

Conducting Climate Vulnerability Assessments at Superfund Sites: Lessons Learned

Nov 14, 2023 Webinar

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Disclaimer: The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency



Agenda

Introductions & Acknowledgements

Overall Agency and Superfund Guidance

Core Climate Concepts

Assessing Climate Change and Remedy Vulnerabilities at NPL Sites

Lessons Learned Regarding Adaptation Measures for Increased Protectiveness Resilience

Presentation of the Issue Paper

Moderated Discussion

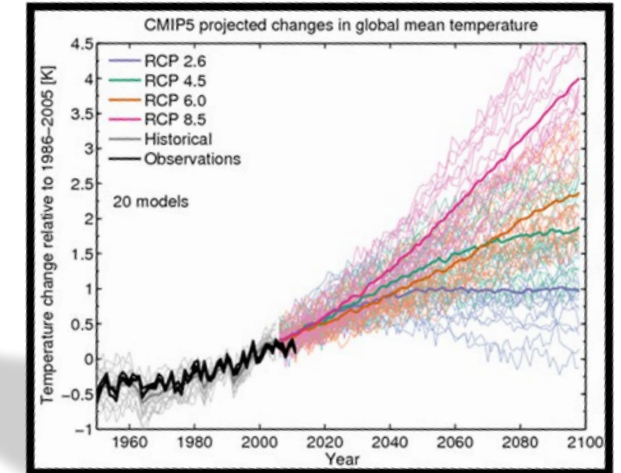
This webinar focuses on climate change adaptation

Climate Change Adaptation: *How is the Superfund Program incorporating climate change science into the implementation of remedies?*

The focus of today's webinar

Climate Change Mitigation: *How can we minimize GHG emissions generated by site cleanups?*

A key focus of green remediation practices



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Climate Change Resilience in Superfund: Overview

The screenshot shows the EPA website's Superfund section. At the top, the EPA logo and 'United States Environmental Protection Agency' are visible, along with a search bar. A navigation bar includes 'Environmental Topics', 'Laws & Regulations', 'Report a Violation', and 'About EPA'. The main content area is titled 'Superfund' and features a sidebar with links: 'Superfund Home', 'Learn About Superfund', 'Community Involvement', 'Cleanup Support' (highlighted), 'Training and Learning Center', 'Superfund Climate Resilience' (highlighted), 'Superfund Green Remediation', 'Superfund Cleanup Optimization', 'Natural Resource Damages', 'Superfund Remedial Program in Indian Country', 'Accomplishments & Benefits', 'Cleaning up Sites', 'Contaminants at Superfund Sites', and 'Contaminated Media at Superfund Sites'. The main article is titled 'Superfund Climate Resilience' and discusses the program's approach to climate change. It includes a 'Resilience Framework' sidebar with links to 'Vulnerability Assessment', 'Resilience Measures', and 'Adaptive Capacity'. Another sidebar, 'Strengthen the Nation's Forests and Economies', mentions an Executive Order from April 27, 2022, with the number 14072.

EPA United States Environmental Protection Agency

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Superfund CONTACT US

Superfund Home

Learn About Superfund

Community Involvement

Cleanup Support

Training and Learning Center

Superfund Climate Resilience

Superfund Green Remediation

Superfund Cleanup Optimization

Natural Resource Damages

Superfund Remedial Program in Indian Country

Accomplishments & Benefits

Cleaning up Sites

Contaminants at Superfund Sites

Contaminated Media at Superfund Sites

Superfund Climate Resilience

Remedies at contaminated sites may be vulnerable to the impacts of climate change and extreme weather events. EPA's Superfund program developed an approach that raises awareness of these vulnerabilities and applies climate change and weather science as a standard operating practice in cleanup projects. The approach involves periodic screening of Superfund remedy vulnerabilities, prioritizing the Superfund program's steps to adapt to a changing climate, and identifying measures to assure climate resilience of Superfund sites.

This Web page provides an overview of climate-related initiatives within the Superfund program and shares information about strategies that can be used to evaluate and strengthen climate resilience at Superfund sites. This information does not impose legally binding requirements on EPA, states, tribes or the regulated community, and does not alter or supersede existing policy or guidance for the cleanup of contaminated sites. EPA, other federal, state, tribal and local decision-makers retain discretion to implement climate adaptation measures on a case-by-case basis.

Climate Adaptation at Superfund Sites

In 2021, the U.S. EPA Office of Land and Emergency Management (OLEM) issued a directive recommending approaches to consider

Resilience Framework

Components:

- [Vulnerability Assessment](#)
- [Resilience Measures](#)
- [Adaptive Capacity](#)

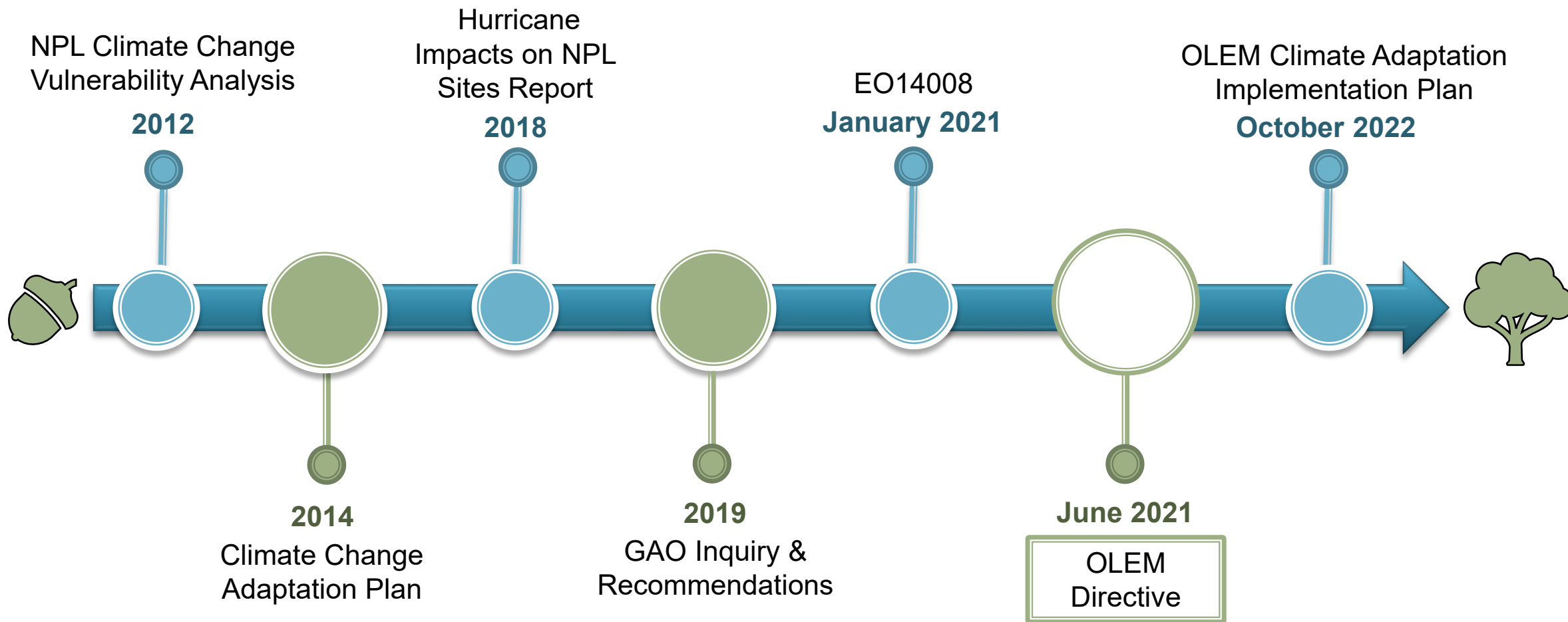
Strengthen the Nation's Forests and Economies

April 27, 2022, Executive Order 14072 sets policy on

<https://www.epa.gov/superfund/superfund-climate-resilience>



Evolution of Climate Resilience in the Superfund Program



Superfund OD Climate Adaptation Memo to the Regions ('21)

- ◆ Memo addressed to EPA regional division directors from OSRTI office director on June 30, 2021
- ◆ Content of the memo:
 - » Reiterates key authorities covering climate resilience efforts
 - » Outlines approaches ensuring resilience
 - » Identifies tools and information available for RPMs
 - » Defines technical support available to Superfund RPMs seeking to conduct climate vulnerability assessments of cleanup projects
- ◆ HQ is expanding its existing optimization/tech support to include climate assessment tech support
 - » CVA lessons learned are based on the approximately 26 CVAs underway or completed to date



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

June 30, 2021

OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

OLEM Dir. No. 9355.1-120

MEMORANDUM

SUBJECT: Consideration of Climate Resilience in the Superfund Cleanup Process for Non-Federal National Priorities List Sites

FROM: Larry Douchand, Director Douchand, Larry
Office of Superfund Remediation and Technology Innovation

TO: Regional Superfund National Program Managers, Regions 1-10

PURPOSE

This memorandum¹ recommends approaches for U.S. Environmental Protection Agency (EPA or Agency) regions to consider when evaluating climate resilience throughout the remedy selection and implementation process for sites proposed or currently listed on the National Priorities List (NPL) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA).²

Consideration of climate resilience in the Superfund cleanup process should be carried out in a manner consistent with CERCLA as well as the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)³ and EPA policy and guidance documents. This memorandum⁴ supplements the Agency's existing policy statements addressing climate resilience activities, tools, considerations and technical information found in fact sheets;⁵ however, it does not amend or modify the NCP in any way. Consideration of climate resilience should not be treated as a new criterion under 40 CFR §300.430(e)(9)(iii).

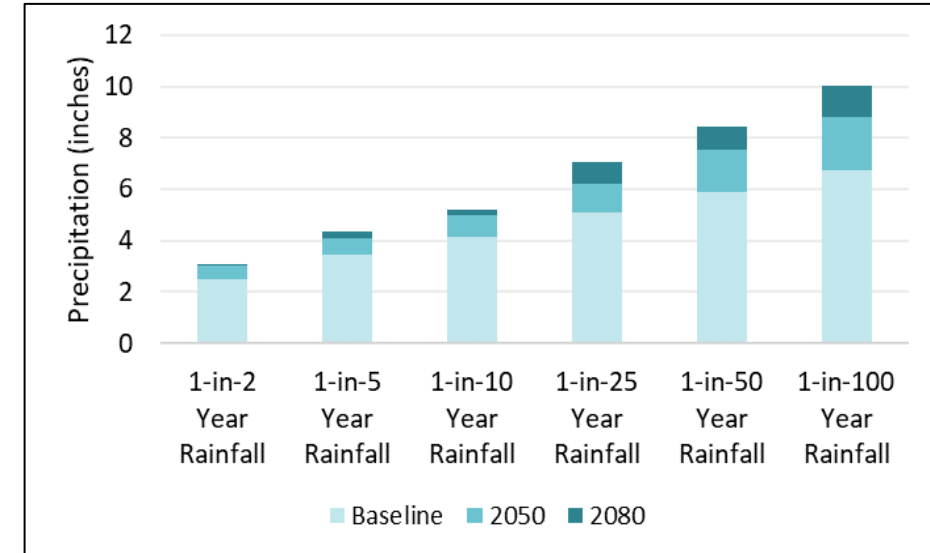
Basin Question Driving Superfund Climate Adaptation

How is climate change likely to affect the protectiveness of my remedy, and what actions do I need to take to ensure its resilience under future climate conditions?

The Climate Change Question

- ◆ Climate is already factored into our decision-making process; the key questions are:

- » What does a forward-looking climate analysis tell us about future conditions at our site?
- » What is the “delta” over current conditions?
- » How does that delta affect remedy decisions, site operations, etc.?



LOCA downscaled precipitation projection data (Pierce et al, 2014); RCP 8.5, 90th percentile model values

- ◆ The challenge for the site team is to determine whether remedy protectiveness may be in jeopardy under future climate conditions.

2022 EPA Climate Adaptation Implementation Plan

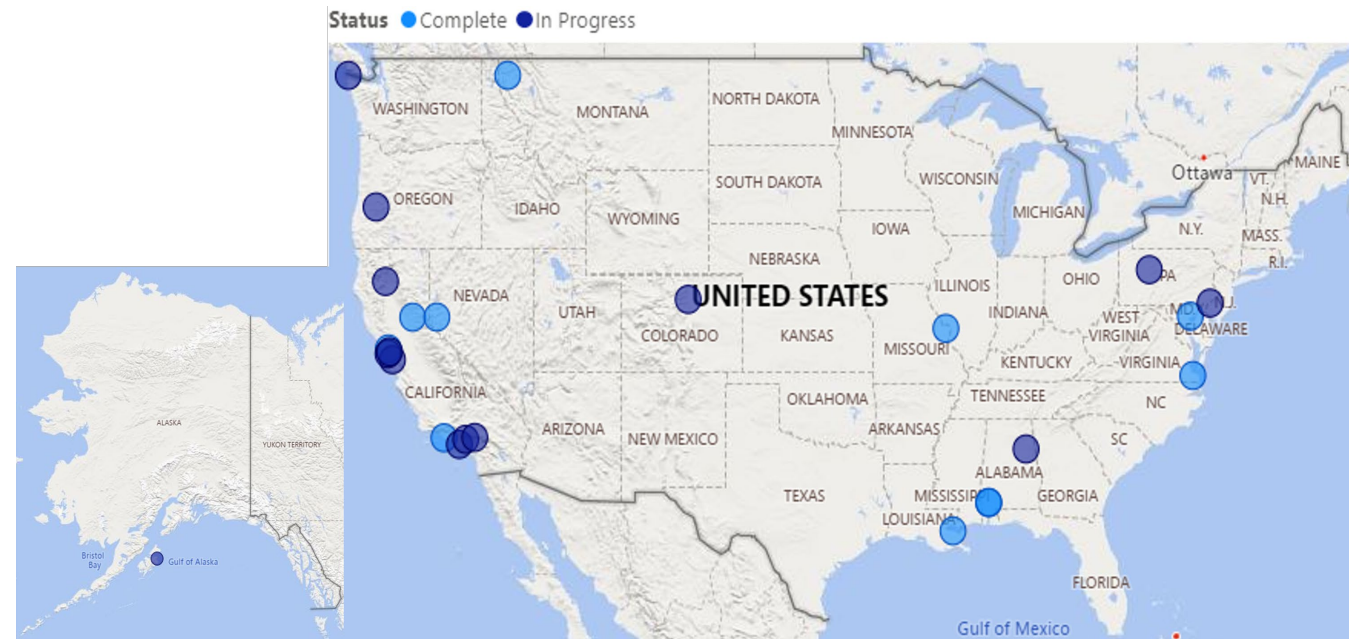
Highlights & Themes Across Regional Climate Adaptation Implementation Actions

Climate vulnerability assessments are a common priority action across regions*

Common Themes	Frequency in Regional Plans
Develop and/or utilize existing tools to assess climate vulnerabilities at remedial sites and identify/implement adaptation measures for new and existing remedies.	5
Develop and/or utilize regional climate vulnerability mapping tools to evaluate remedial sites for potential climate driven risks.	5
Incorporate climate resilience into the remedy selection and five-year review process and develop standard language for inclusion in administrative documents (FS, RODs, FYRs).	4
Mitigate impacts of climate change by implementing Green Remediation best practices at sites.	4
Assess regional resources and expand interagency partnerships to support disaster mitigation activities in communities, sites and facilities most at risk of climate-related impacts.	3
Provide training for regional staff and stakeholders on principals of climate change adaptation and available tools/resources.	2
Ensure climate resiliency considerations incorporate environmental* justice concerns.	2

Superfund Engineering Forum (EF) CVA Issue Paper

- ◆ EF goal is to foster exchange of up-to-date information related to engineering remediation issues at Superfund and RCRA sites.
- ◆ The Engineering Forum has been involved in green remediation and climate adaptation for over 14 years
- ◆ The EF CVA Issue Paper summarizes lessons learned in performing CVA at 26 sites (through FY23)
- ◆ The Superfund Program anticipates a follow up report in mid 2024 summarizing the findings of the first batch of CVAs
- ◆ The CVA Issue Paper contributes to meeting OLEM's objectives in the 2022 Climate Adaptation Implementation Plan



CVAs completed or in progress through FY23

Performing a Climate Screening

Identify Changes in Climate

- Identify *potential* future climate exposures using publicly available screening tools

Consider the Remedy

- Determine timeframe of planned or constructed remedies
- Assess sensitivity of remedies to climate hazards projected to change

Review Results

- Conclude that results indicate the remedy will continue to be protective; OR
- Determine that more information and analysis is required, and request a CVA

Components of a CVA

CLIMATE VULNERABILITY ASSESSMENT COMPONENTS

Exposure

Sensitivity

Adaptive
Capacity

CLIMATE VULNERABILITY ASSESSMENT PILOTS AT SUPERFUND SITES

Engagement
and Scoping

Climate
Exposure

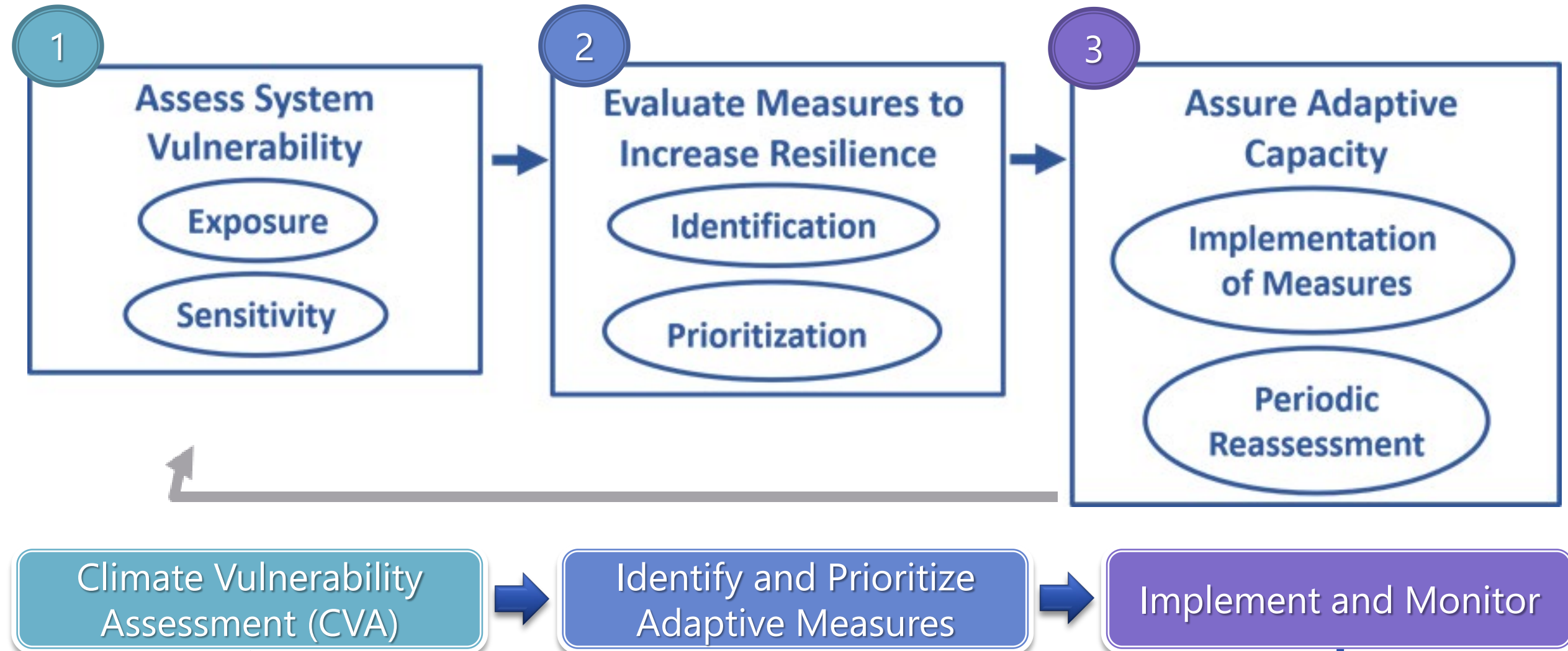
Remedy
Sensitivity &
Vulnerability

Identify
Adaptive
Measures

Draft
Findings

Final Report

The Climate Resilience Framework at Superfund Sites



Poll Question

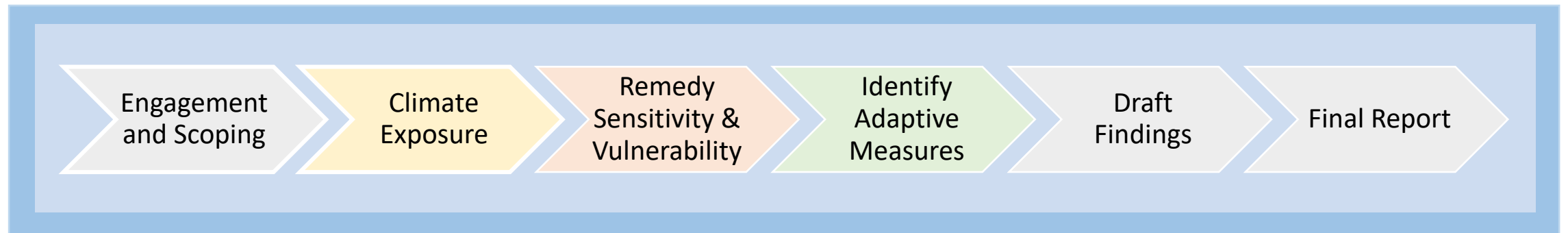
- ◆ **What is your greatest challenge when addressing climate concerns for your site?**
 - » Knowing the right climate data to use
 - » Projecting future climate conditions for my site (i.e. knowing what criteria to use for the various climate exposures)
 - » Applying climate exposure findings to my site and understanding the remedy sensitivities
 - » Developing and implementing adaptive measures scaled to the climate hazard
 - » Other



Questions

Process for Assessing Climate Change and Remedy Vulnerabilities at NPL Sites

CVA Process Used at Superfund Sites



Step 1: Engagement and Scoping

◆ **What sites need a CVA?**

- » Screening determined additional analysis is needed
- » Remedies in a climatologically dynamic environment
- » Documentation of remedy resilience needed to address community or other site stakeholder concerns

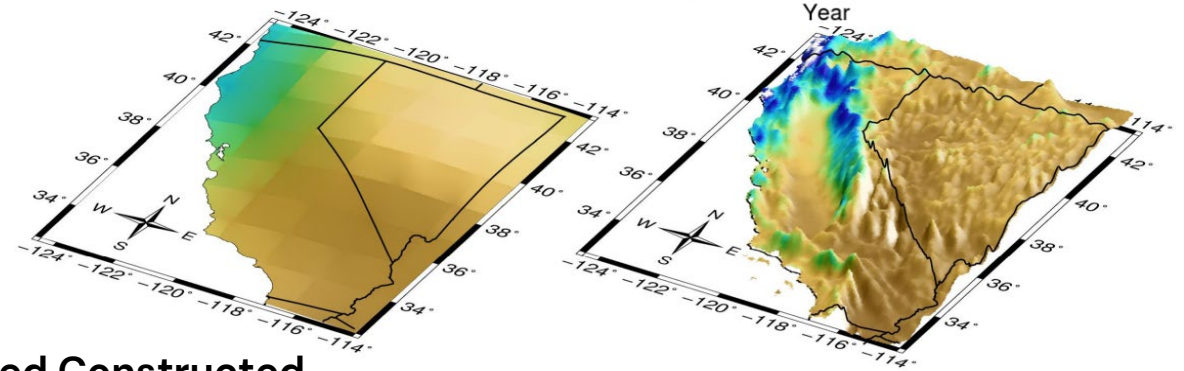
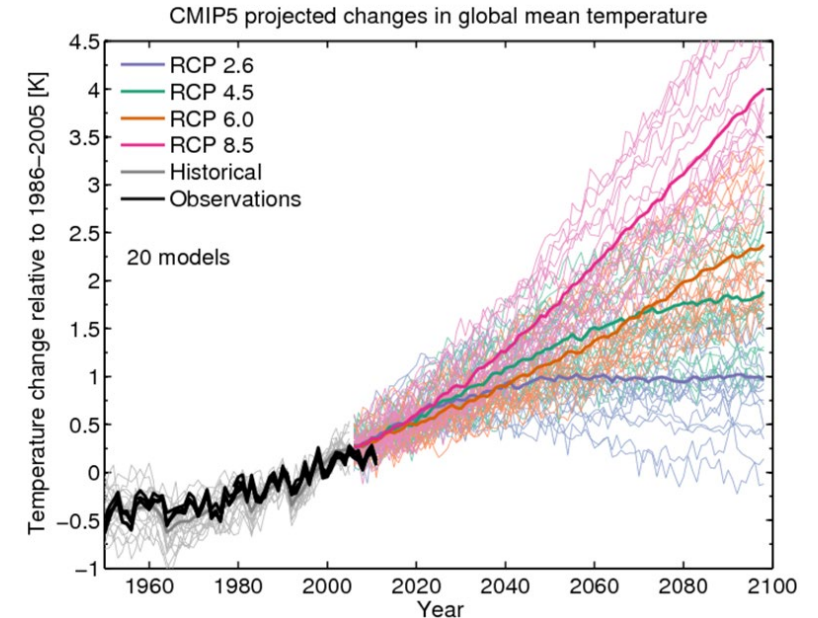
◆ **Focus of assessment tailored to site needs**

◆ **Participation in the CVA**

- » Independent climate and remediation experts
- » Site manager
- » Regional technical staff

Step 2: Climate Exposure

- ◆ Identifies projected changes in climate conditions at the site level
- ◆ Consider
 - » Timeframe
 - » Climate Projection Scenarios
 - » Data Sources
 - » Climate Hazards
 - » Output of the Analysis



D. Pierce, SIO

Poll Question

◆ What climate hazards are a concern for contaminated sites you have worked on?

- » Temperature
- » Precipitation/Drought
- » Sea Level Rise
- » Inland Flooding
- » Wildfire
- » Other

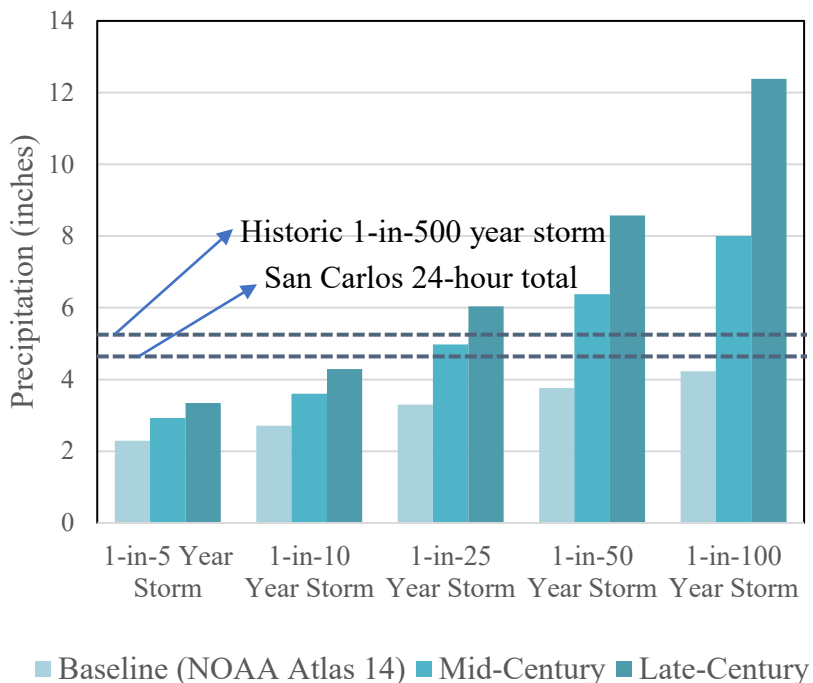


Example Forward-Looking Climate Variables and Data Sources

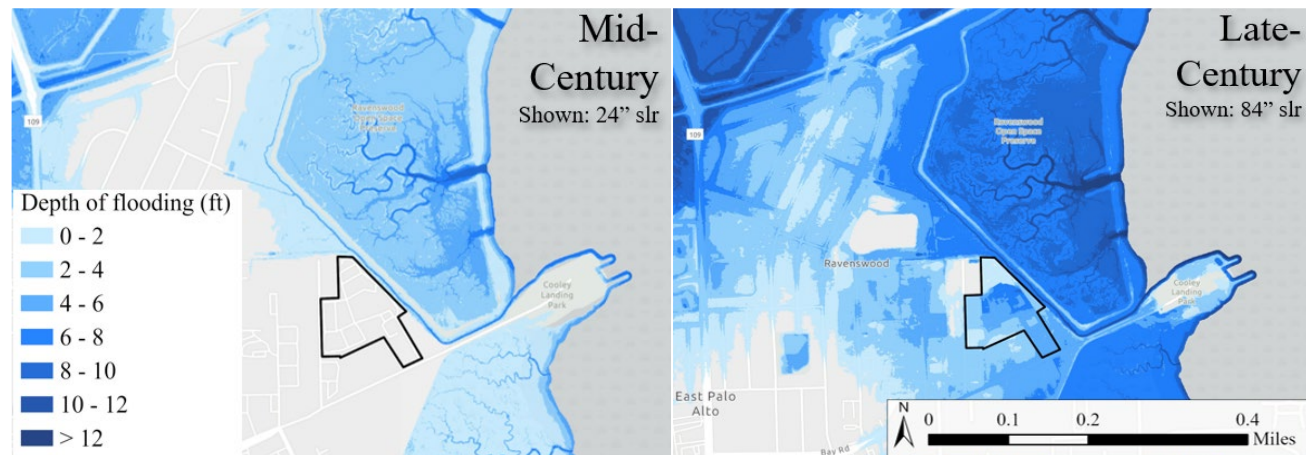
Hazard	Variable	Example Data Sources
Temperature	Number of days above 95°F	LOCA downscaled temperature projection data
	1-in-10-year temperature	LOCA downscaled temperature projection data
Precipitation	Average total monthly precipitation	LOCA downscaled precipitation projection data
	Largest annual five-day precipitation event	LOCA downscaled precipitation projection data
	Return period storms	LOCA downscaled precipitation projection data NOAA Atlas 14 Precipitation Frequency Data
Drought	Consecutive dry days	LOCA downscaled precipitation projection data
Sea level rise	Sea level rise extent	NASA Interagency Sea Level Rise Scenario Tool
		NOAA Sea Level Rise Viewer
Storm surge	Storm surge depth	Coastal Storm Modeling System (CoSMoS) U.S. Geological Survey (usgs.gov)
Wildfire	Wildfire danger days	Climate Mapper MACA v2 METDATA downscaled projections for 100-hour fuel moisture

Example Climate Exposure Analysis

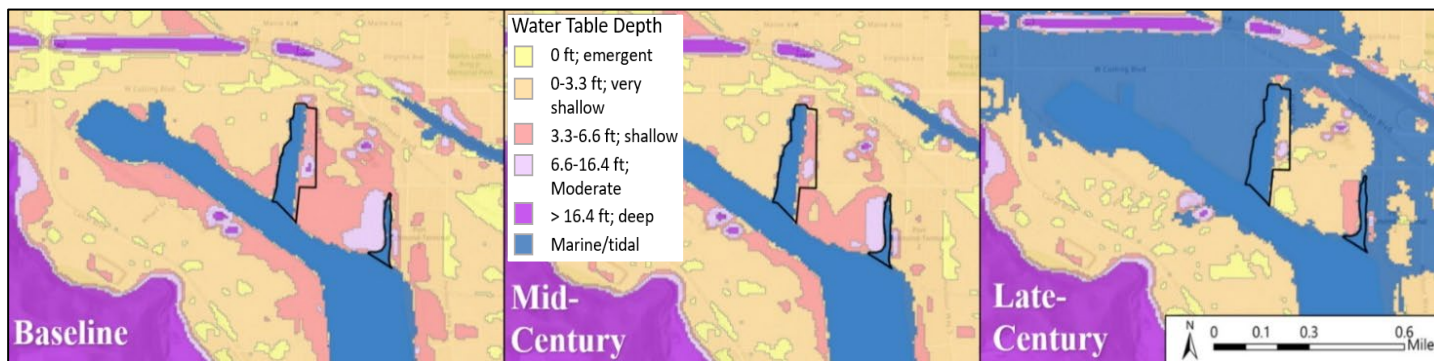
Baseline and Future Projected 24-Hour Storm Intensity for Various Return Intervals



Future Sea Level Rise



Baseline and Future Water Table Depth



Step 3: Remedy Sensitivity & Vulnerability

◆ **Sensitivity:** the degree to which a climate hazard impacts remedy protectiveness

		Remedy Vulnerability		
		High	Med	Low
Climate Exposure	High			
	Med			
	Low			
		Low	Med	High
		Remedy Sensitivity		

◆ **Vulnerability** is the intersection between climate exposure and remedy sensitivity

Examples of Vulnerabilities

Vulnerability	Potential Impacts to Remedy Protectiveness
Increases in extreme precipitation at site with leachate treatment system	System capacity designed for historic 100-year storm event may no longer be protective during such storm events in the future
Increases in wildfire hazard and heavy precipitation at mountainous site with above ground infrastructure	Damage to groundwater pump and treat system results in loss of plume capture

◆ Also consider

- » Relevant climate projection timeframe
- » Impacts to ancillary systems, as necessary

Step 4: Adaptation Measures

- ◆ **Significant redundancies already designed into Superfund remedies**
- ◆ **CVA should:**
 - » Identify existing adaptation measures
 - » Evaluate adaptive capacity of existing measures to climate projections
 - » Assess options and considerations for additional measures to ensure remedy protectiveness



Groundwater treatment plant and storage tanks, constructed on elevated land outside of 500-year floodplain, avoided floodwaters in 2021.

◆ Presentation of preliminary findings to site team

- » Discuss climate exposure analysis, remedy vulnerabilities
- » Site team provides feedback on initial findings

◆ CVA Report

- » Prepared for site manager
- » Designed to assist in activities relevant to cleanup phase

CVA Report Structure

- *Executive Summary*
- *Introduction*
- *Site Background*
- *Climate Exposure*
- *Remedy Vulnerability and Resilience*
- *References*
- *Appendix*

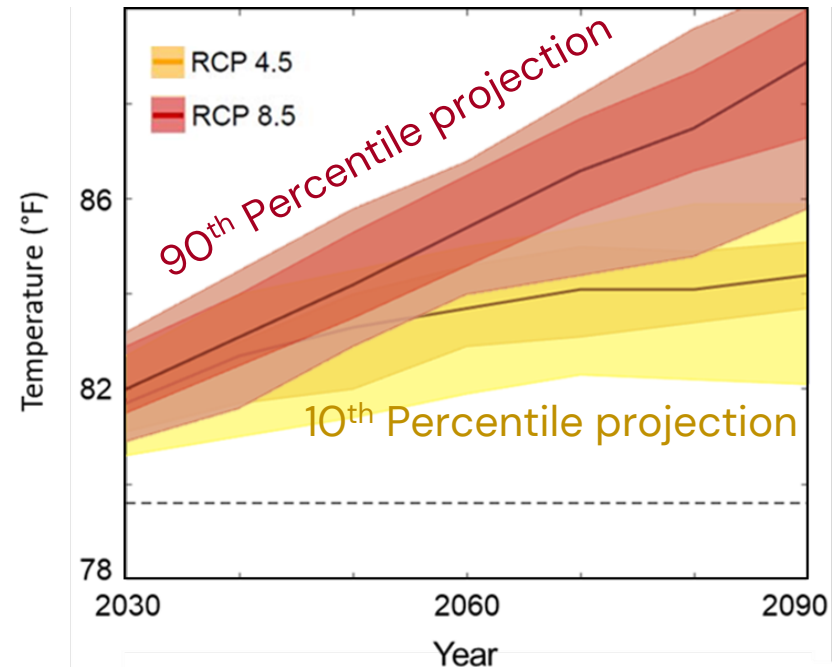
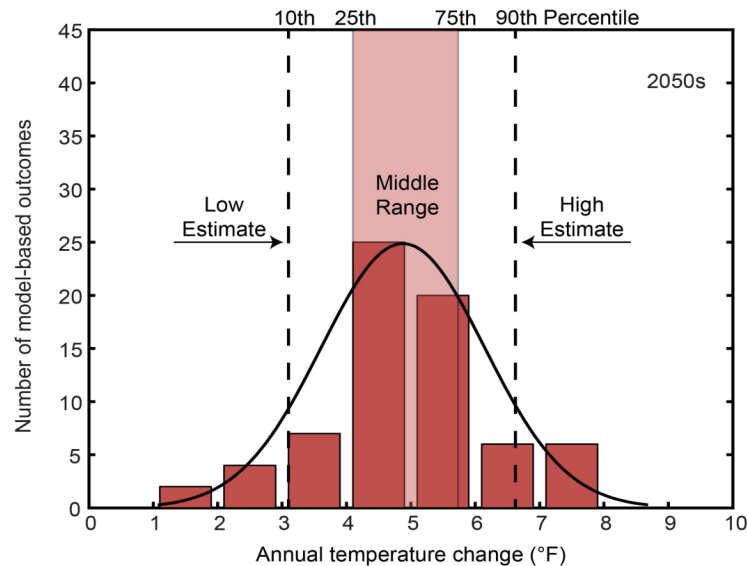
Questions

Climate Adaptation in the Superfund Program

Lessons Learned

Climate Exposure Analysis

- ◆ Use of high-emissions scenarios to determine vulnerability
- ◆ Understand climate projection distribution to support risk-based decision-making



Documentation of Results

◆ **Communication of technical results**

- » Distill climate data into meaningful results for a site
- » Address specific impacts climate change may have on remedy protectiveness
- » Provide considerations for improving adaptive capacity

◆ **Benefits to documenting vulnerabilities and adaptive capacity**

- » Inform next steps in site strategy and incorporate into CSM
- » Use in negotiations with responsible parties
- » Assist in community outreach

CVA's Can Inform Decisions Throughout the NPL Process

Processes	Example Actions the CVA Findings/Considerations may Inform
Investigation and Assessing Alternatives	Address concerns regarding the long-term protectiveness of the remedial alternatives considered during the investigation and feasibility study
Remedy Selection	Identify known vulnerabilities for remedies selected in decision documents and provide considerations on how to address them in design
Remedy Design	Ensure specific adaptation measures are incorporated into the design to provide resilience to future climate impacts
Remedy Operation	Evaluate the remedy during periodic reassessment and implement adaptation measures as needed to ensure long-term protectiveness; evaluate future reuse options for the site
Community Engagement	Provide documentation of existing remedy resilience and plan for proactively addressing vulnerabilities to future climate conditions

Key Takeaways



Do not reinvent the wheel.

Climate Tools are Available.

Help is available to assist with finding the best fit to meet a site's needs.



It is never too early or too late to conduct a CVA.

CVAs have helped RPMs from RI/FS to FYRs. However, we have found that **RI/FS (pre-remedy decision)** is a "sweet spot".



CVA findings may not be "game changers".

But they will **substantiate trends and provide data and rationale** to inform future adaptation decisions and site actions.




Vulnerability analyses can identify adaptation measures already in place.


These measures may not have been previously identified as "adaptation".

Engineering Forum Issue Paper

- ◆ *Conducting Climate Vulnerability Assessments at Superfund Sites*
- ◆ Focuses on the CVA process
- ◆ Summary of CVA outcomes will be released in 2024
- ◆ See profiles of climate adaptation measures at Superfund sites at:
- ◆ <https://www.epa.gov/superfund/superfund-climate-resilience>

 United States Environmental Protection Agency EPA 542-R-23-002
November 2023

Engineering Forum Issue Paper



The groundwater treatment plant and storage tanks at the American Cyanamid Superfund site, constructed on elevated land outside the 500-year floodplain, avoided floodwaters in 2021. Photo Credit: Mark Schmitt.

Conducting Climate Vulnerability Assessments at Superfund Sites

Contents	
1. Purpose	<p>“The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes; it is a function of the character, magnitude, and rate of climate variation to which a system is exposed; its sensitivity; and its adaptive capacity.”</p> <p>— U.S. Environmental Protection Agency, 2021 https://semspub.epa.gov/work/HQ/100002993.pdf</p> <p>1. Purpose</p> <p>The U.S. Environmental Protection Agency (EPA) Office of Superfund Remediation and Technology Innovation (OSRTI), in collaboration with the Technical Support Project (TSP) Engineering Forum, developed this issue paper to document the lessons learned in conducting climate vulnerability assessments (CVAs) at sites on the National Priorities List (NPL). While developed for Superfund, this process is program neutral and may be used as a guide for performing CVAs at contaminated sites managed under other cleanup programs. Vulnerability assessments may be performed at all site types, by all site leads and at all stages of a cleanup. This issue paper may be used by all stakeholders wanting to replicate the CVA process applied in the Superfund Remedial Program.</p>
2. Background	
3. Performing a Climate Screening	
4. Climate Vulnerability Assessment	
5. Summary	
6. Acknowledgements	
7. Notice and Disclaimer	
8. Selected Resources	
9. Cited References	
Appendix A. Determining if a Climate Vulnerability Assessment Is Needed at Your Site	
Appendix B. Previous Efforts Related to Climate Change and Adaptation	

The Technical Support Project Engineering Forum Issue Papers provide information on remediation technologies or technical issues of interest. The information is not guidance or policy.

Discussion

Climate Change Adaptation Pop Quiz

	True	False
1. Under CERCLA there is no need to consider climate change vulnerabilities.		F
2. My site cleanup schedule shows we will achieve unlimited and unrestricted site use within three years. I should complete a CVA ASAP.		F
3. I should be able to task my site contractor to perform a CVA	T	
4. Professional judgement is a necessary part of interpreting a CVA report.	T	
5. A CVA is a robust method to predict precipitation intensities and when extreme storms will happen.		F
6. CVA analyses generally results in the site Team having to change the remedy and issue an Amended Record of Decision.		F
7. If a climate vulnerability screening done as part of a FYR indicates a possible remedy protectiveness vulnerability, we might require a CVA be conducted before the next FYR.	T	