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## **Optimizing for the Post Construction Phase of Superfund Sites**

September 2019

The Association of State and Territorial Solid Waste Management Officials (ASTSWMO) CERCLA Post Construction Focus Group (CPC FG) is comprised of State and Territorial (State) members from all United States Environmental Protection Agency (EPA) regions. This presentation was prepared by the ASTSWMO CPC FG, under Cooperative Agreement 83870001 with the U.S. EPA Office of Superfund Remediation and Technology Innovation (OSRTI).

The mission of the ASTSWMO CPC FG is to promote facilitation and maintenance of reliable, effective, and protective remedies constructed at contaminated sites, to include identification of the resources necessary following remedy construction, and to communicate State program strategies effectively among interested parties.

This document is solely intended to help States in identifying efficient and effective adaptive Operational and Maintenance (O&M) management practices that can be utilized to respond to changing conditions while ensuring protectiveness of human health and the environment. It does not reflect EPA's position on the issues raised.

EPA has recently published an adaptive management definition that acknowledges a continuous re-evaluation and planning based process in order to plan and react to minimize site uncertainties. It is explained that adaptive management can streamline decision making, facilitate site progress, and help control costs. The ASTSWMO CPC FG has prepared this presentation to assist States in identifying efficient and effective adaptive O&M management practices that can be utilized to respond to changing conditions while ensuring protectiveness of human health and the environment. On August 22, 2018, this presentation was given to attendees of the ASTSWMO Brownfields and Superfund Symposium held in Jacksonville, FL.

In researching this project, the team conducted an inventory and evaluation of fund financed Long Term Response Action (LTRA) sites that have gone through a Record of Decision (ROD) amendment and/or an Explanation of Significant Differences (ESD) over the past 15 years. Thirty-nine sites from across the country were reviewed for common trends that led to the triggering of a ROD amendment or ESD. This analysis found several common triggers: incomplete site characterization, removal actions/interim RODs, emerging contaminants, and recognition of additional exposure pathways, changes in technology, remedy optimization, and other issues (i.e. Institutional Controls).

Based upon the findings of this project, the team recommends the following practices that will help States be prepared for O&M:

- Ensure State ARARs are written into the ROD
- States and EPA should coordinate in the process of holistically developing the scope for the remedy
- Recommend use of language in the Superfund State Contract (SSC) model provisions that allow the state to negotiate within the process – example: include “EPA may grant a 1-year extension to the Operational and Functional (O&F) period, if appropriate”
- Identify issues prior to the O&F determination

The team also recommends using a formal Adaptive Management approach to site/remedy management before and after O&M.

# Review of Lessons Learned from Adaptive Practices

- CERCLA Post Construction Focus Group reviewed adaptive practices that have been used by project managers to respond to changing conditions and new site information
- Determined the most direct path to closure often requires reevaluation of course of action specified in original ROD requirements

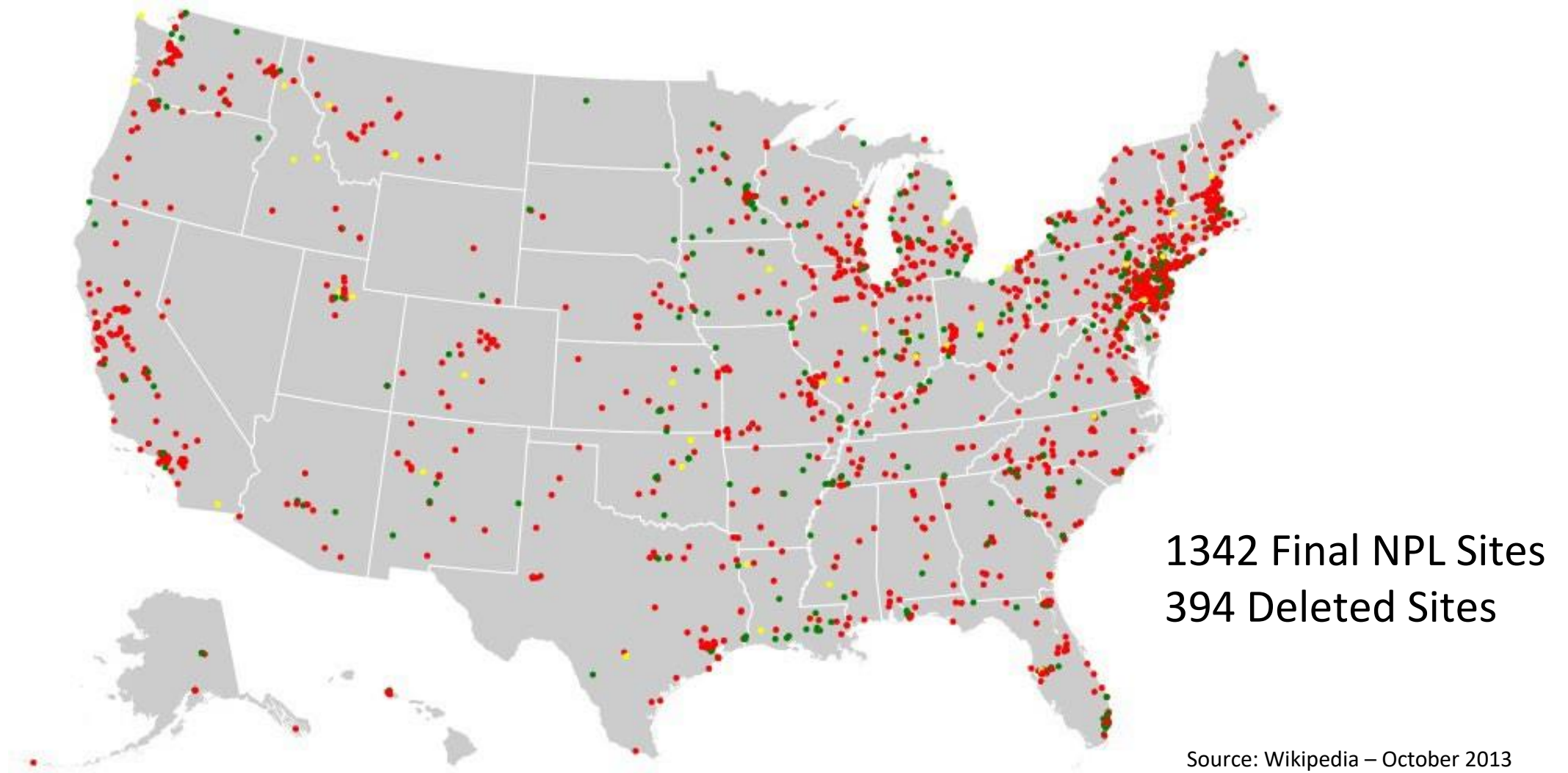


# Project Team

## Contributors to the study

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# Step 1: Develop Site List



Red indicates currently on final National Priority List, yellow is proposed, green is deleted

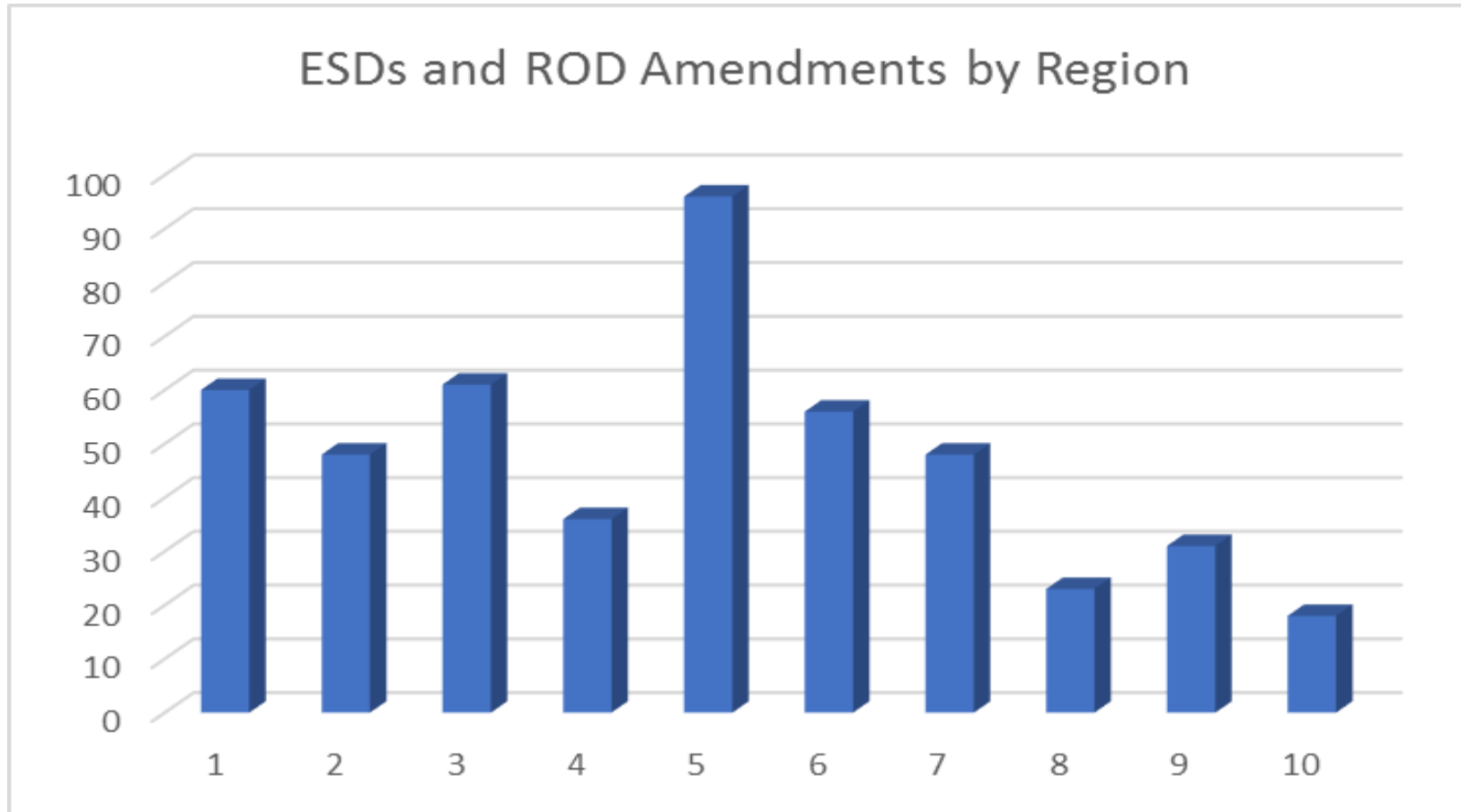
# Step 1: Develop Site List

- EPA Database Query
  - Fund Lead sites
  - Sites with ROD Amendments and ESDs
  - Past 15 years



Region	State	Site ID	EPA ID	Site Name	FF Ind	SAA Flag	NPL Status Code	NPL Status Name	City Name	County Name	Zip Code	OU	OU Name	Action Name	Seq	Perf Lead	Fin Lead	Actual Completion Date
05	MN	0503894	MND980823975	ARROWHEAD REFINERY CO.	N	N	F	Current	HERMANTOWN	ST. LOUIS	55810	01	GROUNDWATER	GOVT Decisio	1	F		09/30/1986
05	MN	0503894	MND980823975	ARROWHEAD REFINERY CO.	N	N	F	Current	HERMANTOWN	ST. LOUIS	55810	01	GROUNDWATER	GOVT LTRA	1	F	FU	06/03/2004
05	WI	0505257	WIT560010118	BETTER BRITE PLATING CO. CHIN	N	N	F	Current	DE PERE	BROWN	54115	03	SEMS	GOVT LTRA	1	S	FU	07/18/2011
05	WI	0505257	WIT560010118	BETTER BRITE PLATING CO. CHIN	N	N	F	Current	DE PERE	BROWN	54115	03	SEMS	GOVT Decisio	1	F		06/28/1991
05	WI	0505257	WIT560010118	BETTER BRITE PLATING CO. CHIN	N	N	F	Current	DE PERE	BROWN	54115	03	SEMS	GOVT Decisio	2	F		09/24/1996
05	MI	0502372	MID006030373	BOFORS NOBEL, INC.	N	N	F	Current	MUSKEGON	MUSKEGON	49442	01	OU1 - GROUNDW	GOVT Decisio	1	F		09/17/1990
05	MI	0502372	MID006030373	BOFORS NOBEL, INC.	N	N	F	Current	MUSKEGON	MUSKEGON	49442	01	OU1 - GROUNDW	GOVT ROD An	2	F		07/16/1999
05	MI	0502372	MID006030373	BOFORS NOBEL, INC.	N	N	F	Current	MUSKEGON	MUSKEGON	49442	01	OU1 - GROUNDW	GOVT ROD An	1	F		07/22/1992
05	MI	0502372	MID006030373	BOFORS NOBEL, INC.	N	N	F	Current	MUSKEGON	MUSKEGON	49442	01	OU1 - GROUNDW	GOVT LTRA	1	F	FU	03/01/2000
05	IN	0501696	IND980607881	DOUGLASS ROAD/UNIROYAL, IF	N	N	F	Current	MISHAWAKA	ST. JOSEPH	46544	01	LANDFILL CAP	GOVT LTRA	1	F	FU	11/11/2011
05	IN	0501696	IND980607881	DOUGLASS ROAD/UNIROYAL, IF	N	N	F	Current	MISHAWAKA	ST. JOSEPH	46544	02	GROUNDWATER	GOVT Decisio	2	F		05/03/1996
05	IN	0501696	IND980607881	DOUGLASS ROAD/UNIROYAL, IF	N	N	F	Current	MISHAWAKA	ST. JOSEPH	46544	01	LANDFILL CAP	GOVT Decisio	1	F		07/13/1995
05	IN	0501696	IND980607881	DOUGLASS ROAD/UNIROYAL, IF	N	N	F	Current	MISHAWAKA	ST. JOSEPH	46544	02	GROUNDWATER	GOVT ESD	1	F		09/14/2012
05	MI	0502793	MID980504716	DUELL & GARDNER LANDFILL	N	N	F	Current	DALTON TOWN	MUSKEGON	49445	01	SITE CLEANUP	GOVT LTRA	1	F	FU	08/29/2012
05	MI	0502793	MID980504716	DUELL & GARDNER LANDFILL	N	N	F	Current	DALTON TOWN	MUSKEGON	49445	01	SITE CLEANUP	GOVT Decisio	1	F		09/07/1993
05	MI	0502793	MID980504716	DUELL & GARDNER LANDFILL	N	N	F	Current	DALTON TOWN	MUSKEGON	49445	01	SITE CLEANUP	GOVT ROD An	1	F		06/29/2001
05	IL	0500755	ILD980794333	LASALLE ELECTRIC UTILITIES	N	N	F	Current	LA SALLE	LA SALLE	61301	01	OFF-SITE	GOVT Decisio	1	S		08/29/1986
05	IL	0500755	ILD980794333	LASALLE ELECTRIC UTILITIES	N	N	F	Current	LA SALLE	LA SALLE	61301	02	ON-SITE	GOVT Decisio	2	S		03/30/1988
05	IL	0500755	ILD980794333	LASALLE ELECTRIC UTILITIES	N	N	F	Current	LA SALLE	LA SALLE	61301	02	ON-SITE	GOVT ESD	1	S		07/09/2004
05	IL	0500755	ILD980794333	LASALLE ELECTRIC UTILITIES	N	N	F	Current	LA SALLE	LA SALLE	61301	02	ON-SITE	GOVT LTRA	1	S		04/30/2005
05	MN	0503892	MND980792469	LEHILLIER/MANKATO	N	N	F	Current	LEHILLIER	BLUE EARTH	56001	01	GROUNDWATER	GOVT Decisio	1	F		09/27/1985
05	MN	0503892	MND980792469	LEHILLIER/MANKATO	N	N	F	Current	LEHILLIER	BLUE EARTH	56001	01	GROUNDWATER	GOVT ESD	1	F		08/29/2008
05	MN	0503892	MND980792469	LEHILLIER/MANKATO	N	N	F	Current	LEHILLIER	BLUE EARTH	56001	01	GROUNDWATER	GOVT LTRA	1	S		11/30/1997
05	MN	0503903	MND980904072	LONG PRAIRIE GROUND WATEF	N	N	F	Current	LONG PRAIRIE	TODD	56347	01	GROUND WATER	GOVT LTRA	1	S	FU	09/18/2008
05	MN	0503903	MND980904072	LONG PRAIRIE GROUND WATEF	N	N	F	Current	LONG PRAIRIE	TODD	56347	01	GROUND WATER	GOVT Decisio	1	S		06/27/1988
05	MN	0503903	MND980904072	LONG PRAIRIE GROUND WATEF	N	N	F	Current	LONG PRAIRIE	TODD	56347	01	GROUND WATER	GOVT ESD	2	S		05/25/1994
05	MN	0503903	MND980904072	LONG PRAIRIE GROUND WATEF	N	N	F	Current	LONG PRAIRIE	TODD	56347	01	GROUND WATER	GOVT ESD	1	S		06/20/1991
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	03	SOIL/WASTE	GOVT LTRA	6	F	FU	09/30/2012
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	03	SOIL/WASTE	GOVT Decisio	3	F		09/22/1994
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	02	GROUNDWATER	GOVT Decisio	1	F		09/30/1991
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	01	DISPOSAL AREA	GOVT Decisio	2	F		12/31/1992
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	01	DISPOSAL AREA	GOVT ROD An	1	S		09/30/1999
05	MN	0503722	MND006192694	MACGILLIS & GIBBS CO./BELL L	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	02	GROUNDWATER	GOVT LTRA	1	F	FU	04/06/2002
05	WI	0505061	WID083290981	N.W. MAUTHE CO., INC.	N	N	F	Current	APPLETON	OUTAGAMIE	54914	01	SOIL & GW COLLE	GOVT Decisio	1	F		03/31/1994
05	WI	0505061	WID083290981	N.W. MAUTHE CO., INC.	N	N	F	Current	APPLETON	OUTAGAMIE	54914	01	SOIL & GW COLLE	GOVT LTRA	1	F	FU	11/30/1998
05	MN	0504010	MN7213820908	NEW BRIGHTON/ARDEN HILLS/Y	N	N	F	Current	NEW BRIGHTON	RAMSEY	55112	07	FINAL REMEDY	FF ESD	2	FF		05/01/2009

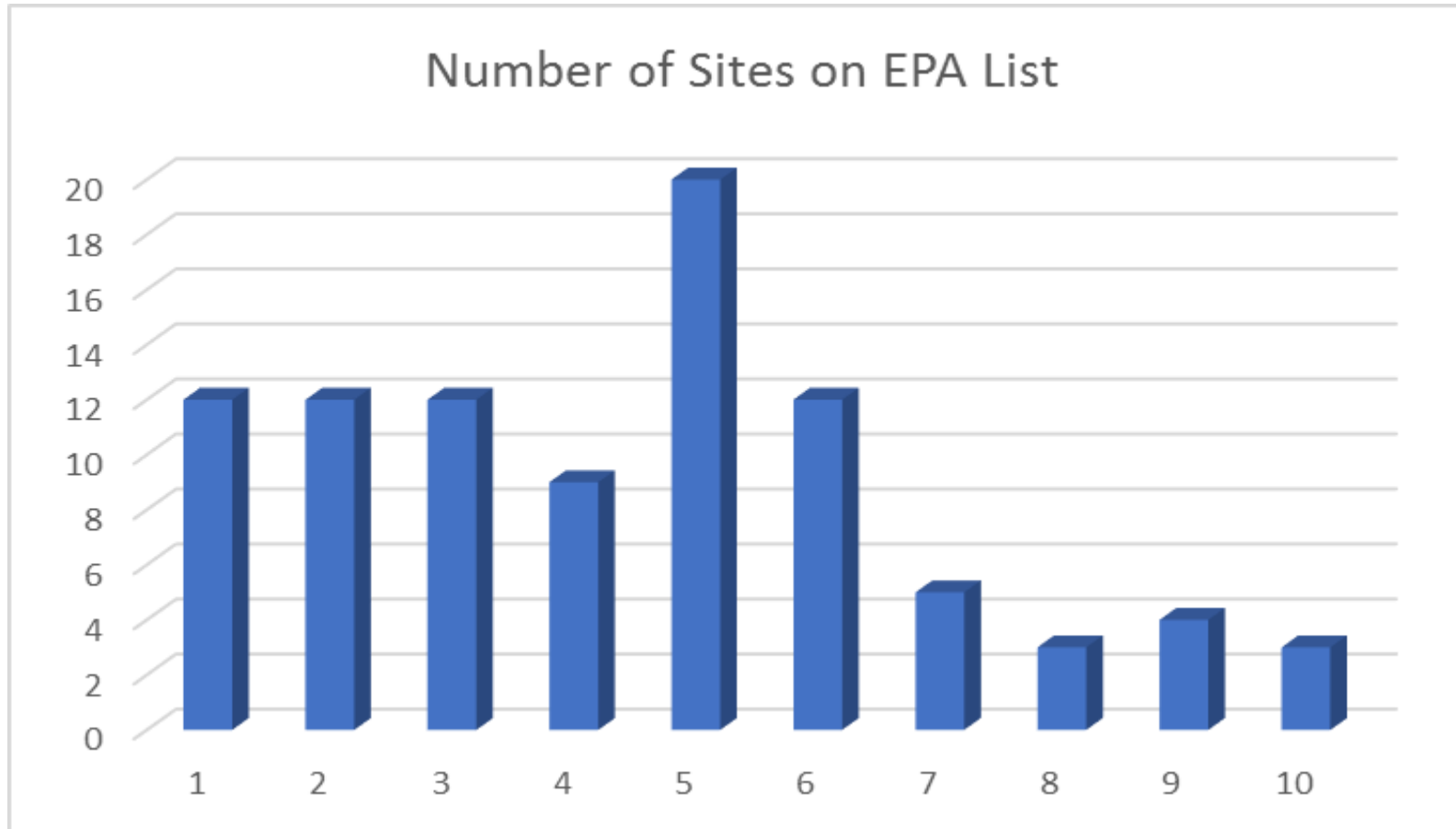
# Step 1: Develop Site List



477 ESDs and ROD Amendments Identified



# Step 2: Identify Sites for the Study List

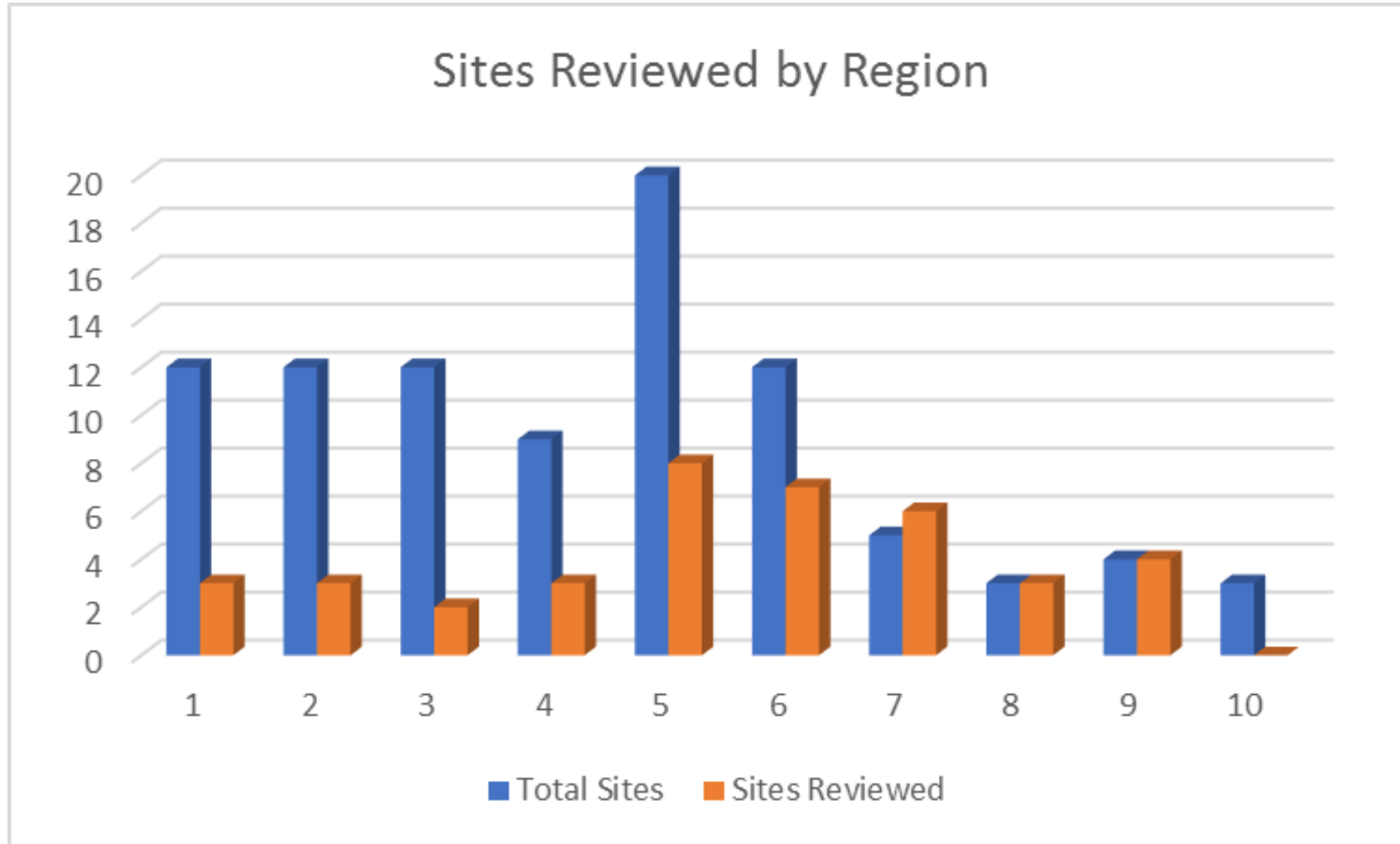


92 Sites with ESDs and ROD Amendments from EPA Query

# Step 3: Review Sites on Study List

- The ASTSWMO CPC Focus Group conducted an evaluation of select LTRA sites
- Goal was to identify efficient and effective adaptive-type O&M management practices
- Showcase how to better respond to changing conditions while ensuring protectiveness of human health and the environment

# Step 3: Review Sites on List



92 Sites on list

39 Sites Reviewed

## Step 4: Identify Triggers



Seven trigger categories identified that resulted in a ROD Amendment or ESD

# Common Triggers - Overview

## Basic “Speed Bump” Categories along Closure Path

1. Incomplete Site Characterization
2. Removal action/IROD
3. Emerging contamination
4. Other Pathway
5. Technology
6. Optimization
7. Other

# Trigger 1. Incomplete Site Investigation

May include

- Incomplete characterization
- Incomplete pathway identification

Two subcategories

1. Physical controls
  - Structural impediments
  - deeper contaminant plume
  - additional media impacted not previously known
2. Risk driver – expedites process
  - Rush to protect drinking water

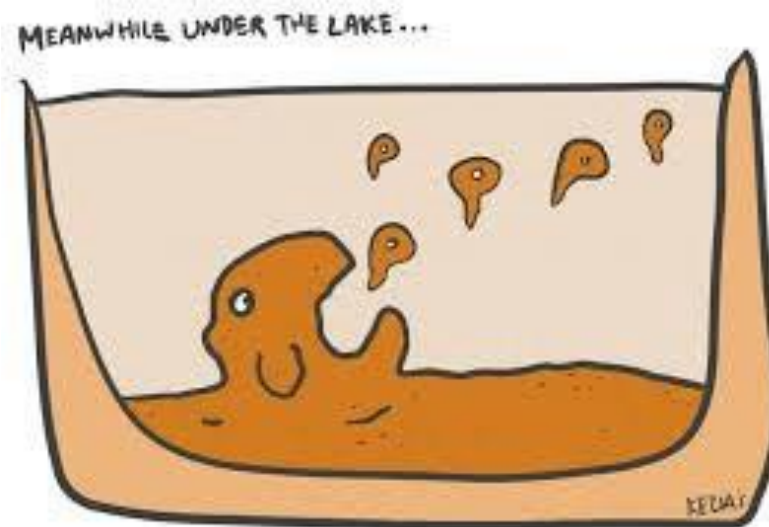
# Trigger 2. Removal Action/IROD

- Completion of a Removal Action or interim ROD cleanup
  - Reduces or eliminates risk
  - Removes priority for action
  - Short circuits full site investigation



# Trigger 3. Emerging Contaminants

- PFAS
- 1,4-dioxane
- Lead
- Arsenic (new toxicological studies)
- Hexavalent Chromium
- Perchlorate





# Trigger 4. Pathway

- Migration and exposure pathways added
  - Vapor intrusion
  - Sediment
  - Surface water



# Trigger 5. Technology

- Applicability/Appropriateness of technology
- Better understanding of technology
- Reassess presumptive remedy
- Challenge limits of technology
- Availability of better technology

# Trigger 6. Optimization

- Remedial System Evaluation performed during LTRA or recommended from Five-Year Review

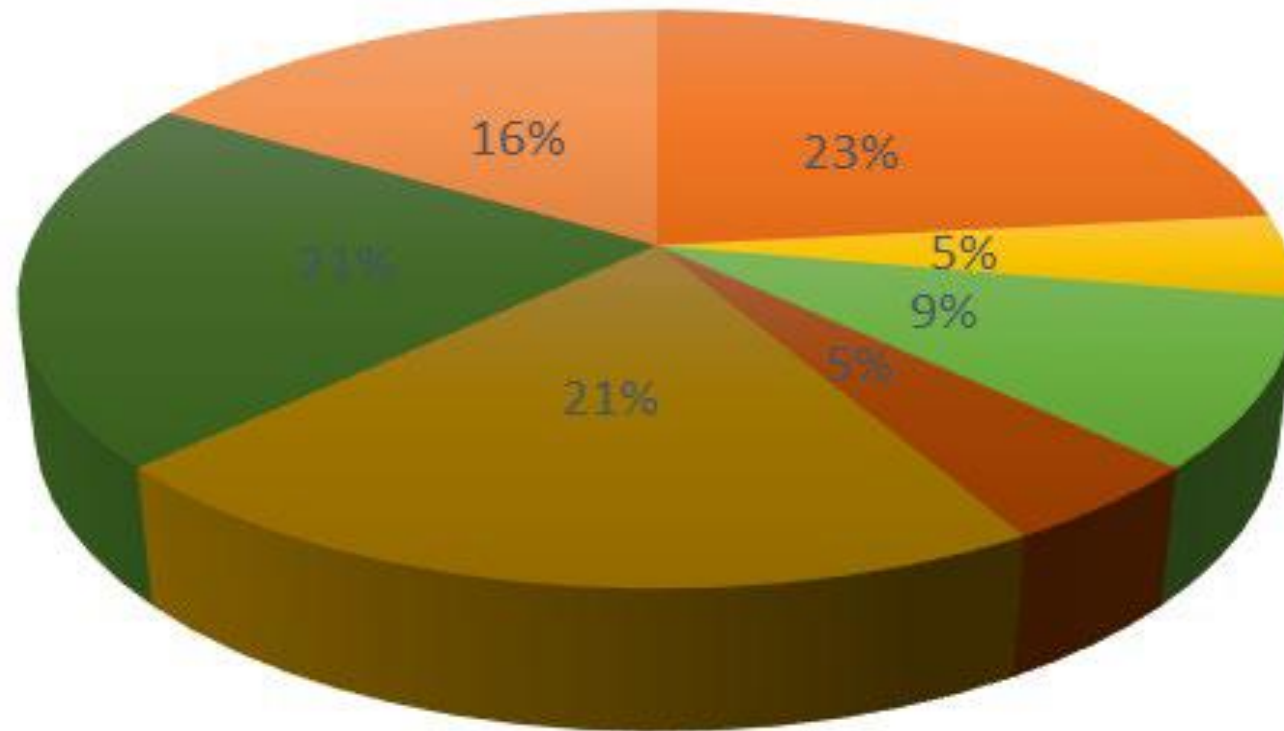


- Commonly includes
  - Modification of technology
  - Addition of supplemental controls
  - Addition or reduction in treatment areas
  - Add wells, extend radius of influence, add treatment features

## Trigger 7. Other

- Most common “Other” is addition of Institutional Controls
- Also a change in ARARs and/or risk understanding

# Triggers



- SI incomplete
- Removal Action
- Emerging Cont
- Other Pathway
- Technology
- Optimization
- Other

# Process Improvement



# Continuous Evaluation under Adaptive Management Methodology

## Evaluate active and non-active remedies

- Protective
- Effective
- Cost Controls
- Efficient
- Green and Sustainable



# Decision Points for Further Assessment

- Financial drivers
  - Responsibility transfer
  - Technology changes
  - Delayed funding of different aspects of the project
  - Settlement funds
- Cleanup targets not met in a reasonable timeframe
- Changes in site use - industrial to residential or restricted to unrestricted
- Impacted receptors
- Unusual/unsuccessful performance of a remedy – unknown/additional impacts
- Optimization review – Year 7 of LTRA
- Five-Year Review

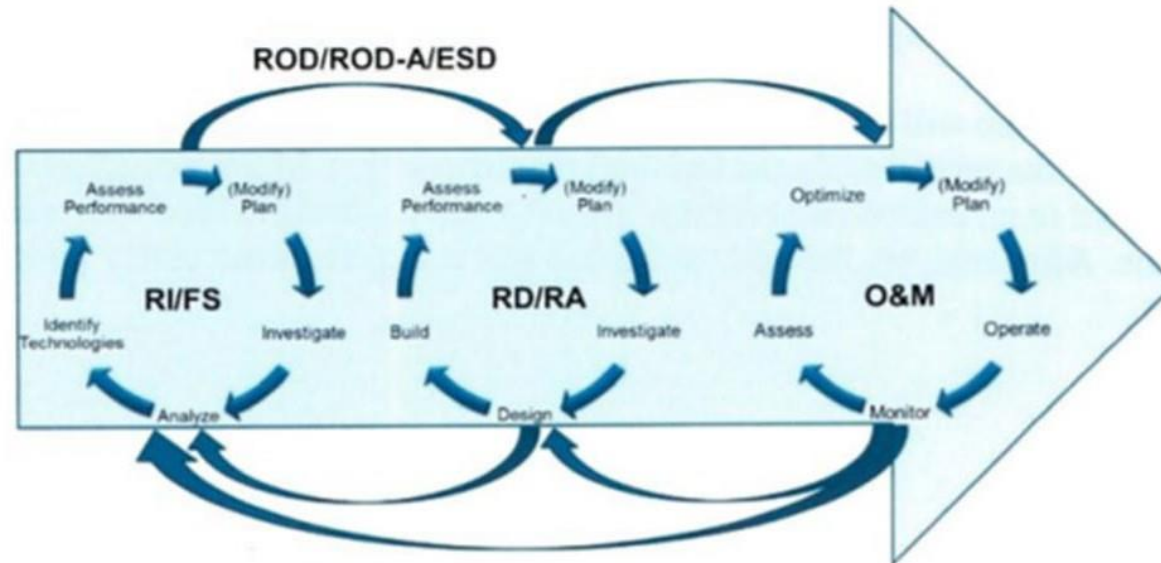


# EPA Adaptive Management Approach

- Adaptive Management can support the development of a remedy completion strategy and provide an opportunity for rethinking the project management plan
- It can also facilitate development of clear criteria for targeted data collection and technology evaluation to inform the need to change or modify the remedy approach

# EPA Adaptive Management Process

Figure 1 Adaptive Management's Application in the Superfund Remedial Process



ROD: Record of Decision  
ROD-A: Record of Decision Amendment  
ESD: Explanation of Significant Differences

RD/RA: Remedial Design/Remedial Action  
R/FS: Remedial Investigation/Feasibility Study  
O&M: Operation and Maintenance

# EPA Adaptive Management Guidance Timeline

Timeframe	Action
End of July 2018	Create draft final pilot criteria; draft tools, evaluation of metrics and measures of success. Disseminate draft products to regional programs for review and comment.
August 2018	Revise criteria and other draft products based on regional feedback.
September 2018	Coordinate/consult with states, tribes and other appropriate stakeholders.
October 2018	Solicit regions for pilot projects.
November 2018	Select pilots to apply formal AM at a variety of sites/projects.
April 2019	Review 6-month status and preliminary feedback from pilots. Determine preliminary scope of formal guidance and begin drafting. Identify any potential impacts to existing policy.
October 2019	Review 1-year status of pilots and incorporate lessons learned into draft guidance.
December 2019	Finalize guidance.

# Summary

- 477 ESDs/ROD amendments issued in past 15 years for 92 fund lead sites
- 39 sites were reviewed by Focus Group
- 7 primary triggers were identified
- Most common triggers were
  - Incomplete site investigation
  - Technology changes
  - Optimization
  - Institutional Controls

# Recommendations

- Based upon the findings of this project, the team recommends the following practices that will help States be prepared for O&M:
  - Ensure State ARARs are written into the ROD
  - States and EPA should coordinate in the process of holistically developing the scope for the remedy
  - Recommend use of language in the SSC model provisions that allow the state to negotiate within the process – example: include “EPA may grant a 1-year extension to the O&F period, if appropriate”
  - Identify issues prior to the O&F determination
- The team also recommends using a formal Adaptive Management approach to site/remedy management before and after O&M

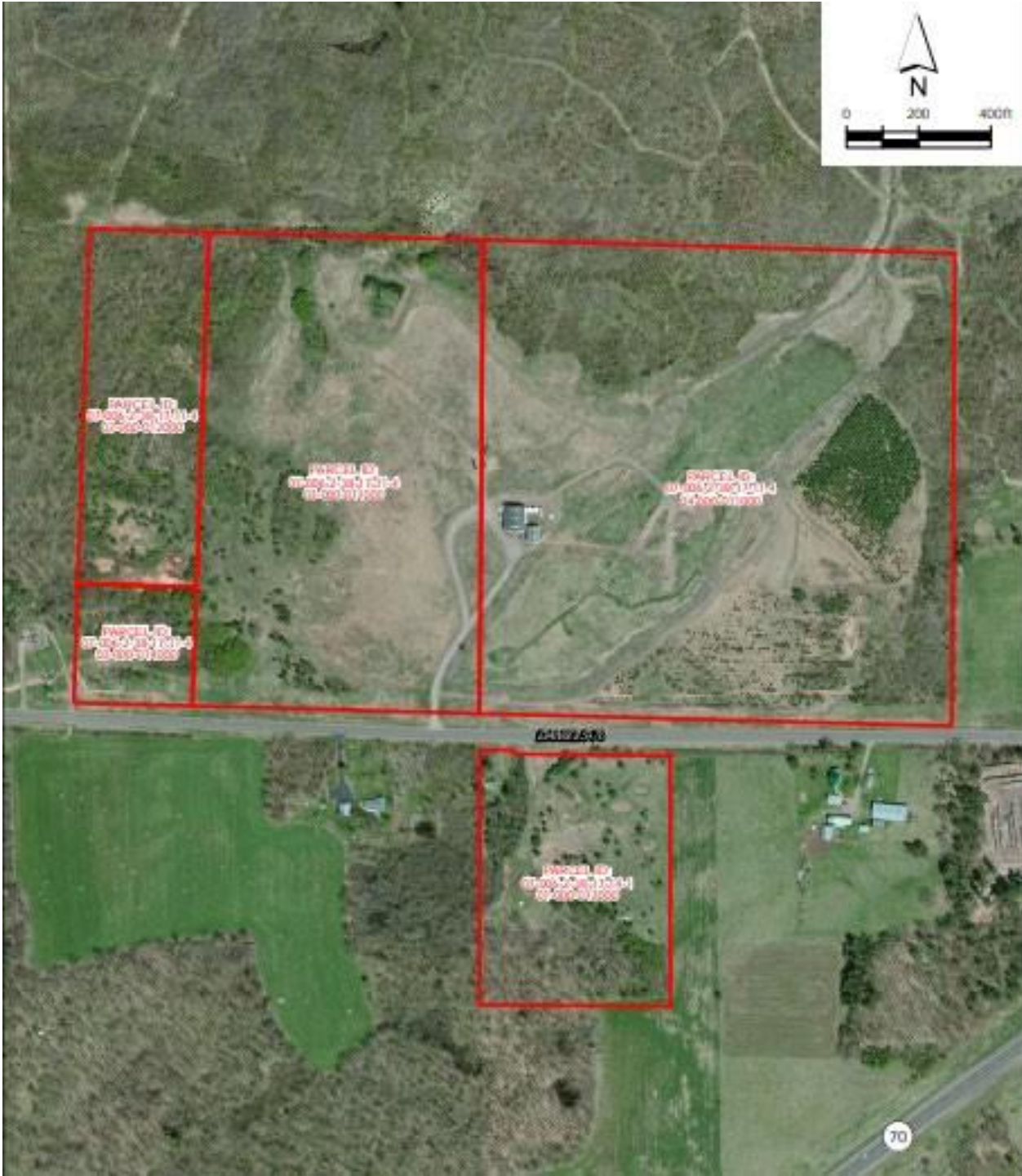
Case Study  
Penta Wood Products  
Siren, WI

# Case Study – Penta Wood Products

- Former wood treating facility operated on 120 acre parcel from 1953-1992
- Listed on NPL in 1996
- Main contaminants of concern are pentachlorophenol (PCP) and arsenic







# Case Study – Penta Wood Products

- Remedial Action completed in 2000, including
  - Building demolition
  - Consolidation of PCP and arsenic contaminated soils into CAMU
  - Ground water pump and treat (with upgrades in 2004)
  - LNAPL removal
  - Bioventing
- Annual operation \$1.1M; Transferred to State in 2014

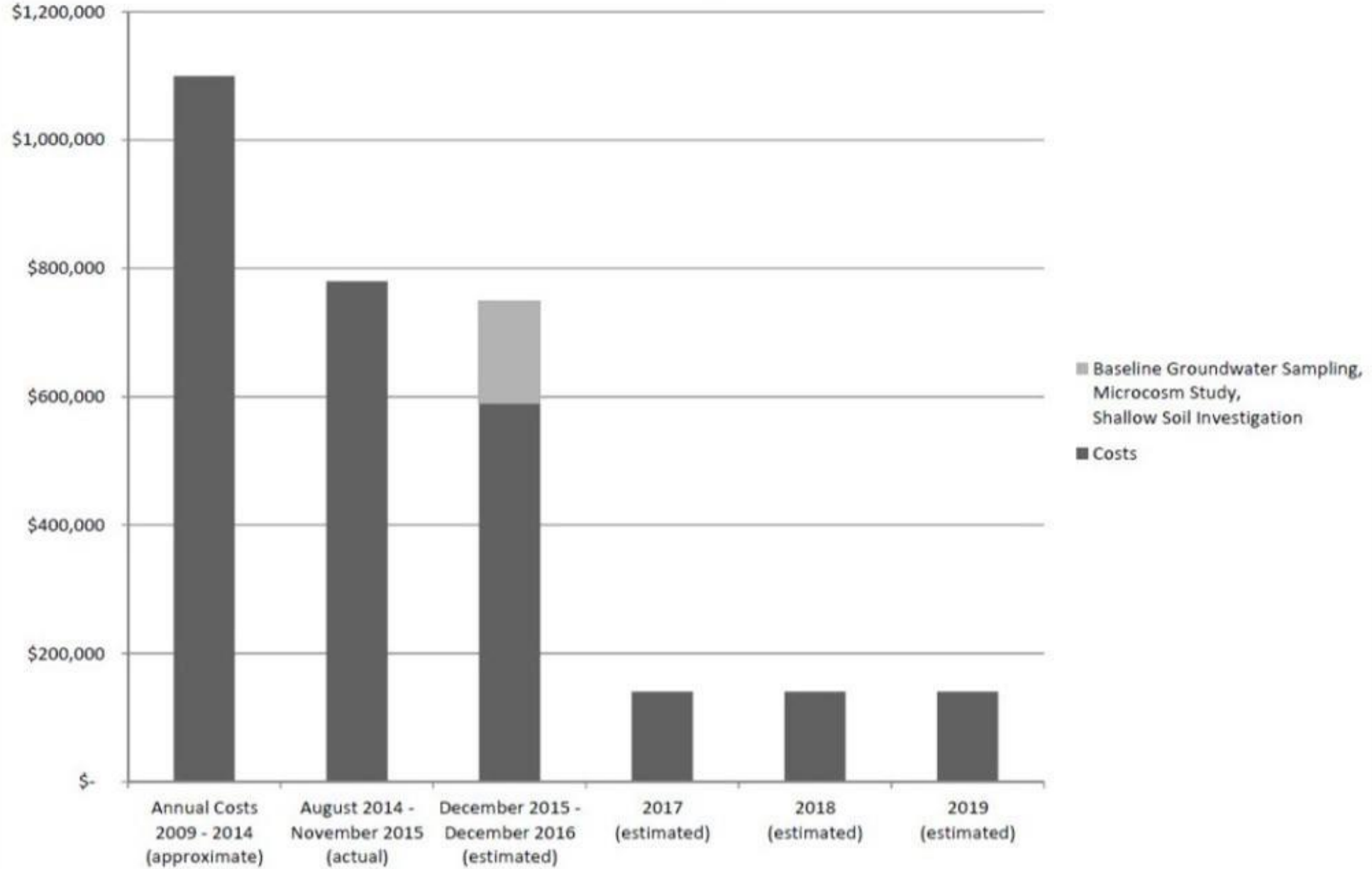
# Catalysts for Action

- Transfer to State – Change in funding
- State has difficulty prioritizing funds for \$1.1M annual operating costs
- Need to identify alternative, less costly solution while still being protective

# Case Study – Penta Wood Products

- State assessed current status
- Several trigger criteria were noted
  - Technology – Natural Source Zone Depletion
  - Optimization
  - Incomplete SI
  - Removal Action
  - Other pathway-sediment

# Penta Wood Products Superfund Site Costs



# Case Study – Penta Wood Products

- Pilot study to reduce long-term funding requirements
  - Eliminate active ground water remediation, bioventing, NAPL removal
  - Evaluate alternate technology-Natural source zone depletion
  - Optimize monitoring
- Next Step, ESD with change in remedial action requirements