022-2024 Strategic Plan and in the 2021 Climate Adaptation Action Plan. Both documents present priority actions the agency will take to ensure that its programs, policies and operations remain effective under future climate conditions while we work to support states, territories, tribes and communities in increasing their own adaptive capacity and resilience to climate change impacts.

From flooding at Superfund sites, to wildfires causing air pollution, to sea-level rise affecting water quality and infrastructure, the EPA will boldly address climate impacts in both its programs and the communities it serves. We recognize the importance of tribal, state and local government partnerships in efficient, effective and equitable implementation of climate change adaptation strategies. Our plans were informed and improved by input we received in listening sessions we held to engage these and other partners as we developed these plans.

To ensure we are addressing the climate crisis in a comprehensive way, each of our national program and regional offices has developed individual Climate Adaptation Implementation Plans that outline how the EPA will attain the agencywide goals described in the broader Climate Adaptation Action Plan. These plans describe how programs and regions will integrate climate adaptation into their programs, partnerships and operations. They also describe how they will help partners build their resilience and capacity to adapt, while delivering co-benefits, including curbing greenhouse-gas emissions and other pollution, and promoting public health, economic growth and climate justice. Of course, the EPA has a major role to play on emissions reductions as well, though that is not the focus of these plans. Indeed, we must focus on both climate adaptation and mitigation to ensure our nation and communities thrive in an era of climate change.

As part of this effort, we will empower our staff and partners by increasing awareness of how climate change may affect our collective ability to implement effective and resilient programs. We will also provide them with the necessary training, tools, data, information and technical support to make informed decisions and integrate climate adaptation into our work.

The EPA will work to modernize its financial assistance programs to encourage climate-resilient investments across the nation. We will also focus on ensuring that investments funded by the Bipartisan Infrastructure Law, the Inflation Reduction Act and other government programs are resilient to the impacts of climate change. Finally, as our knowledge advances and as impacts continue to develop, our response will likewise evolve. We will work to share these developments to enhance the collective resilience of our nation.

The actions outlined in these implementation plans reflect the EPA's commitment to build every community's capacity to anticipate, prepare for, adapt to and recover from the increasingly destructive impacts of climate change. Together with our partners, we will work to create a healthy and prosperous nation that is resilient to the ever-increasing impacts of climate change — which is vital to the EPA's goal of protecting human health and the environment and to ensuring the long-term success of our nation.

Janet G. McCabe

Preface

Climate change poses significant threats to all Americans. Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, sets U.S. policy for taking a government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth. Such an approach requires the U.S. Environmental Protection Agency (EPA) and other federal agencies to coordinate their planning and implementation of key actions that address the policy's goals, and to substantively engage with stakeholders, including state, local and tribal governments.

In accordance with EPA's *2021 Climate Adaptation Action Plan*, the Agency's Office of Land and Emergency Management (OLEM) is proactively incorporating climate adaptation planning into its mission, programs and management functions. OLEM manages programs under various statutory authorities. The program offices and supporting offices worked together to identify shared climate vulnerabilities and identify actions that will be taken to address the climate vulnerabilities. We want to ensure the actions we take are protective of human health and the environment, regardless of future climate conditions.

Assessing the climate vulnerability of our programs and connected communities and building the appropriate level of resilience when and where required is a major challenge. Sharing of experiences and lessons learned across our programs, including those gained in EPA regional offices, is critical to effectively implementing OLEM's climate adaptation plan while maximizing the return on federal dollars invested in accomplishing OLEM's mission. The effort requires significant engagement with overburdened and underserved communities that are likely to bear greater risks and burdens from extreme climate-driven events and experience greater difficulties recovering from such events. It also requires consideration of tribal treaties and protection of tribal reserved rights relating to natural resources, such as hunting, fishing and gathering.

Building our understanding of science-based projections on future climate scenarios and associated implications faced by our programs, as well as expanding our internal and external climate-related training efforts, are key components of OLEM's climate adaptation plan. The current plan outlines priority actions to be taken in fiscal years 2022 and 2023. OLEM will annually update the plan through fiscal 2026 to clarify the status of climate vulnerabilities not yet fully addressed or to specify additional priority actions.

OLEM Climate Resilience Workgroup

The U.S. Environmental Protection Agency's Office of Land and Emergency Management (OLEM) maintains a Climate Resilience Workgroup currently comprising 33 representatives of six OLEM offices responsible for managing regulatory programs or providing mission support. Sixteen members serve on the Workgroup's Coordinating Committee (*):

Dawn Banks, Policy Analysis and Regulatory Management
Nathan Barlet, Office of Superfund Remediation and Technology Innovation *
Christina Barnes, Office of Brownfields and Land Revitalization
Mark Barolo, Office of Underground Storage Tanks
Pamela Barr, Office of Superfund Remediation and Technology Innovation
Aaron L. Bell, Office of Communications, Partnerships and Analysis *
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Kathleen Salyer, Office of Emergency Management
Ted Stanich, Office of Homeland Security
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Nigel Simon, Director of the OLEM Office of Program Management, serves as the OLEM Senior Career Leader for Climate Adaptation.

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1. Introduction

The U.S. Environmental Protection Agency (EPA) Office of Land and Emergency Management (OLEM) evaluated actions it could take to advance progress in meeting goals of EPA's 2021 *Climate Adaptation Action Plan*.[1] The Agency-wide plan accelerates and focuses attention on five priority actions to be taken in fiscal years (FYs) 2023 through 2026 to increase human and ecosystem resilience as the climate changes and disruptive impacts increase:

1. Integrate climate adaptation into EPA programs, policies, rulemaking processes and enforcement activities.
2. Consult and partner with states, tribes, territories, local governments, environmental justice organizations, community groups, businesses and other federal agencies to strengthen adaptive capacity and increase the resilience of the nation, with a particular focus on advancing environmental justice.
3. Implement measures to protect the Agency's workforce, facilities, critical infrastructure, supply chains and procurement processes from the risks posed by climate change.
4. Measure and evaluate performance.
5. Identify and address climate adaptation science needs.

OLEM provides policy, guidance, direction, oversight and funding for the Agency's hazardous waste management, underground storage tanks, brownfields, and accidental oil and chemical release programs. OLEM also provides funding and support to states, tribal nations and territories carrying out site specific, waste program, emergency response and disaster preparedness activities. When contamination does occur, OLEM and its partners investigate, assess and clean up contaminated sites and work with affected communities to create a safer environment. OLEM also prepares for and responds to environmental emergencies, aids emergency preparedness and recovery planning across the nation, and promotes redevelopment of formerly contaminated areas. OLEM mission activities operate through six offices that administer 11 programs and coordinate with EPA regional offices through periodic meetings and working groups to assure that regional priorities and needs are addressed.

Building on its previous (FY 2014) climate adaptation plan, OLEM assessed potential climate vulnerabilities of its programs and evaluated associated actions that could be integrated to increase human and ecosystem resilience to climate change. Evaluation of potential actions considered the *FY 2022-2026 EPA Strategic Plan*[2] with respect to one goal directly applying to OLEM program operations (Table 1.1):

- Goal 6: Safeguard and Revitalize Communities.
  - Objective 6.1: Clean up and restore land for productive uses and healthy communities.
  - Objective 6.2: Reduce waste and prevent environmental contamination.
  - Objective 6.3: Prepare for and respond to environmental emergencies.

Examples of OLEM programs at work: Superfund site cleanup and restoration; storage tank management under Oil Spill Program requirements; and assistance to states responding to environmental emergencies.

[1] *U.S. Environmental Protection Agency 2021 Climate Adaptation Action Plan* (EPA 231R21001), October 2021.
[2] *FY 2022-2026 EPA Strategic Plan*, March 28, 2022.

Table 1.1 OLEM Program Operations Addressed in EPA Strategic Plan "Goal 6"

Strategic Objective	Offices	Programs
Clean up and restore land for productive uses and healthy communities	Office of Superfund Remediation and Technology Innovation	**Superfund Remedial Program**: Addresses long-term risks to human health and the environment resulting from releases of hazardous substances at the nation's highest priority non-federally owned sites.
	Federal Facilities Restoration and Reuse Office	**Federal Facilities Program**: Works with federal entities to ensure fast and effective cleanup at federally owned sites and facilitates partnerships among other federal agencies and surrounding communities.
	Office of Resource Conservation and Recovery	**Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) Program**: Implements the CA program directly in 13 states and territories and oversees state regulation at facilities undergoing CAs in 42 EPA-authorized states. Facilities managing hazardous wastes must clean up releases of hazardous waste and constituents as necessary to protect human health and the environment. The program is critical to preventing future Superfund sites.
	Office of Brownfields and Land Revitalization	**Brownfields Program**: Addresses environmental site assessment and cleanup of abandoned and potentially contaminated sites through grants, cooperative agreements and technical assistance to communities, states and tribes. Brownfield sites have potential contamination that needs to be assessed, and in some instances cleaned up, before redevelopment and reuse can occur. These sites generally are less contaminated than Superfund and RCRA corrective action sites.
	Office of Underground Storage Tanks	**Leaking Underground Storage Tank (LUST) Cleanup Program**: Works with state and tribal partners to clean up releases from LUST sites, many of which impact groundwater resources. EPA provides resources to support the infrastructure of state LUST programs and provides regulations, guidance and policy to support cleanup of tank releases.
Reduce waste and prevent environmental contamination	Office of Resource Conservation and Recovery	**RCRA Solid Waste Program**: Encourages states to develop comprehensive plans to manage nonhazardous industrial solid waste and municipal solid waste, sets criteria for municipal solid waste landfills and other solid waste disposal facilities, and prohibits open dumping of solid waste. A core function is to seek and incentivize sustainable ways to manage materials, thereby prolonging the life of materials as usable commodities.
	Office of Resource Conservation and Recovery	**RCRA Hazardous Waste Program**: Issues comprehensive national regulations, defines solid and hazardous wastes, and imposes standards on entities that generate, transport, treat, store or dispose of hazardous waste. The program also monitors movement of hazardous waste across U.S. borders and helps ensure that exported waste is property recycled or disposed of.
	Office of Underground Storage Tanks	**Underground Storage Tank (UST) Program**: Works with state and tribal partners to set and implement standards that prevent and detect releases from USTs. EPA provides resources to support the infrastructure of state and tribal UST programs and provides regulations, guidance and policies to support program implementation.
Prepare for and respond to environmental emergencies	Office of Emergency Management	**Superfund Emergency Response and Removal Program**: Functions as the backbone federal response to emergency events; provides response support to state, local, tribal and potentially responsible parties when their response capabilities are exceeded; and manages risks to human health and the environment. Removal actions are typically responses intended to protect people from threats posed by the release, or threat of release, of hazardous substances into the environment.
	Office of Emergency Management	**Oil Spill Program**: Protects U.S. waters by preventing, preparing for and responding to oil spills. Section 311 of the Clean Water Act and the Oil Pollution Act of 1990 provide EPA with the authority to establish a regulatory program for preventing, preparing for and responding to oil spills that occur in U.S. navigable waters.
	Office of Emergency Management	**EPA Chemical Emergency Preparedness and Prevention Program**: Provides the national regulatory framework to prevent, prepare for and respond to catastrophic accidental chemical releases at U.S. industrial facilities.

Evaluation of potential actions also considered broader goals of EPA's strategic plan, such as:

- Goal 1: Tackle the climate crisis.
  - Objective 1.1: Reduce emissions that cause climate change.
  - Objective 1.2: Accelerate resilience and adaptation to climate change impacts.

Additionally, OLEM considered federal government executive orders, such as:

- Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*.[3]
- Executive Order 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*.[4]

The resulting FY 2022-2023 OLEM climate adaptation implementation plan (CAIP), as outlined herein, will be annually reviewed and updated through 2026.

2. Climate Vulnerability Assessment

OLEM used information in the Fourth U.S. National Climate Assessment[5] to update the 2014 OLEM vulnerability assessment.[6] Information sources used to further evaluate and document climate vulnerabilities of OLEM programs and connected communities as of 2022 included:

- The U.S. EPA Adaptation Resource Center (ARC-X).[7]
- The U.S. Climate Resilience Toolkit Climate Explorer.[8]
- Regional climate change trends documented in site-specific feasibility studies, records of decision and five-year reviews under the Superfund Program.
- Regional climate change trends documented in facility-specific corrective measures under the RCRA program.
- The Federal Emergency Management Agency (FEMA) National Risk Index.[9]
- The federal GeoPlatform[10] and EPA's EnviroAtlas[11] geospatial data sets and associated web-based tools.

OLEM's updated assessment identified additional program vulnerabilities beyond those noted in OLEM's 2014 plan, such as:

- Climate change impacts at currently contaminated lands may limit future land redevelopment.
- Inaccurate, incomplete or outdated information may result in less recognition of local hazards and vulnerabilities affecting sites and adjacent communities.
- Flooding, drought, soil erosion, plant disease and food shortages may be caused and/or enhanced by the impacts of climate change.

As the core of our efforts to build climate resilience into OLEM programs, we seek to ensure that forward-looking climate data are consistently applied in planning and decisions informing site operations.

[3] *Tackling the Climate Crisis at Home and Abroad*, Executive Office of the President, January 27, 2021.
[4] *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, Executive Office of the President, December 8, 2021.
[5] *Fourth National Climate Assessment*, Volumes I and II, U.S. Global Change Research Program, 2018.
[6] *2014 EPA Climate Adaptation Plans*.
[7] Adaptation Resource Center (ARC-X), an interactive resource to help local governments effectively deliver services to their communities even as the climate changes.
[8] The Climate Explorer, which provides interactive graphs and maps showing past and projected climate conditions for counties and county equivalents across the United States.
[9] The National Risk Index, a dataset and online tool to help illustrate the U.S. communities most at risk for 18 natural hazards.
[10] GeoPlatform, which provides public access to federal geospatial data, services and applications.
[11] EnviroAtlas, which provides geospatial data, tools and other resources concerning ecosystem services.

- Solid waste management infrastructure including recycling might be vulnerable to climate-related disruptions, which could affect the disposal or management of waste and recyclable materials (resulting in an accumulation of materials) and limit inputs to products made with recycled material.
- Community infrastructures for sustainable materials management may not have been built for climate resilience, which may result in larger quantities of disaster debris from extreme weather or climate events.
- The frequency and severity of accidental chemical releases and oil spills could increase due to climate change impacts such as more intense flooding or more frequent wildfires.
- Climate change and natural hazard risks need to be considered when developing chemical release and oil spill prevention regulations or issuing or updating policies and guidance materials.
- Tribal nations may require additional assistance in evaluating and addressing climate vulnerabilities.
- Communities with potential environmental justice concerns may require additional engagement, technical assistance or resources to evaluate and address climate vulnerabilities they may face related to the proximity of chemical facilities, contaminated sites, waste management facilities and oil facilities.
- Existing EPA mechanisms to fund state, tribal and territorial grants and programs are unlikely to have provisions concerning climate change.

3. Identification and Measurement of Priority Actions

Since 2014, OLEM completed four priority actions to address certain climate vulnerabilities previously identified (Table 3.1). Ongoing implementation of these actions continues to help the corresponding OLEM programs address the vulnerabilities identified above.

Table 3.1 OLEM Priority Adaptation Actions Completed

Relevant Program	Priority Action	Vulnerability Addressed
All programs	1. Develop technical fact sheets on climate adaptation for the types of sites most vulnerable to climate change impacts (contaminated sediment sites, contaminated waste containment systems, or groundwater remediation systems) (2019).[12]	Projected climate conditions should be used in assessing sites, selecting remediation and containment strategies, and designing and constructing contaminated site cleanups.
Superfund Remedial	2. Provide guidance to EPA regions on approaches to consider when evaluating climate resilience throughout the remedy selection and implementation process for non-federally owned sites proposed or currently listed on the National Priorities List (2021).[13]	Projected climate conditions should be used in assessing sites, selecting remediation and containment strategies, and designing and constructing contaminated site cleanups.
Brownfields	3. Update the "analysis of brownfields cleanup alternatives" language in brownfields grant "terms and conditions" to include a requirement that recipients consider potential changing climate conditions when evaluating cleanup alternatives (2017).	Projected climate conditions should be used in assessing sites, selecting remediation and containment strategies, and designing and constructing contaminated site cleanups.
UST	4. Update or develop guidelines for state, local and tribal authorities to use in the event of a threatened or actual flood or wildfire affecting underground or aboveground storage tanks (2020, 2021).[14]	Remediation and containment strategies and materials used in construction may need to be strengthened to reflect changing climate conditions.

[12] *Climate Resilience Technical Fact Sheet: Contaminated Sediment Sites* (EPA 542-F-19-003), *Climate Resilience Technical Fact Sheet: Contaminated Waste Containment Systems* (EPA 542-F-19-004) and *Climate Resilience Technical Fact Sheet: Groundwater Remediation Systems* (EPA 542-F-19-005).

[13] Memorandum from Office of Superfund Remediation and Technology Innovation to regional Superfund national program managers, June 2021 (applying to non-federal facilities).

[14] *Underground Storage Tank Flood Guide* (EPA 510-B-20-001) and *Wildfire Guide: Preparation and Recovery for Underground and Aboveground Storage Tank Systems* (EPA 510-B-21-001).

In FY 2022-2023 OLEM will initiate six additional priority actions to accelerate climate adaptation in OLEM programs and connected communities (Table 3.2). Identification of priority actions included collaborations with EPA regional offices that carry out program work under relevant statutory and regulatory authorities.

Table 3.2 OLEM Priority Adaptation Actions in FY 2022-2023

Relevant Program	Priority Action	Vulnerability Addressed	Performance Metric and Timeframe
All programs	5. Release the compiled OLEM FY 2022-2023 CAIP.	Agency priority 1: Integrate climate adaptation into programs (addressing multiple specific vulnerabilities).	FY 2022: Release the CAIP in August 2022.
All programs	6. Develop and deliver core adaptation training and identify stakeholder audiences and channels.	Agency priority 1: Integrate climate adaptation into programs (addressing multiple specific vulnerabilities).	FY 2022: Develop climate adaptation training for each of six OLEM offices. FY 2023: Deliver core training (twice) for each of six OLEM offices.
All programs	7. Develop climate adaptation fact sheets on (a) characterization of sites with known or potential contamination and (b) known, recurring non-severe weather and climate adaptation challenges. Additionally, update the existing fact sheet on sediment remedies to include technical guidance specific to evaluating and addressing climate vulnerabilities affecting sediment caps.	Projected climate scenarios should be used in assessing contaminated sites, selecting site remediation and waste containment strategies at contaminated sites, and designing and constructing remedies at contaminated sites.	FY 2022: Develop three fact sheets. FY 2023: Release three fact sheets.
All programs	8. Deploy technical capacity to provide climate vulnerability assessments.	Agency priority 1: Integrate climate adaptation into programs (addressing multiple specific vulnerabilities).	FY 2022: Develop technical capacity. FY 2023: Develop climate vulnerability assessments, targeting one focused assessment plan in each of six umbrella offices to integrate resilience into engagements with communities identified in 2022 vulnerability assessments. FY 2023: Deploy one climate engagement-focused vulnerability assessment plan in each of six umbrella offices.
All programs	9. Expand assessments for newly identified climate vulnerabilities, with a focus on communities located near contaminated or waste management sites, municipal waste management facilities or waste recycling facilities.	Communities with potential environmental justice concerns may require additional engagement and resources to evaluate and address climate vulnerabilities they may face related to the proximity of chemical facilities, contaminated sites, waste management facilities and oil facilities.	FY 2022: Conduct a targeted assessment per program to define areas of vulnerability. FY 2023: Define new priority actions to address vulnerabilities identified in 2022.
RCRA Corrective Action	10. Develop a memorandum that calls for climate change impacts to be considered as part of the remedial investigation, remedy selection, and statement of basis for any necessary corrective action at a RCRA facility.	Projected climate scenarios should be used in assessing contaminated sites, selecting site remediation and containment strategies at contaminated sites, and designing and constructing remedies at contaminated sites.	FY 2023: Release the memorandum.

Anticipated Co-Benefits of OLEM Priority Action Implementation

The primary intent of OLEM's actions is to ensure that consideration of climate change vulnerabilities and adaptation actions, as needed, is integral to the implementation of our mission/programs. Each OLEM program maintains an important internal or external community engagement infrastructure that focuses on communities located near contaminated or waste management sites, municipal waste management facilities or waste recycling facilities. Priority action outcomes shared through OLEM's collective community engagement infrastructure will inform and otherwise benefit affected communities striving to better understand the vulnerabilities and potential adaptation actions at a local level.

A majority of the actions in this CAIP are being developed and implemented in multiple OLEM programs. A significant co-benefit of this approach is the resulting efficiencies and economies of scale, with internal capacity building across all programs. For example, the intramural and extramural resources required to develop or update a single fact sheet are anticipated to benefit all OLEM programs. Other direct co-benefits of this approach involve the sharing of pertinent datasets, technical information and subject matter experts; a capability to customize shared analytical tools; and the leveraging of place-based or general lessons learned across OLEM programs.

As EPA's "land program," OLEM's mission closely links to the current or anticipated use of contaminated lands that are undergoing assessment or cleanup. OLEM anticipates greater collaboration with regional counterparts to assure future climate scenarios are considered in site reuse planning as well as site assessment and cleanup. As a result, certain OLEM priority adaptation actions are anticipated to pave the way for future indirect co-benefits relating to climate change mitigation. For example, OLEM fact sheets increasingly describe and encourage the climate adaptation-mitigation synergies of site remediation or reuse projects involving:

- Development of onsite renewable energy that can help build energy independence while contributing to reductions in greenhouse gas emissions.
- Use of green infrastructure that enhances infiltration of precipitation and requires little or no extrinsic energy.
- Creation of greenspace that can help avoid flood- or wind-related soil erosion while removing atmospheric carbon.

Additional co-benefits of OLEM's priority actions concern the optimized management of waste streams at various scales, and the increased revitalization of urban infill as an alternative to development in greenspace.

Implementation of OLEM program missions depends on extramural funding for financial assistance such as:

- Brownfields grants to communities, states, tribes and others for use in assessing, safely cleaning up and sustainably reusing properties with potential or known contamination.
- Superfund Technical Assistance Grants (TAGs), which provide community groups with funds to contract their own technical advisors to interpret and explain technical reports, site conditions and EPA's proposed cleanup proposals and decisions.
- Multipurpose Grants (MPGs) to states and tribes for discretionary high-priority activities that complement activities funded under established environmental statutes.
- Solid Waste Infrastructure for Recycling (SWIFR) grants, which support improvements to local post-consumer materials management organizations, municipal recycling programs and local waste management authorities working to improve their waste management systems.
- Recycling Education and Outreach (E&O) grants to states, local governments, Indian tribes, nonprofits and public-private partnerships providing education on residential and community recycling programs.

To the extent allowed under existing program authorities and resources, OLEM seeks to encourage financial assistance recipients to leverage these grants and contracts when developing focused plans to help communities assess newly identified vulnerabilities (OLEM priority action 9).

Identification of the OLEM priority actions included collaborations with EPA regional offices, which carry out the program work in accordance with relevant statutory and regulatory authorities. Other anticipated OLEM actions complement actions underway or planned in regional offices, such as:

- Working with the U.S. Geological Survey's National and Regional Climate Adaptation Science Centers.[15]
- Developing geographic information system (GIS)-based capability to provide site- and facility-specific information about projected climate conditions.
- Incorporating flooding- and stormwater-related risk factors into Superfund remedy decisions and five-year reviews.
- Improving public awareness on the links between waste (particularly food waste) and climate change.
- Conducting outreach to state and tribes about the Agency's guidelines for preparing for and recovering from wildfire or flooding events that affect underground or aboveground storage tanks.
- Taking steps to ensure the outcomes of infrastructure investments using Infrastructure Investment and Jobs Act (IIJA) or Bipartisan Infrastructure Law (BIL) funds are resilient to the impacts of climate change.
- Exploring opportunities to integrate climate change considerations into OLEM financial assistance programs in order to expand support for projects that increase climate resilience while delivering co-benefits for public health, the mitigation of greenhouse gases and the reduction of other pollution.
- Promoting the use of green infrastructure, soil amendments, revegetation and other nature-based systems to address conditions such as flooding and urban heat islands at brownfields.
- Expanding OLEM-focused venues and EPA national/regional collaborations that provide opportunities to engage communities with environmental justice concerns, community organizations, and tribes.
- Developing proposed and final regulations to enhance community protections against accidental releases at chemical facilities, including those caused by climate change and other natural hazards.

In addition to measures identified above, OLEM will continue actions such as:

- Working with EPA's Office of Research and Development (ORD) and regional offices to improve climate-related GIS mapping and modeling capabilities at regional and local levels.
- Refining the data and inputs required for models typically used for site-and facility-specific planning.
- Compiling site- and facility-specific examples of measures that have been taken in OLEM-connected communities to increase resilience to extreme weather events and gradually changing conditions on a local level.
- Offering technical assistance grants and services and establishing cooperative agreements that help communities with environmental justice concerns evaluate and address climate vulnerabilities.

OLEM will annually evaluate the progress of each priority action, review associated outcomes such as co-benefits, identify any changes in resource requirements, and assess the status of key partnerships or stakeholder communities. Associated updates to the OLEM CAIP will include identification of priority actions to address vulnerabilities for which specific actions have not yet been defined. Each update also will describe any additional vulnerabilities identified during the previous year. Appendix A describes vulnerabilities identified by the OLEM Climate Resilience Workgroup since FY 2014.

[15] Climate Adaptation Science Centers, a partnership-driven program that teams scientists with natural and cultural resource managers and local communities to help fish, wildlife, waters and lands across the country adapt to changing conditions.

4. Climate Change Resilience Training Plan

To ensure field readiness of OLEM personnel, project stakeholders and connected communities, OLEM will implement a training plan that enhances general and technical knowledge of relevant climate impacts and climate adaptation approaches. The 2022-2023 training plan builds on multiple activities initiated in 2014-2021, with an emphasis on:

- Advancement of OLEM's 2022-2023 priority actions (outlined in Table 3.2).
- Greater collaboration among the OLEM offices responsible for managing and overseeing regulatory programs, to maximize the exchange of new information about technical parameters, shared vulnerabilities, innovative adaptation approaches and lessons learned.
- Increased transferability and synergies of program-specific training components, to maximize return on associated investments.
- Enhanced partnerships with other federal agencies, states, tribes, territories and non-government organizations, to mutually strengthen adaptive capacity while advancing environmental justice. Such partnerships may consider traditional ecological knowledge, unique exposure pathways, cultural considerations and existing climate adaptation plans, as appropriate, from tribes and local communities.

OLEM training will include sessions dedicated to the topic of local impact assessment, including associated modeling. Effective climate modeling requires integration of regional variables such as topography, land cover, land use and complex coastlines. It also requires accurate methods for downscaling global or regional climate models and interpreting the results of modeling.

OLEM's climate adaptation training focuses on conveying information about the following core topics:

1. Vulnerability assessment that includes evaluating the exposure and sensitivity of a facility, system or project to hazards of concern, such as high floodwater, drought conditions or wildfire threats.
2. Identification of adaptation measures that can be taken to increase resilience to climate change.
3. Adaptive capacity that can be built by implementing adaptation measures and periodically reassessing vulnerabilities to determine if additional capacity is needed.

OLEM anticipates training channels such as:

- EPA's annual National Association of Remedial Project Managers (NARPM) meeting.
- EPA's Federal Facilities Academy training series[16] for project managers working on federal facility Superfund sites, as well as periodic offerings of the *Federal Facility RPM* course.[17]
- OLEM's Training Exchange (TRAINEX), a platform for providing training to EPA, other federal, state and tribal personnel responsible for regulatory and enforcement activities relating to solid and hazardous waste cleanup and emergency response.[18]
- The Association of State and Territorial Solid Waste Management Officials.[19]

[16] Federal Facilities Academy.
[17] Federal Facility RPM, a 3-day training course open to federal facility remedial project managers representing federal or state agencies or tribes across the nation.
[18] TRAINEX.
[19] Association of State and Territorial Solid Waste Management Officials (ASTSWMO).

- The Interstate Technology and Regulatory Council.[20]
- Conference venues such as the National Brownfields Training Conference[21] and National Tanks Conference.[22]
- Open-access webinars addressing cross-program or program-specific topics. Each webinar will be designed to share new information or lessons learned gained through other training channels, program developments, or experiences of connected communities.[23]
- ARC-X capacity to publicly share outreach materials such as videos and project descriptions.
- The Tribal Lands and Environment Forum.[24]
- Other OLEM-focused venues and EPA national/regional collaborations that provide opportunities to train communities with environmental justice concerns, community organizations and tribes.

5. Relevant Science Needs

As stated in Executive Order 14008 of January 27, 2021, "We must listen to science – and act." This requires that existing science be utilized to the fullest and that gaps in the science be identified and plans be put in place to fill them. OLEM has identified the need for additional science-based information and tools (Table 5.1) that are needed to ensure climate considerations are incorporated across all OLEM programs and communities and to ensure resiliency against the impacts of climate change already manifested and continuing to intensify.

Relevant science needs include not only technical- and engineering-oriented analytical tools but also researchers and practitioners experienced in planning, behavioral, public health and social science. Assistance from such internal or external personnel will help improve our ability to communicate how the changing climate increases particular risks and to engage communities in efforts to slow or counter those risks and associated hazards.

OLEM anticipates modeling efforts that make greater use of forward-looking data to project vulnerabilities under a range of climate scenarios. This approach is demonstrated at the Malone Services Company Superfund Site in Texas City, Texas, where remedy design and construction planning involved use of National Oceanic and Atmospheric Administration models to analyze storm surge and wave run-up under various hurricane and sea level rise scenarios.

[20] Interstate Technology and Regulatory Council (ITRC), a state-led coalition working to reduce barriers to the use of innovative air, water, waste, and remediation environmental technologies and processes.
[21] National Brownfields Training Conference sponsored by EPA and the International City/County Management Association (ICMA).
[22] National Tanks Conference sponsored by NEIWPCC, a regional commission that helps the states of the Northeast preserve and advance water quality.
[23] As publicized/delivered through EPA venues such as the CLU-IN seminar series and Sustainable Materials Management Web Academy.
[24] Tribal Lands and Environment Forum for environmental professionals from tribes, EPA, other government agencies and community organizations to share knowledge about improving management, protection and restoration of tribal lands.

Table 5.1 Relevant Science Challenges and Needs

Challenges	Needed Information and Tool Development
Ensuring forward-looking climate data are applied in models used to evaluate and mitigate risk at sites and facilities managed or overseen by OLEM.	Updated surface water and groundwater model input data reflecting future changes. Guidance and tools on how facility and community planners can best prepare to address the impacts of climate change on asset location, siting, emergency power, risk overlaps, and response planning.
Understanding and quantifying the effect of soil and groundwater chemistry changes resulting from weather changes and sea level rise.	A better understanding of the effect of increased or decreased salinity of clay caps and liners in covered landfill systems, as well as the effects of increases in ionic strength, precipitation, and water content on clay mineral swelling and shrinking. Data on potential changes in subsurface microbial communities and activity with changes in salinity, to better understand the effects of salt water intrusion on natural attenuation. A better understanding of changes in sorption and cation exchange capacity relating to changes in ionic strength.
Limited ability to evaluate expected changes in groundwater and soil vapor hydrology resulting from short-term or sustained climate changes.	Tools for estimating changing precipitation and sea level rise effects on groundwater flow. Methods to determine if groundwater monitoring wells and sampling plans will be able to adapt to changes in groundwater levels and movement over time. Estimates of contaminant movement and release resulting from hydrology changes. Data on the effect of changing temperature, chemistry, and flow conditions on vapor phase transport and vapor intrusion.
Limited ability to evaluate the effects of changes in ecological conditions on remedy effectiveness and associated exposure risks at contaminated sites.	Data to allow projection of expected changes in plant community and animal populations that may affect site containment, including: • Expected vegetation changes over time. • Potential increases in burrowing fauna and associated effects on terrestrial and aquatic caps. • The potential for changes in plant and animal diseases, including vector control issues.
Limited understanding of the effects of changing temperature on hazardous chemical exposure and uptake and associated effects on humans, plants and animals.	Updated exposure factors data for risk evaluation and management. Updated model inputs to estimate changes in food and water ingestion rates, chemical uptake and depuration, metabolic effects, etc., resulting from temperature increases and other climate-related stressors.
Lack of understanding of climate change impacts on physical and chemical processes associated with soil and sediment erosion, waste submergence, and contaminant behavior at landfills and capping systems at nearshore locations.	Research on the erosion potential and mechanisms for landfill structures and contents. Contaminant release mechanisms and rates during extreme weather events or sustained climate changes. Information on the fate and transport of solid waste and dissolved species as soil and sediment continues to erode. Dissolution and transport rates and mechanisms when contaminated soil is eroded. Estimates of the release of insoluble materials such as micro and macro plastics from eroding landfills and associated inputs to the marine plastic load. Degradation and release of materials containing per- and polyfluoroalkyl substances (PFAS), polychlorinated biphenyls (PCBs) and other persistent, bioaccumulative and toxic (PBT) chemicals. Effects of soil and sediment erosion on local environments and associated bioavailability to local and global ecosystems and human receptors.
Experience in the use of tools for projecting changes in energy regimes in rivers and nearshore sediment sites and associated effects on contaminated materials.	Projective models of precipitation and sea level rise yielding information about future increases or decreases in surface water flow energy and erosion rates that may impact sediment caps or contaminated material left in place.

Challenges	Needed Information and Tool Development
Need to incorporate the social and behavioral aspects of climate change, which may result in changed risk calculations and mitigation approaches.	Information on the effect of climate change on social justice aspects of OLEM programs. Information on how changes in water use, availability and demand may require changes in local and regional groundwater beneficial use designations. Quantification of potential human population changes near sites and facilities managed or overseen by OLEM, which may result in exposure and risk to different segments of society. Effect of population movements resulting from sea level rise, flooding, wildfire or other climate impacts on OLEM sites and connected communities.

6. Partner and Stakeholder Engagement

In 2021 OLEM engaged multiple partners in discussions about climate change vulnerabilities, priorities and actions through venues such as the:

- Federal Remediation Technologies Roundtable, which dedicated its Fall 2021 interagency meeting to the topic of ensuring remedy protectiveness and climate resilience in site cleanups.[25]
- National Environmental Justice Advisory Council, a federal advisory committee to the U.S. EPA.[26]
- Tribal Superfund Working Group efforts to mitigate and adapt to climate change at Superfund sites.[27]
- Northwest Remediation Conference organized by the Northwest Environmental Business Council to exchange information about remediation technologies and science and brownfields redevelopment.[28]
- Open-access Agency webinars on topics potentially influenced by climate change and associated adaptation or mitigation strategies, such as brownfields redevelopment in economically distressed areas,[29] food waste research,[30] optimizing renewable energy reuse on Superfund sites,[31] and ecosystem services benefits and considerations for contaminated mine site cleanups.[32]
- Association of State and Territorial Solid Waste Management Officials 2021 mid-year meeting.[33]
- Quarterly meetings held with other federal agency partners to provide technical assistance for innovative remedial technologies and sustainable redevelopment, including generation of renewable energy.
- Presentations delivered to a range of stakeholders (including cities, counties, territories and tribes) regarding resilience to natural disasters and proper management of natural disaster debris, as described in EPA's *Guidance on Planning for Natural Disaster Debris* (PNDD).[34]

Further development and ongoing implementation of the OLEM CAIP will consider and protect tribal treaty and reserved rights (TTR) by strengthening consultation as well as staff training and by implementing other

[25] Recordings of presentations at the two-part meeting (on November 8 and November 15, 2021), a recap of the November 8 general discussions, and a summary of relevant federal policies, guidance and implementation tools (as of November 8) are available online.
[26] The National Environmental Justice Advisory Council's *Superfund Remediation and Redevelopment for Environmental Justice Communities* report released in May 2021 considers the impacts of climate change and natural disasters on Superfund remedies.
[27] Activities of the Tribal Superfund Working Group are coordinated by Northern Arizona University.
[28] The Northwest Environmental Business Council is a non-profit trade association that represents businesses working to protect, restore and sustain the natural and built environment.
[29] EPA webinar archive: Show Me How: Brownfields Redevelopment in Economically Distressed Areas, November 19, 2021.
[30] EPA webinar archive: Food Waste Research, November 17, 2021.
[31] EPA webinar archive: Superfund Redevelopment Program Webinar Series – Optimizing Renewable Energy Reuse on Superfund Sites, May 6, 2021.
[32] EPA webinar archive: Ecosystem Services – Benefits and Considerations for the Cleanup of Contaminated Mine Sites, September 21, 2021.
[33] Planning for Resiliency and Sustainability of Remedies in a Changing Climate virtual presentation, April 28, 2021.
[34] *Planning for Natural Disaster Debris* (EPA 530-F-19-003), April 2019. EPA archive: Emergency Response Research Webinar Series.

requirements of a September 2021 federal interagency memorandum of understanding regarding TTR.[35] Under the Constitution, treaties with tribal nations are part of the supreme law of the land and establish unique sets of rights, benefits and conditions for the treaty-making tribes who were forced to cede millions of acres of their homelands to the United States in return for recognition of property rights in land and resources and for federal protections. Treaty and reserved rights, including but not limited to the rights to hunt, fish and gather, may be found both on and off-reservation lands.

7. Summary of Actions and Next Steps

OLEM will initiate or continue actions to ensure resilience of its programs and connected communities as the climate continues to change. Most of the 2022-2023 priority actions address climate-related vulnerabilities that are shared among OLEM programs:

- Current and projected climate conditions should be used, as appropriate, to assess sites with suspected or known contamination, select any remediation and containment strategies, and design and construct remedies at contaminated sites to ensure safe future reuses.
- Communities with potential environmental justice concerns may require additional engagement, user-friendly tools, and resources to evaluate and address climate vulnerabilities they may face due to their proximities to chemical facilities, contaminated sites, waste management facilities or oil facilities.
- Training on the core components of climate adaptation is needed to assure use of a consistent science-based approach across OLEM programs and to facilitate adaptation in connected communities.
- Outreach materials such as technical fact sheets and related case studies are needed to share lessons learned and new information across OLEM programs and connected communities.
- OLEM technical assistance may be needed to assess climate vulnerabilities at specific sites or facilities.

OLEM's Climate Resilience Workgroup will continue to work with OLEM management and staff to track action progress, potentially refine actions, and document any climate vulnerabilities not yet identified. OLEM anticipates updating its CAIP on an annual basis and making each update publicly available online.[36]

[35] Memorandum of Understanding Regarding Interagency Coordination and Collaboration for the Protection of Tribal Treaty Rights and Reserved Rights. Tribal treaty rights have the same legal force and effect as federal statutes and should be integrated into and given the fullest consideration throughout EPA's collective work. Reserved rights are the rights tribes retain that were not expressly granted to the United States by tribes in treaties.

[36] Office of Land and Emergency Management information supporting EPA's Climate Adaptation Plan.

Appendix A: Climate Vulnerabilities Identified Since Fiscal Year 2014

The OLEM Climate Resilience Workgroup's updated climate vulnerability assessment of OLEM core programs included the following areas for which specific priority actions were not identified in 2022. OLEM anticipates defining additional actions to address these vulnerabilities in the 2023-2026 updates to the OLEM CAIP.

Area	Vulnerabilities
Restoring Land	The environmental hazards and cleanup costs at vacant and underutilized lands may increase under future climate conditions. Such increases may reduce the likelihood of market-driven cleanups at these lands and reduce the availability of land for redevelopment, hence putting increased pressure on greenspace.
Emergency Response	The frequency and severity of accidental chemical releases and oil spills could increase due to climate impacts.
Municipal Waste and Materials	Flooding, drought, soil erosion, plant disease and food shortages may be caused and/or enhanced by the impacts of climate change. Solid waste management infrastructure might be vulnerable to climate-related disruptions that could affect the disposal or management of waste and recyclable materials. This may result in an accumulation of materials and limit inputs to products made of recycled material. Consideration of these vulnerabilities may be incorporated in OLEM projects being stood up in response to new federal line-item funding authorized in the 2021 BIL. Constructed horizontal and vertical structures existing in many communities may not be resilient to new and increased risks caused by a changing climate, which may result in larger quantities of debris associated with extreme weather events or sustained climate changes. This also may impact sustainable materials management in many communities.
Vulnerable Communities	Tribal nations may require assistance in evaluating and addressing climate vulnerabilities.
State Grants and Program Funding	Existing state grant and program funding mechanisms do not have provisions related to climate change. Underlying funding agreements do not require authorized states to consider the increasing impacts from climate change or factor climate change conditions into their program priorities at the state and local levels.