

**EXVIC** Engineering and Expeditionary Warfare Center

# Managing Lead-Impacted Sites under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Chris Saranko, PhD, DABT Geosyntec Consultants

**RITS 2025** 

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This presentation concerns the updated EPA Residential Soil Lead Guidance. Guidance does not set response actions or cleanup levels. Changes to Navy site management following the updated EPA Guidance must be approved by Navy leadership.

Information in this presentation is current as of May 22, 2025.

EXWC: Engineering and Expeditionary Warfare Center NAVFAC: Naval Facilities Engineering Systems Command

# **Speaker Introduction**



### Chris Saranko, PhD, DABT

Principal Geosyntec Consultants



- PhD in Toxicology North Carolina State University
- Board-certified toxicologist with over 25 years of experience evaluating health effects associated with exposures to chemicals in the environment and the workplace
- Extensive experience with assessing and remediating sites with lead contamination, including blood-lead modeling and site-specific bioavailability testing
- Adjunct Professor College of Public Health, University of Georgia

PhD: Doctor of Philosophy DABT: Diplomate, American Board of Toxicology

## **Speaker Introduction**







 Worked on risk assessments for several launch complexes at Kennedy Space Center and got to see Space Shuttle Atlantis on the pad just before STS-106 mission in 2000

## **Presentation Overview**



## Introduction

- Lead Risk Assessment Primer
- EPA 2024 Updated Residential Soil Lead Guidance
- Case Studies
- Summary/Key Takeaways





This presentation will feature several interactive poll questions



### Join by Web



- 1) Go to **PollEv.com**
- 2) Enter **RITSn200**
- 3) Respond to activity

### Join by Text



- 1) Text **RITSn200** to **22333**
- 2) Text in your response





What is your level of experience with investigation and cleanup of soil lead impacts?

- A. High (>10 years)
- B. Intermediate (3–10 years)
- C. Beginning (<3 years)
- D. None



### **Options to respond**

- 1. Text RITSn200 to 22333 to join session then enter response
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# Question 1: What is your level of experience with investigation and cleanup of soil lead impacts?



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Pb: lead

#### Introduction

### Lead is a soft metal that is easy to work with and abundant in the environment

- Lead has been used throughout recorded history for weapons, metalwork, coins, fuel additive, paint, medicines, flavorings, makeup, and other uses
- It is a common by-product of mining and smelting operations
- Lead poisoning causes learning disabilities and behavioral problems, and, at high enough levels, can cause seizure, coma, or death
- Young children are most sensitive population

Lead Overview

- Damage can occur before symptoms appear—early detection is key
- Concentration of lead in blood is a reliable exposure/effect biomarker
- A threshold level below which adverse effects do not occur is not available for CERCLA projects (NBUMD 2017)





Lead

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(Virginia Department of Health, 2024;

CDC n.d.)

# Navy/DoD Sources of Lead

- Munitions constituents
  - Small arms bullets/shot
  - Primary explosives (lead azide, lead styphnate)
  - Primer compositions (lead mononitroresorcinate)
  - Propellants (lead oxide)
- Lead-acid storage batteries, alloys such as brass in plumbing fixtures, nuclear and x-ray shielding, etc.
- Lead-based paint
  - 2014 NAVFAC LBP Guidance/Frequently Asked Questions
  - Check with leadership if there is uncertainty
- Naturally occurring lead compounds (ubiquitous)
- Anthropogenic background sources
  - Leaded compounds from vehicle exhaust (e.g., gasoline additives)
  - Stack emissions from industrial processes
  - Pesticide application

# DoD: Department of Defense LBP: lead-based paint Introduction



(MSE Group 2018)





## **Presentation Overview**



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- Lead Risk Assessment Primer
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# **Section Overview**



### Lead Risk Assessment Primer

- Lead risk assessment is unique
- EPA biokinetic models for lead
- EPA screening/cleanup level guidance 1994-2023
- Navy risk assessment process for lead
- IEUBK Model overview
- ALM overview
- Scientific basis for EPA guidance updates

ALM: Adult Lead Methodology IEUBK: Integrated Exposure Uptake Biokinetic Model for Lead in Children

Lead Risk Assessment Primer

# Lead Risk Assessment is Unique



- Multimedia exposure
  - Lead HHRAs assess site contribution to total risk of adverse health effects from multiple sources and exposure pathways
  - Nonsite-related background sources contribute to the total lead body burden
- Lead does not have traditional toxicity values (e.g., RfD and/or CSF)
- Lead exposure evaluated using BLLs (also known as "PbB")
- Environmental exposures to lead are modeled to predict BLLs associated with those exposures



(EPA 2013)

BLL or PbB: blood lead level CSF: cancer slope factor

HHRA: human health risk assessment RfD: reference dose

Lead Risk Assessment Primer

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#### Managing Lead-Impacted Sites under CERCLA 14

PRG: preliminary remediation goal

#### Lead Risk Assessment Primer

# **EPA Biokinetic Models for Lead**

- Integrated Exposure Uptake Biokinetic Model (IEUBK)
  - Estimates BLLs in young children based on exposure to lead in different media (e.g., soil, water, air, food)
  - Estimates the probability of exceeding specified BLL targets ٠
  - Calculates soil cleanup levels for residential land use
- Adult Lead Methodology (ALM)
  - Simple spreadsheet-based model
  - Estimates BLLs in women of childbearing age exposed to soil in nonresidential settings
  - Evaluates the transfer of lead from a mother to a fetus in utero
  - Calculates soil PRGs for nonresidential land use
- All-Ages Lead Model (AALM)
  - More sophisticated, but still under review and not yet approved by EPA ٠ for use

**KEY** 

POINT

IEUBK = Residential

ALM = Non-Residential



### (EPA 2021)





- 0





What is your familiarity with any of EPA's lead models?

- A. I have used them myself
- B. I have reviewed data from a coworker/contractor
- C. I have seen results in reports
- D. I am completely unfamiliar



### **Options to respond**

- 1. Text RITSn200 to 22333 to join session then enter response
- 2. Enter PollEv.com/ritsn200 in browser
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### Question 2: What is your familiarity with any of the EPA's lead models?



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# **Historical Perspective**

- 1994 OSWER Directive
  - Established 400 ppm (mg/kg) soil screening level for residential land use
  - Screening level derived using the IEUBK Model for Lead in Children
  - Based on a modeled risk of ≤5% of exceeding a blood lead level of 10 µg/dL for a typical child or group of children
  - If site concentrations exceed 400 ppm, recommends using the IEUBK model with site-specific information to evaluate risk and calculate PRGs



OSWER: Office of Solid Waste and Emergency Response	mg/kg: milligram(s) per kilogram
ppm: part(s) per million, equivalent to mg/kg	µg/dL: microgram(s) per deciliter

<b>\$</b> EPA	EPA OSWER Directive #9355.4-1 August 1994
REVISED IN RCRA CO	MEMORANDUM: OSWER DIRECTIVE: ITERIM SOIL LEAD GUIDANCE FOR CERCLA SITES AND DRRECTIVE ACTION FACILITIES
Off	fice of Solid Waste and Emergency Response U.S. Environmental Protection Agency Washington, DC 20460

# **Navy Risk Assessment Process for Lead**





Lead Risk Assessment Primer

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# **IEUBK Model Overview**



- Developed by EPA in the early 90s
- Evaluates exposure of young children to lead in soil/dust and other media (i.e., water, air, diet, other)
- Basis for former 400 ppm residential soil lead screening level (with 10 µg/dL BLL target)
- Some Superfund sites have adopted cleanup levels higher than 400 ppm based on site-specific inputs
- EPA released new version of model with updates to several default parameters in 2021, including the following
  - Default target BLL of 5 µg/dL
  - Soil and dust ingestion rates
  - Inhalation rates
  - Dietary lead exposures
  - Maternal blood lead concentration

KEY POINT The IEUBK Model only evaluates lead exposures during childhood.

### IEUBK Model Structure



Lead Risk Assessment Primer

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# **IEUBK Overview: Run Model Function**



ppb: parts per billion

75

50

25

Lead Risk Assessment Primer

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(EPA 2021)

## **Adult Lead Model Overview: PRG Calculation**

KEY



- Microsoft Excel spreadsheet-based model
- Uses a simplified "slope factor" approach
- Slope factor relates change in BLL (µg/dL) per µg/day of lead absorbed
- The ALM can also be used to calculate soil PRGs for nonresidential land use
- Using model default parameters (including 5 µg/dL BLL target)
  - PRG = 1,050 ppm

dult Lead Methodology (ALM) alculations of Preliminary Remediation Goals (PRGs) for Soil in Nonresidential Areas .S. EPA Technical Review Workgroup for Lead, Adult Lead Committee							
ersion date 06	/14/2017		EDIT RED CELLS				
Variable	Description of Variable	Units	NHANES 2009-2014 GSDi and PbBo				
PbB <sub>fetal</sub> , 0.95	Target PbB in fetus (e.g., 2-8 µg/dL)	µg/dL	5				
R <sub>fetal/maternal</sub>	Fetal/maternal PbB ratio		0.9				
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4				
GSDi	Geometric standard deviation PbB		1.8				
PbB <sub>0</sub>	Baseline PbB	µg/dL	0.6				
IR <sub>s</sub>	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050				
AF <sub>S, D</sub>	Absorption fraction (same for soil and dust)		0.12				
EF <sub>s, D</sub>	Exposure frequency (same for soil and dust)	days/yr	219				
AT <sub>s, d</sub>	Averaging time (same for soil and dust)	days/yr	365				
PRG in	Soil for no more than 5% probability that fetal PbB exceeds target PbB	ppm	1,050				

### (EPA 2003)



## Public Health Research Drives Changes to EPA Guidance



- Public health studies published in 1990s and early 2000s provided evidence of adverse health effects of lead in children at BLLs <10  $\mu g/dL$
- In-depth compilations/reviews of primary literature on lead health effects were prepared by United States government in 2012–2013
  - 2012 NTP monograph: *Health Effects of Low-level Lead*
  - 2012 CDC-ACCLPP report: Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention
  - 2013 EPA report: Integrated Science Assessment for Lead

ACCLPP: Advisory Committee on Childhood Lead Poisoning and Prevention CDC: Centers for Disease Control and Prevention NTP: National Toxicology Program

Lead Risk Assessment Primer

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# 2012 CDC Report



### Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention

• Presents scientific rationale for eliminating CDC's 10 μg/dL blood lead "level of concern"

### **KEY POINTS / RECOMMENDATIONS**

Based on the scientific evidence, the ACCLPP recommends that the term "level of concern" be eliminated from all future agency policies, guidance documents, and other CDC publications, and that current recommendations based on the "level of concern" be updated according to the recommendations contained in this report.

CDC should use a childhood BLL reference value based on the 97.5th percentile of the population BLL in children ages 1-5 (currently 5 µg/dL) to identify children and environments associated with lead-exposure hazards. The reference value should be updated by CDC every four years based on the most recent population based blood lead surveys among children.

- Established blood lead "reference value" concept
  - Moving target, theoretically updated on a 4-year cycle
  - Based on 97.5th percentile BLL in US children ages 1–5
  - BLLs above reference value defined as "elevated"

Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention
Report of the
Advisory Committee on Childhood Lead Poisoning Prevention
of the Centers for Disease Control and Prevention
January 4, 2012
Disclaimer This document was solely produced by the Advisory Committee for Childhood Lead Poisoning Prevention. The posting of this document to our website in no way authorizes approval or adoption of the recommendations by CDC. Following the committee vote on January 4, 2012 to approve these recommendations, HHS and CDC will begin an internal review process to determine whether to accept all or some of the recommendations and how to implement any accepted recommendations.



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BLLs in United States Children 1976–2016

- Lead Regulation Milestones
  - 1971 Lead-Based Paint
    Poisoning Prevention Act
  - 1978 CPSC ban of residential paint with >600 ppm lead
  - 1986 Ban of lead in pipe, solder, and flux
  - 1992 Lead-Based Paint Hazard Reduction Act
  - 1995 FDA ban of lead solder in food packaging
- Blood Lead Reference Values
  - 2012: 5 µg/dL
  - 2021: ? µg/dL

CPSC: Consumer Product Safety Commission FDA: Food and Drug Administration

Lead Risk Assessment Primer

(Egan et al. 2021)









The blood lead reference value was 5  $\mu$ g/dL in 2012; what is the "current" CDC reference value, updated in 2021?

- A. 4.5 μg/dL
- B. 4.0 μg/dL
- C. 3.5 µg/dL
- D. 2.5 µg/dL
- E. 1 µg/dL



### **Options to respond**

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# Question 3: The blood lead reference value was 5 µg/dL in 2012; what is the "current" CDC reference value, updated in 2021?



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## BLLs in US Children 1976–2016

- Lead Regulation Milestones
  - 1971 Lead-Based Paint
    Poisoning Prevention Act
  - 1978 CPSC ban of residential paint with >600 ppm lead
  - 1986 Ban of lead in pipe, solder, and flux
  - 1992 Lead-Based Paint Hazard Reduction Act
  - 1995 FDA ban of lead solder in food packaging
- Blood Lead Reference Values
  - 2012: 5 µg/dL
  - 2021: 3.5 µg/dL





## **Presentation Overview**



- Introduction
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- EPA 2024 Updated Residential Soil Lead Guidance
- Case Studies
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## • EPA 2024 Updated Residential Soil Lead Guidance

- Screening level changes
- Screening vs. cleanup levels
- Incorporating EPA screening levels at Navy sites
- Supporting tools/guidance
- Background levels
- Bioavailability

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DASN: Deputy Assistant Secretary of the Navy DON: Department of the Navy

EPA 2024 Updated Residential Soil Lead Guidance

## **EPA Updated Residential Soil Lead Guidance**

KEY

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### Key Changes

- Lower Residential RSL
  - Previous RSL = 400 ppm
  - Updated RSL = 200 ppm
  - For sites with additional sources of lead, Updated RSL = 100 ppm
    - Use of 100 ppm RSL at DON sites requires explicit written approval from DASN

KEY

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No changes to industrial

**RSL** for lead.

• Applicable to <u>residential sites</u>: defined as any areas where children have unrestricted access to lead contaminated soil



guidance also apply to federal facility cleanup programs subject to CERCLA section 120, and potentially to federal agencies using response action authorities delegated to them under Executive Order 12580 (OFR, 1987).

When evaluating residential sites with soil lead contamination,<sup>1</sup> OLEM recommends:

For the purpose of this guidance, a residential site with soil lead contamination (residential lead site) is defined as any areas where children have unrestricted access to lead contaminated soil which include, but are not limited to, properties containing single- and multi-family dwellings, partment compresex, scant lots in residential areas, schools, day-care containing single- and multi-family dwellings, partment compresex, scant lots in residential areas, schools, day-care containing single- and multi-family dwellings, partment compresex, scant lots in residential areas, schools, day-care containing single- and multi-family compared to the school sch





## **EPA Updated Residential Soil Lead Guidance**



## • Purpose

- Enhanced recommendations for investigating and cleaning up leadcontaminated soil
- Reflects commitment to protect communities from lead, especially those facing multiple sources of lead
- Supports EPA's priority of recognizing the potential cumulative impacts from multiple sources of lead in a community
- Basis of updated soil screening levels
  - 200 ppm RSL: based on IEUBK Model using 5  $\mu$ g/dL target BLL
  - 100 ppm RSL: based on IEUBK Model using 3.5 µg/dL target BLL

# **Screening Levels vs. Cleanup Levels**



- RSLs
  - Tools to identify areas needing further evaluation
  - Not cleanup levels
- Site-Specific Decisions
  - Guidance does not dictate response actions or cleanup levels
  - Cleanup decisions to be made on a site-by-site basis, considering site-specific factors such as exposure and risk, bioavailability, and background lead levels
- EPA expects that lower screening levels may prompt more residential property investigations for soil lead impacts and result in more cleanup



Silver Bow Creek/Butte Area NPL Site, MT (EPA 2024c)

#### Existing BPSOU Boundary and Proposed Expansion

Existing BPSOU Boundary 4,265 acres 4,700 households **Proposed BPSOU Expansion** 3,637 additional acres 7,253 additional households



BPSOU: Butte Priority Soils Operable Unit

EPA 2024 Updated Residential Soil Lead Guidance

# Lead Cleanup Level Planning at Navy Sites



- Establishing cleanup levels
  - EPA policies still point to 10 µg/dL target BLL (OSWER 1994 and 1998)
    - Equates to 400 ppm screening level
  - 2024 EPA guidance recommends lower target BLLs of 5  $\mu$ g/dL or 3.5  $\mu$ g/dL
    - Equates to soil lead levels of 200 ppm or 100 ppm, respectively
  - Policy vs. Guidance: to be consistent with other chemicals, EPA policies take precedence over guidance
- Initial PRG should be based on 10 µg/dL BLL target
- If possible, also evaluate impact of a PRG based on 5  $\mu$ g/dL BLL target
- If acceptable, consider using more conservative PRG, with Navy Headquarters approval
  - For example: if reasonable amounts of additional excavation or minimal LUC boundary expansion would achieve more conservative PRG
  - Use of 100 ppm requires <u>written permission from DASN</u>
- Check state-specific ARARs

ARAR(s): applicable or relevant and appropriate requirements LUC: land use control

EPA 2024 Updated Residential Soil Lead Guidance

## **Incorporating EPA Screening Levels at Navy Sites**



- Navy sites typically screen residential lead sites to 200 ppm
  - For deviations, coordinate with leadership for current best practices and approval
- Cleanup level is site-specific, not based on RSL
  - Use of IEUBK model and/or ALM
  - Site-specific inputs
  - Average soil concentration (site-wide or decision-unit-wide)
  - Predicted BLLs (e.g., >5% of children with blood lead >10  $\mu$ g/dL)



## EPA Updated Residential Soil Lead Guidance Supporting Tools and Guidance



- Updated OLEM Residential Lead Guidance Explainer
  <a href="https://semspub.epa.gov/work/HQ/100003437.pdf">https://semspub.epa.gov/work/HQ/100003437.pdf</a>
- Frequent Questions About the Updated Residential Lead Guidance
  <a href="https://www.epa.gov/superfund/frequent-questions-about-updated-residential-soil-lead-guidance">https://www.epa.gov/superfund/frequent-questions-about-updated-residential-soil-lead-guidance</a>
- Supplemental Framework: Selecting a Remedial Screening Level for Residential Soil Lead <u>https://semspub.epa.gov/work/HQ/100003397.pdf</u>
- Residential Lead Screening Level Checklist
  <u>https://semspub.epa.gov/src/document/HQ/100003395</u>
- Residential Lead GIS Screening Tool
  <u>https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=ffe699ef7fdc4f8982d933806de179d7</u>
- Superfund Residential Lead Sites Handbook
  <u>https://semspub.epa.gov/work/HQ/100003401.pdf</u>

For additional information, visit <u>www.epa.gov/lead</u>

OLEM: Office of Land and Emergency Management

EPA 2024 Updated Residential Soil Lead Guidance

## Screening Level Selection **Residential Lead Screening Checklist**



### Series of three tables

Table 1: Evaluate Primary Data Sources

- NAAQS non-attainment zone for lead?
- Lead Paint Index ≥80th percentile?

Table 2: Evaluate Secondary Data Sources on Potential Lead Exposures

• Other local or site-specific information?

Table 3: Evaluate Mitigation Efforts

Ongoing or past mitigation efforts?

						Res	idential Le	ead So	cre	eni	ng Level Checklist			]
Site I	nforn	natio	n											(EPA 2024d)
Site o	or stu	dy ar	ea name											
Locat	ion (	City/0	County, State, Zip)								SEMS EPA ID			
Curre	ent re	medi	al pipeline phase								Does a site boundary exis	t in SEMS? 🛛 Yes	□ No	
Brief reme inclu	ly des dial v ding p	oribe vork previo	any removal or completed to date, ous screening levels											
Brief	y des	cribe	the geographic scope	Tab	le 2:	Eval	uate Secondary	Data Se	ourc	es o	Potential Lead Exposures			
while	e stud	iy are pletir	ng the checklist	Yes	No	?	Question				Data Evaluation Notes		References	
Char			lated by:				Are you aware exposures due t	of any po to deteri	orati	ial so ng ei	il terior		EPA Regional Lead	-Based Paint Contacts
Chec	klist o	comp	leted by:		-	-	lead-based pair	nt? Gar in the			as with		Canada fas fasilitias	to access their compliance
Nam	5					1	known lead viol	lations?	e stuk	oy ar	ca with		Check with state a	nd local contacts for facilities
													not subject to EPA	authorities
Table Yes	1: Ev No	/alua ?	te Primary Data Source Question				Are you aware a	of lead p	ipes	and/	or lead		Check with the stat	te's drinking water program
			Is the study area in a N	4			Service lines in t	the study	yares				Check local drinkin	g water quality annual reports
_	_		nonattainment zone fo				Among the scho there drinking v	ools in th	e stu orts	dy a	rea, are sting		The local public wa	iter department may have
			data demonstrate that the homes in the study	t			that indicate	Table	e 3: E	valu	ate Mitigation Efforts			
			above the 80 <sup>th</sup> percent	t				Yes	No	?	Question	Data Evaluation Notes		References
			Are you able to you se			-	Are unit and				Does the state, tribe, or territory have an EPA-authorized lead-based paint			Lead-based paint abatement programs
			sources?		1	1	practices or				program?			RRP program information
Versio	n 1 –	Febr	Jary 2024				may involve							Identify authorized professionals
v ci 5i0		I CDI	101 y 2024				making)							EPA Regional Lead-Based Paint Contacts
							Are there re elevated bk				Is the study area covered by a lead ordinance or local lead laws? (e.g., real estate disclosure, dust hazard			Check with the state and local government authorities to find out about lead laws and ordinances specific to the area.
							children in t reports indi				mitigation, building codes, permits or requirements for renovations)			Learn about federal lead laws and regulations
														Real estate disclosures about potential lead hazards
				Ver	sion	1 - F	ebruary 202				Are you aware of whether older homes and/or schools have addressed lead- based paint through mitigation, encapsulation, or renovation?			Check with your regional Lead-Based Paint Coordinator, the local health department, education department, or school district(s) for this information.
														How to check for lead hazards in schools and childcare facilities
											Are you aware of whether lead service lines have been replaced or are scheduled to be replaced?			Check with the local public water department more information
											Have there been other previous initiatives to directly address lead exposures in the study area? (If yes, add notes on the outcome, including successes, challenges and gaps in effectiveness.)			Check with your state or local health departme
								Versi	on 1 -	– Feb	ruary 2024			3

NAAQS: National Ambient Air Quality Standards

**Superfund Residential Lead Sites Handbook** 

- Resource guide for RPMs, OSCs, and risk assessors evaluating residential lead sites
- Identifies tools and summarizes best practices to promote consistency and provide flexibility
- Captures advances in those tools and best practices which have evolved since EPA first issued the handbook in 2003
- Moving forward, each chapter of the handbook will be a module that can be updated or modified as new information and experience are gathered



(EPA 2024b)

OSC: On-Scene Coordinator RPM: remedial project manager

EPA 2024 Updated Residential Soil Lead Guidance



## **Background Considerations for Lead**

- EPA's updated residential soil lead screening levels may be below background concentrations
- Establishing statistically robust background lead levels will be important for some sites
- CERCLA generally does not clean up to concentrations below natural or anthropogenic background levels
- Cleanup levels may be set at sitespecific background concentrations

United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation

OLEM Directive 9200.2-141 A March2018

Frequently Asked Questions About the Development and Use of Background Concentrations at Superfund Sites: Part One, General Concepts

"Generally, under CERCLA, cleanup levels are not set at concentrations below natural background levels. Similarly, for anthropogenic contaminant concentrations, the CERCLA program normally does not set cleanup levels below anthropogenic background concentrations (US EPA, 1996; US EPA, 1997b; US EPA, 2000c). The reasons for this approach include cost-effectiveness, technical practicability, and the potential for recontamination of remediated areas by surrounding areas with elevated background concentrations. In cases where areawide contamination may pose risks, but is beyond the authority provided under CERCLA, EPA may be able to help identify other programs or regulatory authorities that are able to address the sources of area-wide contamination, particularly anthropogenic (US EPA, 1996; US EPA, 1997b; US EPA, 2000c). In some cases, as part of a response to address CERCLA releases of hazardous substances, pollutants, and contaminants, EPA may also address some of the background contamination that is present on a site due to area-wide contamination."

(EPA 2018)



# **EPA Definition of Background**



 In urban areas, it may be difficult to distinguish between anthropogenic background and siterelated sources of lead United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation

OLEM Directive 9200.2-141 A March2018

Frequently Asked Questions About the Development and Use of Background Concentrations at Superfund Sites: Part One, General Concepts

> OLEM Directive 9200.2-141 A March2018

#### Questions

#### 1. What is natural background? What is anthropogenic background?

The Role of Background Guidance defines both anthropogenic and natural background (US EPA, 2002b):

*Background* refers to constituents or locations that are not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic (US EPA, 1989; US EPA 1995a):

- 1) Anthropogenic natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA release in question); and
- 2) *Naturally occurring* substances present in the environment in forms that have not been influenced by human activity.

(EPA 2018)

# **Superfund Background Lead Initiative**



- EPA is conducting lead background studies at up to 20 Superfund sites across the United States
- Example: Former Kil-Tone Superfund Site Vineland, New Jersey
  - Sampling Grid is a 10 x 10 matrix
  - 100 grid cells of 0.6 mi by 0.7 mi each
  - 60 grid cells randomly selected for sampling (50 primary, 10 contingency)
  - Calculate UTL threshold-based background level



(RTI International and Geosyntec Consultants 2025)

mi: miles UTL: upper tolerance limit

EPA 2024 Updated Residential Soil Lead Guidance

# **Navy 2004 Background Policy**





# **Navy 2004 Background Policy**





DEPARTMENT OF THE NAVY OFFICE OF THE CHIEF OF NAVAL OPERATIONS 2000 NAVY PENTAGON WASHINGTON, D.C. 2035-2000

> IN REPLY REFER TO 5090 Ser N45C/N4U732212 30 January 2004

From: Chief of Naval Operations To: Commander, Naval Facilities Engineering Command

Subj: NAVY POLICY ON THE USE OF BACKGROUND CHEMICAL LEVELS

Encl: (1) Navy Policy on the Use of Background Chemical Levels

1. Enclosure (1) is provided in response to field concerns to clarify Navy policy on the consideration of background chemicals as it applies in the Environmental Restoration Program. This policy further clarifies the Navy's interpretation of the Environmental Protection Agency's <u>Role of Background in the CERCLA Cleanup Program, April 2002</u>. The policy describes how to consider background chemical levels by 1) identifying those chemicals that are in the environment due to releases from the site; 2) eliminating from consideration in the risk assessment process both naturally occurring and anthropogenic chemicals that are present at levels below background; 3) ensuring documentation and discussion of potential risk of chemicals that have been eliminated during the background evaluation process; and 4) developing remediation action levels that are not below background.

2. Questions can be addressed to Dave Olson at (703) 602-2571; DSN 332-3571 or by email: David.L.Olson@navy.mil.

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(Navy 2004)

#### Anthropogenic chemical levels (non-naturally occurring) -

Concentrations of chemicals that are present in the environment due to human-made, non-site sources (e.g., application of pesticides, herbicides, lead from automobile exhaust). (RAGS Part A EPA, 1989)

#### Anthropogenic Chemical Levels (ACL)

Anthropogenic background chemicals and their levels are substances that are in the environment as a result of human activities. Standard application (i.e., applied according to directions) of chemicals (e.g. pesticides and herbicides) are to be considered anthropogenic levels when it can be demonstrated that on-site and background levels are similar.

#### Base-wide Background Chemical Levels

To fully understand the nature of the site it is necessary to distinguish between releases caused by Navy operations and those chemicals caused by non-site related sources (background). Base-wide background chemical levels should be established and considered as early as the Preliminary Assessment/Site Inspection phase of the CERCLA process and/or the Resource Conservation and Recovery Act (RCRA) Facility Investigation of the RCRA process. Establishing scientifically defensible background chemical levels early in the process provides rationale to support no further action decision for sites with 'no site releases'.

#### Managing Lead-Impacted Sites under CERCLA 42

EPA 2024 Updated Residential Soil Lead Guidance

# **Site-Specific Lead Bioavailability**



- Bioavailability is a measure of the fraction of an ingested chemical dose that enters the bloodstream
- Lead is present in different chemical forms in soils, with some forms more bioavailable than others
- Lower bioavailability indicates a smaller fraction of lead in soil that can be absorbed by the body
- EPA generally recommends that site-specific relative bioavailability data be collected at leadcontaminated sites using validated *in vitro* methods

Guidance for Sample Collection for *In Vitro* Bioaccessibility Assay for Arsenic and Lead in Soil and Applications of Relative Bioavailability Data in Human Health Risk Assessment

United States	
Environmental	
Protection Agency	



Guidance for Sample Collection for *In Vitro* Bioaccessibility Assay for Arsenic and Lead in Soil and Applications of Relative Bioavailability Data in Human Health Risk Assessment

#### January 4, 2021

(EPA 2021)



(EPA 2017)

	METHOD 1340 IN VITRO BIOACCESSIBILITY ASSAY FOR LEAD IN SOIL	
Table of	Contents	
1.0	SCOPE AND APPLICATION	1
2.0	SUMMARY OF METHOD	2
3.0	DEFINITIONS	2
4.0	INTERFERENCES	3
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6.0	EQUIPMENT AND SUPPLIES	4
7.0	REAGENTS AND STANDARDS	4
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17.0	TABLES, DIAGRAMS, FLOWCHARTS, AND VALIDATION DATA	13

#### Disclaimer

SW-846 is not intended to be an analytical training manual. Therefore, method procedures are written based on the assumption that they will be performed by analysts formally trained in the basic principles of chemical analysis and in the use of the subject technology.

In addition, SW-846 methods, with the exception of required use for the analysis of method-defined parameters, are intended to be guidance methods which contain general information on how to perform an analytical procedure or technique, which a laboratory can use as a basic starting point for generating its own detailed standard operating procedure (SOP), either for its own general use or for a specific project application. Performance data included in this method are for guidance purposes only and must not be used as absolute quality control (QC) acceptance criteria for the purposes of laboratory QC or accreditation.

#### 1.0 SCOPE AND APPLICATION

1.1 The purpose of this method is to define the proper analytical procedure for the validated *in vitro* bioaccessibility (IVBA) assay for lead in soil, to describe the typical working range and limits of the assay, quality assurance (QA), and to indicate potential interferences. At this time, this method has only been validated for lead-contaminated soil under field conditions and not for other matrices (e.g., water, air, amended soils, dust, food, etc.).

SW-846 Update VI	1340 - 1	Revision 1 February 2017
		rebruary 2017

### (EPA 2017)

EPA 2024 Updated Residential Soil Lead Guidance

### Managing Lead-Impacted Sites under CERCLA 43

## **Presentation Overview**



- Introduction
- Lead Risk Assessment Primer
- EPA 2024 Updated Residential Soil Lead Guidance
- Case Studies
- Summary/Key Takeaways

# **Section Overview**



## Case Studies

- Westside Lead Site: Atlanta, Georgia -
- Site 78A: Andersen AFB, Guam
- Sites 21A and 63A: Andersen AFB, Guam

From S. Alexander, J. Jefferies, and B. Martin, 2025. *EPA Updated Residential Soil Lead Policy and Guidance – Case Studies*. Georgia Environmental Conference, Aug. 22, 2024.

From A. Miyamoto, 2025. *Case Studies of Managing Changing Lead RSLs*, Navy 2025 Environmental Restoration Conference, Feb. 2025.



- Emory University grad student studying lead in urban gardens found slag in a west Atlanta neighborhoods
- Historically, many foundries operated in Atlanta
- Slag is suspected of being used as fill during neighborhood development, circa 1900–1940s
- This slag enriched with lead and slightly high in arsenic



Figure 1 - Atlanta's Westside slag can appear as a dark layer of sandy grit just below the soil or as gravelly pieces often described as "lava rocks" or "moon rocks."

(EPA 2024a)



(EPA 2021b)

### **Case Studies**

### Managing Lead-Impacted Sites under CERCLA 46



### **Project Timeline**

Action	Date
NPL Proposed Listing	September 2021
NPL Final Listing	March 2022
RI/FS Report	August 2022
Record of Decision	November 2022
Remedial Design	January 2023
Remedial Action Start	August 2023
Updated Residential Soil Lead Guidance	January 2024
Lead Background Study Work Plan	September 2024
Lead Background Study Implementation	November 2024

(Alexander et al. 2025)

FS: feasibility study NPL: National Priorities List RI: remedial investigation

Case Studies



### Westside Lead Status Update As of April 10, 2025

### **Sampling Metrics**

- Total Properties (estimated): 2,097
- Access Granted: 1,680
- Properties Sampled: 1,624
- Properties Requiring Remediation (>400 ppm): 606

### **Remediation Metrics**

- Properties Completed: 300
- Properties Remaining: 254
- Properties in Progress: 10
- Nonhazardous Soil Removed (Tons): 89,130

Soil Removed (in tons) in Completed - Ready for Remova **Removal in Progress** 24.86k **Removal Completed** 6 Since August 2023 300 140 128 120 Parcels Sampled 100 .446 **Property Type** 80 60 Resident 85.54% 35 40 Unknow 20 3 5 Parcels ready to schedule inspection (By Tier)

### Westside Lead Site: Removal Statistics Dashboard

(Alexander et al. 2025)



### Updated Residential Lead Guidance Implications

- Assuming a Cleanup Level of 200 ppm, ~71% of parcels sampled will require remediation
  - An additional ~828 parcels will need to be addressed (total 1,500 parcels in OU-1)
  - ~\$100,000,000 remedial cost estimate
  - Establishing a new site-specific cleanup level
  - Background study
  - Other lead sources evaluation
  - Amended/new decision document development (ESD with comments or AROD)



(Google Earth 2024)

AROD: administrative record of decision ESD: explanation of significant differences OU: operable unit

**Case Studies** 

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### Managing Lead-Impacted Sites under CERCLA 50

### Case Study 2 Marine Corps Base Camp Blaz, Guam (Pre-ROD)

• RI/FS completed in 2014

**Case Studies** 

- Draft ROD selected UU/UE remedy
- Conducted Removal Action based on a tentative agreement from EPA to sign ROD
- Removal action completed in 2016
- New EPA PM disagreed with IEUBK model inputs and lead remedial goal (551 mg/kg)

### Four Categories of AOC Lead Identified

- 1. Soil removed, confirmed lead conc. <400 ppm
- 2. Soil removed, no confirmation results for lead
- 3. No removal, AOC average lead conc. <400 ppm
- 4. No removal, AOC average lead conc. >400 ppm
- Insufficient data to define LUC boundaries to 400 ppm

AOC: area of concern UU/UE: unlimited use/unrestricted exposure



PM: project manager



## Case Study 2 Marine Corps Base Camp Blaz, Guam (Pre-ROD)



- Because more assessment work was needed, project team elected to delineate to 200 ppm to evaluate effects of screening level change
  - XRF was used to assist with selecting locations of samples sent to fixed-base lab
- Possible Outcomes
  - AOC with average concentration <200 ppm
  - AOC with average concentration >200 ppm but <400 ppm</li>
  - AOC with average concentration >400 ppm

## Most difficult scenario

XRF: x-ray fluorescence

Possible Problems

- EPA Position 1: Point value of lead needs to be addressed, regardless of AOC average
- EPA Position 2: Need to clean up to average concentration ≤200 ppm
- Potential Resolutions
  - Educate regulator
  - Agree to disagree? (consider involving risk assessor and/or legal)
  - Potentially consider cleaning up to <400 ppm based on site-specific conditions (NEED HEADQUARTERS APPROVAL)

## Case Study 3 Andersen AFB Sites 21A and 63A (Post-ROD)



- RODs finalized in 2009 (21A) and 2011 (63A)
  - Both selected UU/UE remedy
  - Due to various delays, remedial action did not commence until 2023
- Remedial Action Work Plan stage
  - EPA disagreed with remediation goals, which were based on a BLL of 10 μg/dL
  - EPA PM identified point concentrations >400 ppm





(Google Maps 2025)

### (AECOM 2011)





## Site 21A

- Headquarters approved
  cleanup to 200 ppm
- Due to MEC regulation, could not complete remedial action
  - In remediated areas, used XRF to delineate to either PRG (200 mg/kg) or background (166 mg/kg)



(Modified from Cape Environmental Management 2023a)

MEC: munitions and explosives of concern

Case Studies





### Site 63A

- Headquarters approved evaluation of cleanup to 200 ppm
- RI data were insufficient to develop robust cost estimate for cleanup to 200 ppm
- Conducted additional delineation/confirmation sampling (XRF)



(Modified from Cape Environmental Management 2023a)





### Site 63A

- Successfully delineated to 200 ppm
- Additional cost for cleanup to 200 ppm was deemed acceptable
- With Headquarters approval, will proceed with cleanup to 200 ppm



(Modified from Cape Environmental Management 2023b)

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# **Summary/Key Takeaways**



- Lead risk assessment is unique
- EPA 2024 Updated Residential Soil Lead Guidance substantially lowers default screening levels for lead in soil
  - Based on lower BLL target: 10 μg/dL → 5 μg/dL

400 ppm → 200 ppm

- Use of lower BLL targets in calculation of cleanup levels could increase cost to achieve closure
- Developing site-specific background levels may be more important at some sites





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# Questions