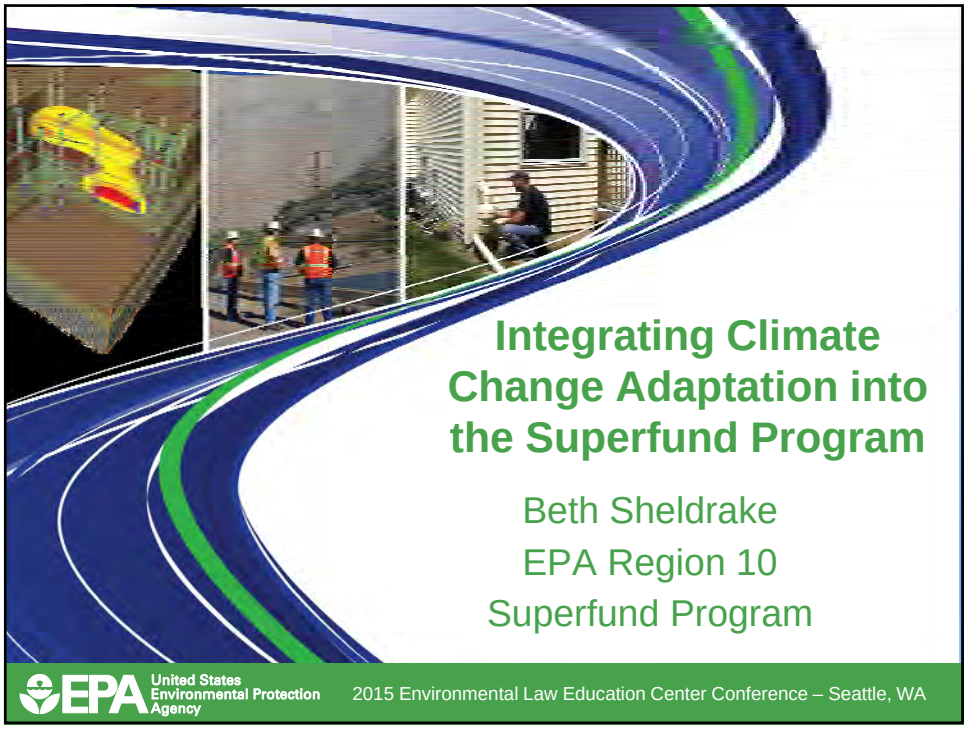


Integrating Climate Change Adaptation into the Superfund Program

Beth Sheldrake
EPA Region 10
Superfund Program

United States Environmental Protection Agency

2015 Environmental Law Education Center Conference – Seattle, WA

Why Address Climate Change?

- EPA's human health and environmental protection mission
- One of EPA's top priorities
- Presidential Executive Order 13653
- Extensive investments in Superfund remedies

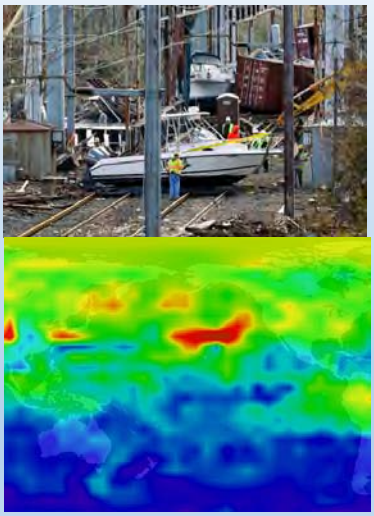


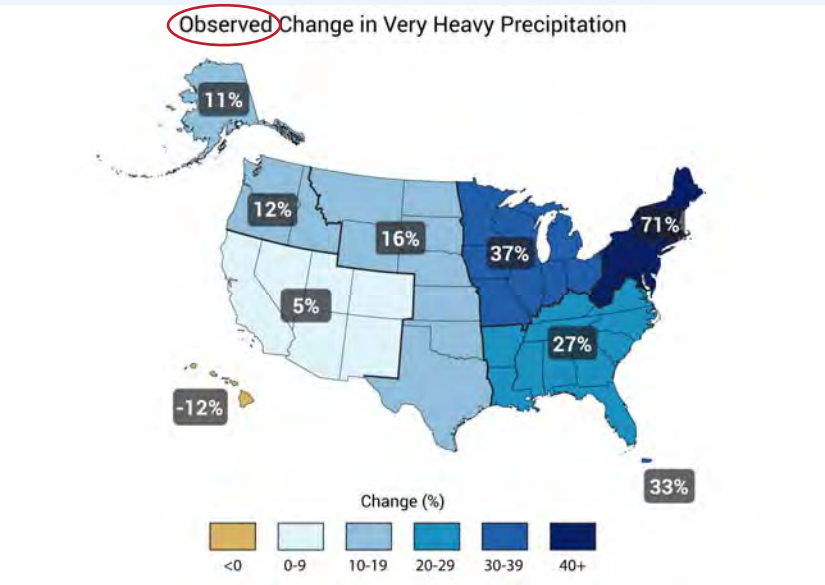
Image credit: U.S. Global Change Research Program (www.globalchange.gov).

Climate Change Impacts

Key potential climate change impacts agreed upon by climate experts and included in EPA's Climate Change Adaptation Plan are:

Increased extreme temperatures	Sustained changes in average temperature	Sea level rise
Decreased permafrost in Arctic regions	Decreased precipitation days, increasing drought intensity	Increased heavy precipitation events
Increased flood risk	Increased frequency and intensity of wildfires	Increased intensity of hurricanes

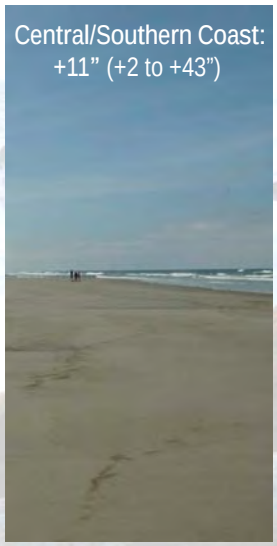
Image credit: U.S. Global Change Research Program (www.globalchange.gov)

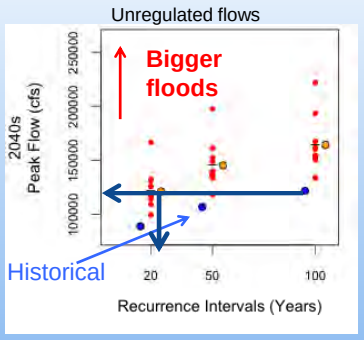


Source: 2014 National Climate Assessment

Washington State Sea Level Rise *(Mote et al. 2008)*

Medium (w/range) estimates of sea level rise in Washington for **2100:**



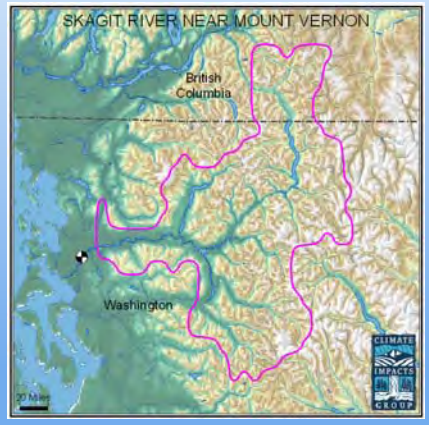


Not enough reservoir space to eliminate this risk

By the 2040s:

- the historical 100-year event becomes a 22-year event

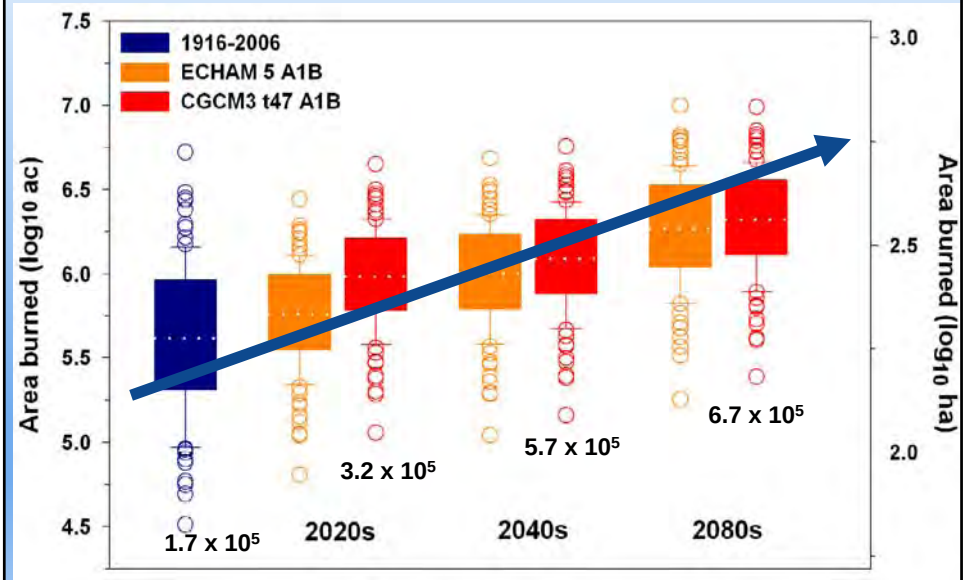
Projecting Changing Flood Risk



Skagit River at Mt Vernon

Data source: CIG, http://warm.atmos.washington.edu/2860/

WA: Prediction of Future Area Burned
Source: Littell et. al, 2013



Potential Issues/Concerns at Superfund Sites

- Past may not (likely doesn't) predict the future
- Older remedies may not fully consider our changing climate
- Many remedies in place for a long time
- Standard engineering or construction practices may no longer be appropriate

National Remedy Vulnerability Analysis

Common Remedy Types*	Climate Change Scenarios							
	Flooding (Event)	Inundation (Chronic)	Extreme Storms	Large Snowfall	Wild Fires	Drought	Extreme Heat	Landslide (Precip)
Source In Situ								
SVE								
Solidification/Stabilization*								
In Situ Thermal Treatment								
Multi-phase Extraction								
Bioremediation								
Source Ex Situ								
Solidification/Stabilization*								
Physical Separation								
Recycling								
Surface Water Treatment								
Unspecified Off Site Treatment								
On-site Containment								
Groundwater In Situ								
Bioremediation								
Chemical Treatment								
Air Sparging								
Permeable Reactive Barrier								
Groundwater Ex Situ								
P&T								
Vertical Engineered Barrier								
Monitored Natural Attenuation								

Qualitative Vulnerability Analysis

No known potential impacts

Minor impacts: Potential for temporary loss of remedy functionality or effectiveness, contaminant(s) remain contained

Moderate impacts: Potential for total loss of remedy functionality and effectiveness indefinitely, contaminant(s) remain contained

Major impacts: Potential for total loss of remedy functionality and effectiveness indefinitely, contaminant(s) release

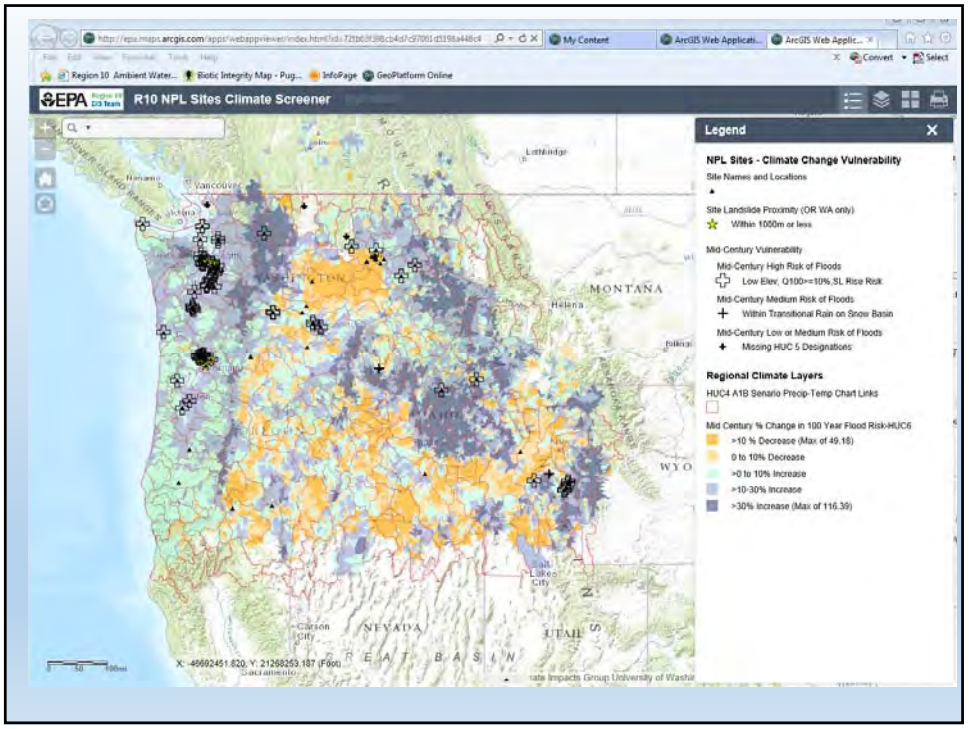
* Most common remedy types based on Superfund Remedy Report

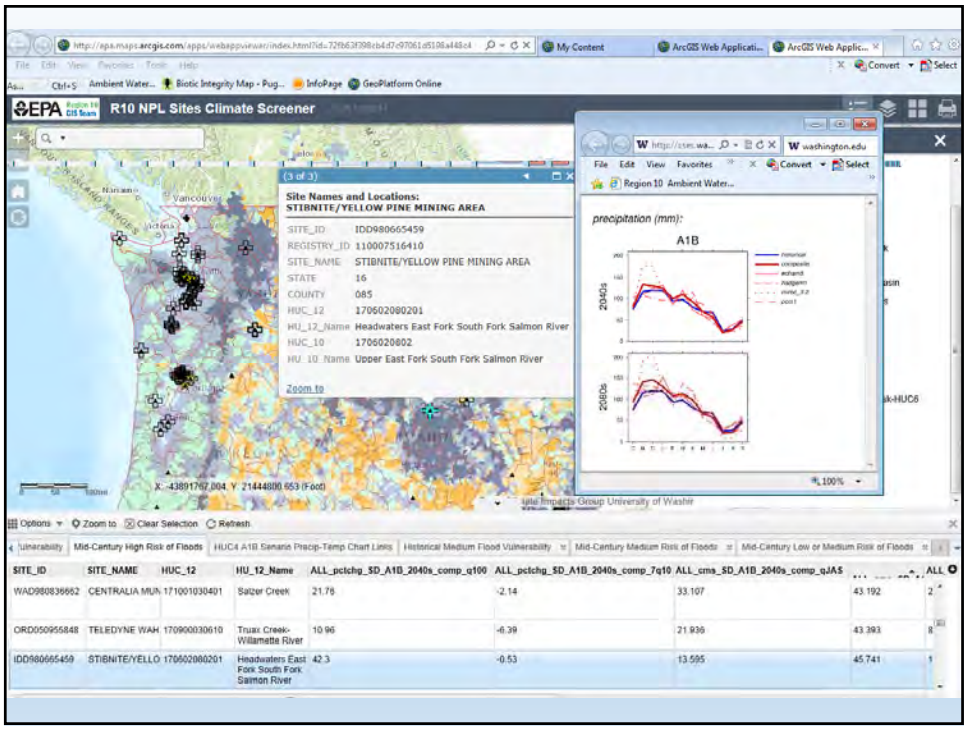
Region 10 Superfund Site Screening

Identify Superfund sites most vulnerable to climate change impacts.

Vulnerabilities:

- Sea level rise
- Flooding
- Fire
- Landslide


R10 NPL Sites Climate Screener
Legend
NPL Sites - Climate Change Vulnerability
Site Names and Locations
Site Landslide Proximity (OR WA only)
Within 1000m or less
Mid-Century Vulnerability
Mid-Century High Risk of Floods
Low Elev, Q100>=10% SL Rise Risk
Mid-Century Medium Risk of Floods
Within Transitional Rain on Snow Basin
Mid-Century Low or Medium Risk of Floods
Missing HUC 5 Designations
Regional Climate Layers
HUC4 A1B Senario Precip-Temp Chart Links
Mid Century % Change in 100 Year Flood Risk-HUC6
>10 % Decrease (Max of 49.18)
0 to 10% Decrease
>0 to 10% Increase
>10-30% Increase
>30% Increase (Max of 116.39)
MONTANA
NEVADA
UTAH
GREAT BASIN


R10 NPL Sites Climate Screener
Site Names and Locations:
STIBNITE/YELLOW PINE MINING AREA
SITE_ID IDD980665459
REGISTRY_ID 110007516410
SITE_NAME STIBNITE/YELLOW PINE MINING AREA
STATE ID
COUNTY 085
HUC_12 170602080201
HU_12_Name Headwaters East Fork South Fork Salmon River
HUC_10 1706020802
HU_10_Name Upper East Fork South Fork Salmon River
Zoom to
precipitation (mm):
A1B
2040s
2080s
SITE_ID SITE_NAME HUC_12 HU_12_Name ALL_pctchg_SD_A1B_2040s_comp_q100 ALL_pctchg_SD_A1B_2040s_comp_7q10 ALL_cms_SD_A1B_2040s_comp_qJAS
WAD980836662 CENTRALIA MUN 171001030401 Salzer Creek 21.76 -2.14 33.107 43.192
ORD050955848 TELEDYNE WAH 170900030610 Truax Creek-Willamette River 10.96 -6.39 21.936 43.393
IDD980665459 STIBNITE/YELLO 170602080201 Headwaters East Fork South Fork Salmon River 42.3 -0.53 13.595 45.741

What sites are vulnerable?

Threat	Current Condition- metrics	Projected Vulnerable (mid-century)
Inundation	• Sea-level rise and elevation	**Vulnerable if** • Greater than 2 ft sea-level rise and at low elevation (<10 meters)
Flooding	• Floodplain. • Flow • Watershed classification (snow, snow/rain, or rain dominant)	**Vulnerable if** - Near/in 100 year floodplain and - Q100 > 10% change and - Change from snow to snow/rain or rain dominant
Landslide	• Proximity to landslide	**Vulnerable if:** - Within 500 M of landslide and - Q100> 10% change
Fire and Drought	• Fire risk: Wildland urban interface • Drought: Avg. max temp summer.	**Vulnerable if:** - > 4 degree F avg. max temp. increase and - Low flow (7Q10) decrease.

12

The Good News!

Existing Superfund authorities and processes provides a robust structure to:

- Evaluate vulnerabilities;
- Consider potential climate change impacts; and
- Implement adaptation measures.

Remedial Investigation/ Feasibility Study

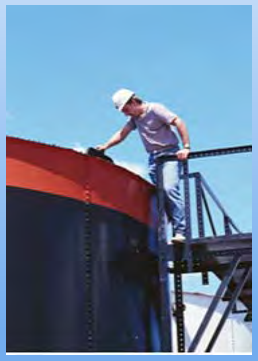
- Consider climate change when:
  - Assessing the nature and extent of the contamination and associated risk
  - Developing conceptual site model
  - Evaluating remedial alternatives and considering long-term stewardship
- Use best available data and models
- Confer with local/regional experts

Analysis of Remedial Alternatives: Nine Remedy Evaluation Criteria

- Threshold Criteria:
  - Overall protection of human health and the environment
  - Compliance with applicable and relevant and appropriate requirements
- Balancing Criteria:
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying Criteria:
  - State acceptance
  - Community acceptance

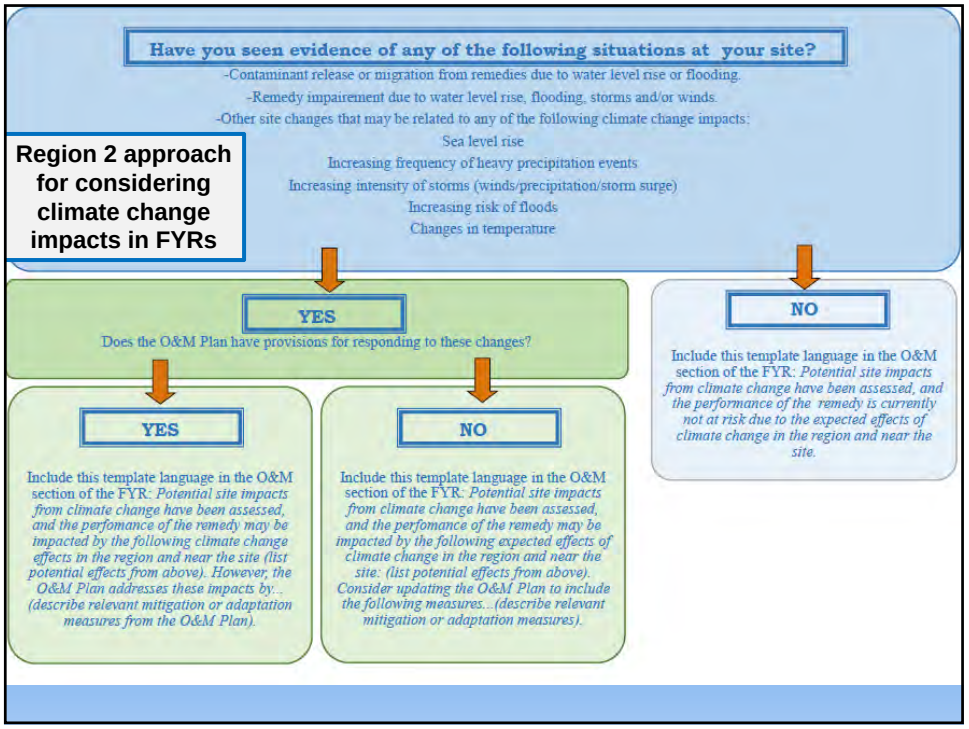
Remedial Design/Remedial Action

- Consider site vulnerabilities and adaptation measures
  - Design flows
  - Site operations and infrastructure
- Incorporate into design and construction
  - Increase design flows, elevate electrical panels, armor containment/caps, etc.
- Consider long-term stewardship (O&M)



Post Construction Completion

- Operation and Maintenance
  - Monitor remedy for climate change related vulnerabilities and impacts
  - Emergency operations and response plans (O&M Plan)
- Five-Year Reviews
  - Evaluate remedy performance to determine if still protective.
    - Is the remedy functioning as intended?
    - Are the assumptions, data and cleanup levels still valid?
    - Is there new information, such as climate change impacts, that could call into question protectiveness of the remedy?
  - If issues, may need updated O&M Plan or remedy changes


Region 2 approach for considering climate change impacts in FYRs
Have you seen evidence of any of the following situations at your site?
-Contaminant release or migration from remedies due to water level rise or flooding.
-Remedy impairement due to water level rise, flooding, storms and/or winds.
-Other site changes that may be related to any of the following climate change impacts:
Sea level rise
Increasing frequency of heavy precipitation events
Increasing intensity of storms (winds/precipitation/storm surge)
Increasing risk of floods
Changes in temperature
YES
Does the O&M Plan have provisions for responding to these changes?
NO
Include this template language in the O&M section of the FYR: Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.
YES
Include this template language in the O&M section of the FYR: Potential site impacts from climate change have been assessed, and the perfomance of the remedy may be impacted by the following climate change effects in the region and near the site (list potential effects from above). However, the O&M Plan addresses these impacts by:.. (describe relevant mitigation or adaptation measures from the O&M Plan).
NO
Include this template language in the O&M section of the FYR: Potential site impacts from climate change have been assessed, and the perfomance of the remedy may be impacted by the following expected effects of climate change in the region and near the site: (list potential effects from above). Consider updating the O&M Plan to include the following measures...(describe relevant mitigation or adaptation measures).


http://www.epa.gov/superfund/climatechange/
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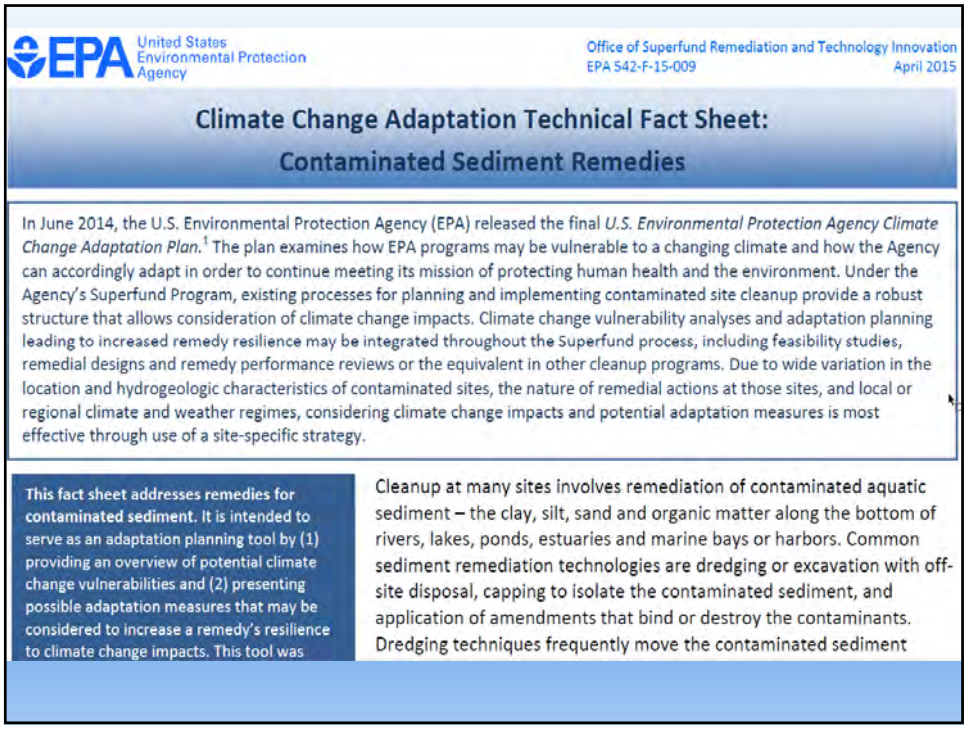
Cleanup Process
Climate Change Adaptation
Community Involvement
Training & Learning Center
Laws, Policy & Guidance
Enforcement
Superfund En Español
Related Links
You are here: EPA Home » Superfund » Climate Change Adaptation
Climate Change Adaptation
Remedies to address contaminated sites may be vulnerable to the impacts of climate change. EPA's Superfund Program has developed an approach that raises awareness of the vulnerabilities and applies climate change science as a standard business practice in site cleanup projects. To date, the approach has involved screening of Superfund remedy vulnerabilities on a national basis, prioritizing the Agency's adaptation efforts at Superfund sites, and identifying adaptation measures that may be taken to increase a remedy's resilience to climate change. EPA is publishing this webpage as a means of disseminating useful information regarding approaches for adapting to climate change as we implement cleanups at contaminated 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 contaminated site cleanup. EPA, federal, state, tribal and local decision-makers retain discretion to implement approaches on a case-by-case basis.
Climate Change Impacts on the Superfund Program
EPA conducted a screening analysis to evaluate the extent to which the vulnerabilities may affect soil, sediment, or groundwater remedies involving technologies such as soil vapor extraction, bioremediation, permeable reactive barriers, and pump-and-treat (P&T) systems or involving strategies such as monitored natural attenuation or ex situ containment. The analysis included plotting Superfund sites located near or within 100-year and 500-year floodplains and Superfund sites situated within a 1-meter sea level rise zone. Results indicated that cleanup projects involving P&T technology for groundwater remediation and/or onsite systems for contaminant source containment may be particularly vulnerable to climate change due to their frequent use, general design components, and often lengthy durations.
Recent Web Seminar
View EPA's April 1 "Adaptation of Superfund Cleanup to Climate Change" seminar archive, which provides an overview of climate change vulnerability analyses and adaptation at contaminated sites.
Planning Tools
Climate Change Adaptation Technical Fact Sheets: EPA has released three fact sheets designed to help project managers and other cleanup stakeholders identify, prioritize, and implement site-specific measures for increasing remedy resilience to climate change impacts.
New! Contaminated Sediment Remedies (PDF)
Landfills and Containment as an Element of Site Remediation (PDF)
Groundwater Remediation Systems (PDF)



United States Environmental Protection Agency

Office of Superfund Remediation and Technology Innovation
EPA 542-F-15-009
April 2015

Climate Change Adaptation Technical Fact Sheet: Contaminated Sediment Remedies

In June 2014, the U.S. Environmental Protection Agency (EPA) released the final *U.S. Environmental Protection Agency Climate Change Adaptation Plan.*[1] The plan examines how EPA programs may be vulnerable to a changing climate and how the Agency can accordingly adapt in order to continue meeting its mission of protecting human health and the environment. Under the Agency's Superfund Program, existing processes for planning and implementing contaminated site cleanup provide a robust structure that allows consideration of climate change impacts. Climate change vulnerability analyses and adaptation planning leading to increased remedy resilience may be integrated throughout the Superfund process, including feasibility studies, remedial designs and remedy performance reviews or the equivalent in other cleanup programs. Due to wide variation in the location and hydrogeologic characteristics of contaminated sites, the nature of remedial actions at those sites, and local or regional climate and weather regimes, considering climate change impacts and potential adaptation measures is most effective through use of a site-specific strategy.

This fact sheet addresses remedies for contaminated sediment. It is intended to serve as an adaptation planning tool by (1) providing an overview of potential climate change vulnerabilities and (2) presenting possible adaptation measures that may be considered to increase a remedy's resilience to climate change impacts. This tool was

Cleanup at many sites involves remediation of contaminated aquatic sediment – the clay, silt, sand and organic matter along the bottom of rivers, lakes, ponds, estuaries and marine bays or harbors. Common sediment remediation technologies are dredging or excavation with off-site disposal, capping to isolate the contaminated sediment, and application of amendments that bind or destroy the contaminants. Dredging techniques frequently move the contaminated sediment

In Summary

- Screen sites for climate change related **vulnerabilities**
- Conduct **sensitivity analysis** to screen out low probability/low impact vulnerabilities
- Evaluate **adaptation** measures available and applicable to address vulnerabilities and increase remedy **resilience**
- Incorporate into **remedy selection and desgin** as appropriate
- **Implement** adaptation measures
- Get **help**
  - http://www.epa.gov/superfund/climatechange