

Lead Screening Kit – Helping Families Find Lead Hazards in their Home Environment



The University of Notre Dame Lead Innovation Team

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SOUTH BEND'S STUBBORN LEAD PROBLEM

By Ted Booker | South Bend Tribune

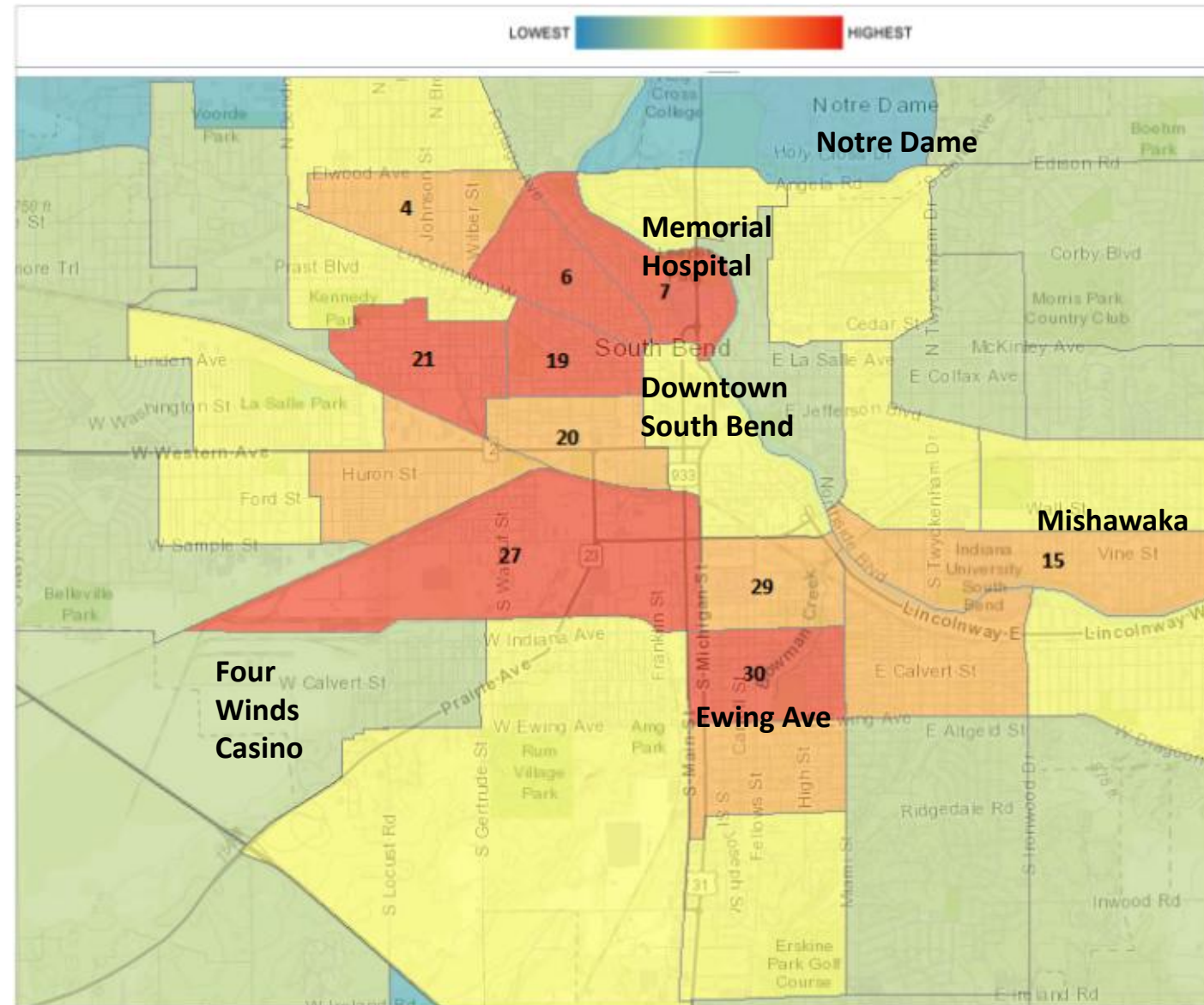


Childhood Lead Risk Level

Who's at risk?

Children 6 and under, and pregnant women, especially if:

- Live in older housing (87% of homes in SB built before 1980)
- Low income
- Members of racial-ethnic minorities
- Recent immigrants
- Have parents who are exposed to lead at work



The Notre Dame Lead Screening Kit

In 2018 ND launched a lead screening kit containing the supplies for residents to collect soil, paint, dust and water samples. The kit is then returned to our lab for XRF analysis.



The kit was previously validated by comparing sample measurements *in-situ* and *ex-situ* and showed 96% accuracy for detection of environmental lead hazards

Research Questions

Does the screening kit identify lead hazards in homes as well as Lead Inspection and Risk Assessments (LIRAs)?

Are samples collected in the screening kit returning independent results or is there correlation between sample types?

LIRA versus Lead Screening Kit

LIRA

- ~\$400-\$600
- 1-3 hours of inspector in home
- >6 weeks to receive results
- Provides detailed information
- Basis for interim control/abatement

Screening Kit

- ~\$20
- Performed by resident in ~20 minutes
- 2 weeks to receive results
- Provides non-specific information
- Basis for lead information

Indiana Department of Health: 2023 Childhood Lead Surveillance Report

Total number of children tested	Number of children who received a confirmed EBL ≥ 3.5 $\mu\text{g}/\text{dL}$	Number of risk assessments completed	Shortfall
108,533	1,862	961	901

X-Ray Fluorescence Spectroscopy (XRF) as an Analytical Tool

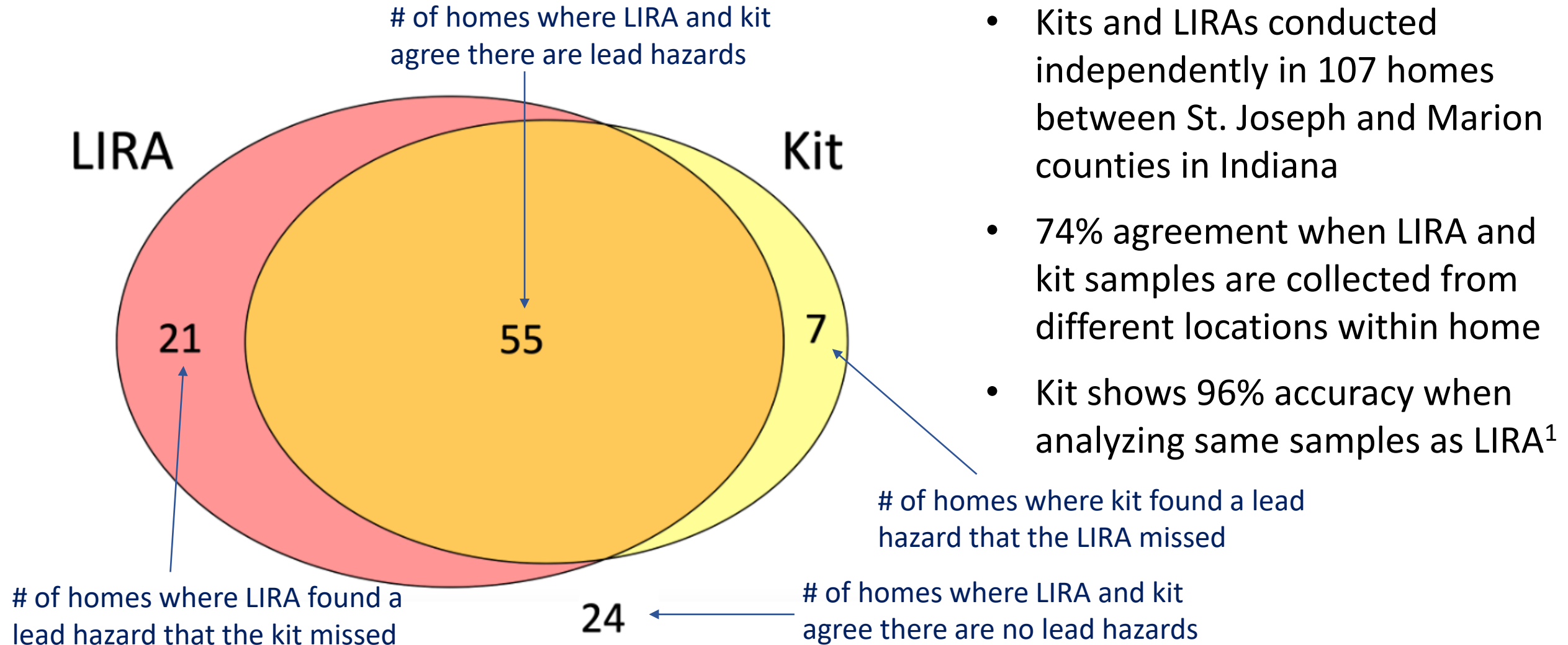
- Solid matrix (no sample prep)
- 1 minute run time per sample
- Initial cost: ~ \$25,000
- LoD: ~5 ppm
- Already owned by many health departments



Sample Type	EPA Limit
Paint	5000 ppm
Soil	400 ppm
Dust	5 $\mu\text{g}/\text{ft}^2$ ← 20 ppm
Water	15 ppb ← 150 ppm

Using appropriate sample collection and concentration methods we can generate strong calibration curves for dust and water detection

Do Kits and LIRAs Agree on Presence of Lead Hazards?



¹Tighe, M.; et al., Environ. Res. 2020, 181, 108892.

Summary of Lead Screening Kit Research

- Comparable performance in identifying lead hazards
- Less expensive than LIRAs
- Serves as a screening tool; not to replace LIRAs
- Provides the resources to shift the paradigm and test homes *before* a child becomes lead poisoned

Living Lead Safe: Helping Pregnant Moms Bring Baby Home to a Lead Safe Environment

Project goal: Help pregnant women identify and mitigate lead exposure risks through education, testing, and remediation.

- Partnership with Beacon Community Impact ar
- Distribution of lead screening kits to WIC client
- BABE store
- Client incentives
- Access to City of South Bend HUD remediation
- (income qualified)



Lead Screening Kit
Data
July 2024 - June 2025

Lead Screening Kits by Number of
Elevated Results

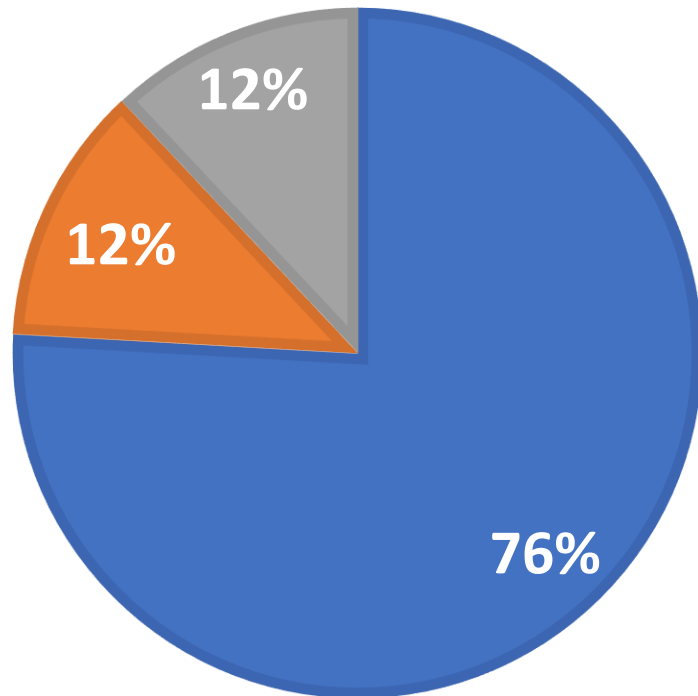
N = 188 ¹	
Total Elevated Samples	
0	80 (43%)
1	19 (10%)
2	26 (14%)
3	37 (20%)
4	9 (4.8%)
5	6 (3.2%)
6	7 (3.7%)
7	2 (1.1%)
9	2 (1.1%)
¹ n (%)	

108 (57.4%)
kits had at
least one
elevated result

Lead Screening Kits

ELEVATED LEAD SAMPLES BY AGE OF HOME: ALL KITS

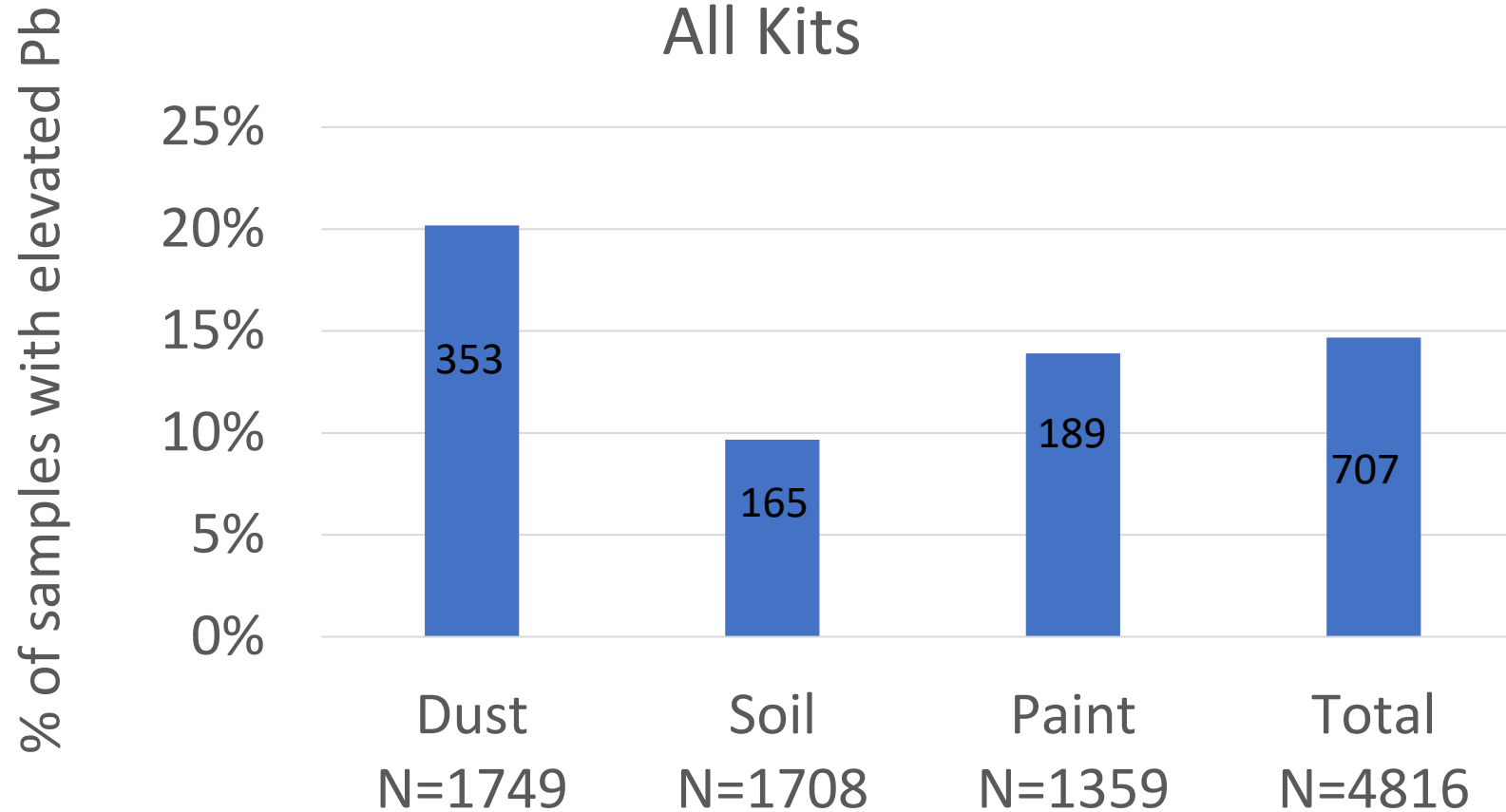
■ Pre 1950 ■ 1950-1978 ■ Unknown



- 590 kits
- 291 (49%) kits with elevated samples
- Zero elevated samples in homes built post-1978
- 54.6% of homes have children ≤ 6 years old

Lead Screening Kits

% of samples with elevated Pb by type
All Kits



Children Living in Homes with Lead Hazards

Children Under 7 in Homes with at Least One Elevated Result

N =
108¹

Children Under 7 in Home

0	3 (3.2%)
1	45 (47%)
2	23 (24%)
3	16 (17%)
4	4 (4.2%)
5	3 (3.2%)
6	1 (1.1%)
Missing	13
¹ n (%)	

92 (96.84%)
of the homes
had at least
one child <7
years

176 children
living in
homes with
lead hazard

Kit Completeness

Kit Completeness by Elevated Result

	Overall N = 188 ¹	No Lead Identified N = 80 ¹	Lead Identified N = 108 ¹
Kit Completeness			
Complete	105 (56%)	37 (46%)	68 (63%)
Incomplete	83 (44%)	43 (54%)	40 (37%)
¹ n (%)			

Missing Samples Data

Missing Samples By Elevated Result			
	Overall N = 188 ¹	No Lead Identified N = 80 ¹	Lead Identified N = 108 ¹
Missing Any Sample	83 (44%)	43 (54%)	40 (37%)
Missing Soil	14 (7.4%)	8 (10%)	6 (5.6%)
Missing Paint	72 (38%)	38 (48%)	34 (31%)
Missing Dust	18 (9.6%)	8 (10%)	10 (9.3%)
Missing Water	3 (1.6%)	1 (1.3%)	2 (1.9%)
¹ n (%)			

Do Incentives Matter?

Time to Return by Incentive Offered

	Overall N = 188 ¹	Cleaning Kit Only N = 81 ¹	Cleaning Kit or Gift Card N = 107 ¹	p- value ²
Time To Return Kit (Weeks)	2.9 (1.0, 7.0)	7.0 (3.6, 10.9)	1.0 (0.7, 2.7)	<0.001
Missing	23	16	7	

¹ Median (Q1, Q3)

² Wilcoxon rank sum test

Summary of Our Work with WIC

- Low cost intervention to:
 - Identify a high rate of lead hazards
 - Identify children at risk of exposure and poisoning
- This project has led to new partnerships and increased distribution of kits
- Extends lead prevention reach

The Impact

*“It makes you feel helpless...
knowing your child was exposed
before you even had a chance to
protect them.”*

– South Bend mom

Final Thoughts and Next Steps

- Seek funding & partnership to scale this work
- Seek funding & partnership for childhood blood testing
- Implement User Feedback Survey

Questions?

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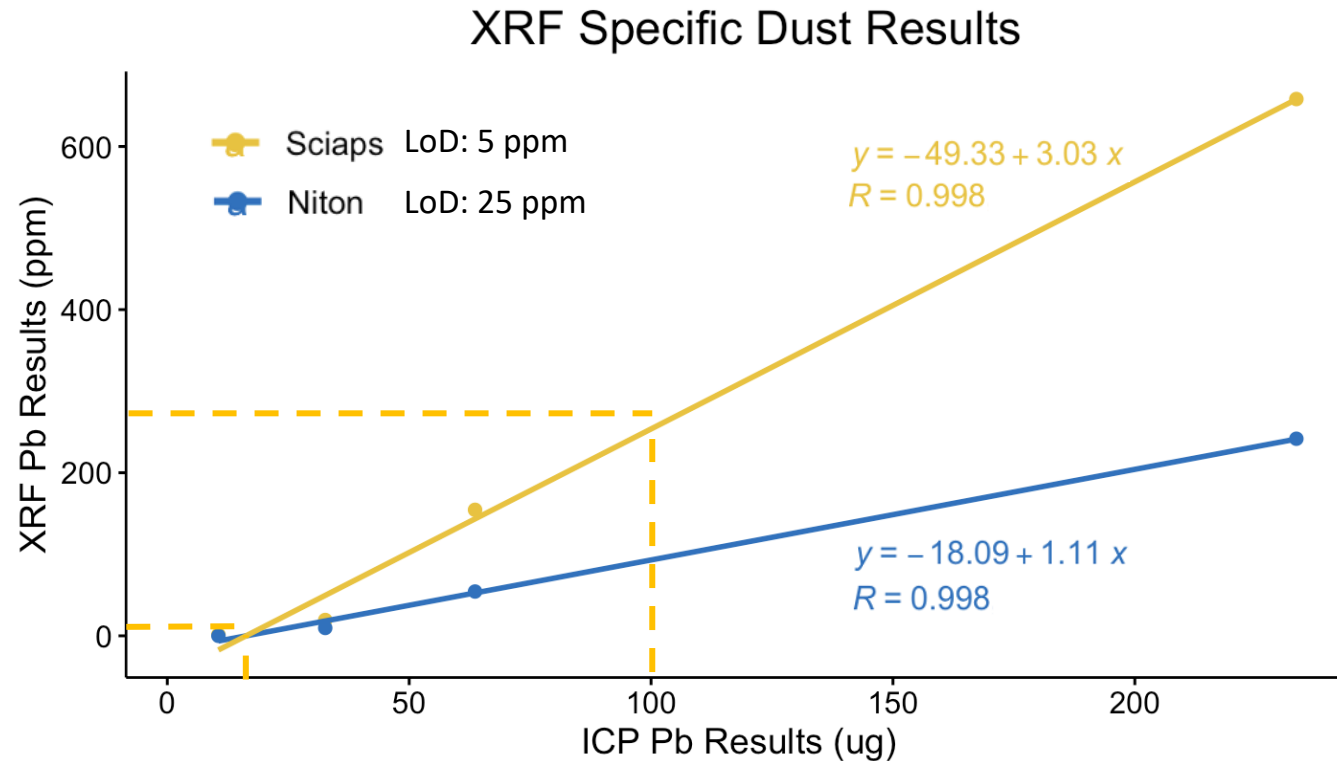
574.220.7932



Appendix

Calibration Data

Modern XRF has high sensitivity that meets regulatory requirements



EPA Limit $5 \mu\text{g}/\text{ft}^2 = 20 \text{ ppm}$
EPA Limit $100 \mu\text{g}/\text{ft}^2 = 230 \text{ ppm}$