

# Quality Control

XRF Results versus Laboratory Testing

RMS Quality Control Team

5 September 2023

# Objectives

We used on XRF to screen >1000 items, but are our results accurate?

*Across RMS Product Categories (toys, spices, cosmetics etc.):*

- Evaluate XRF testing results with an independent XRF in New York
- Compare XRF readings with laboratory testing results
- Provide laboratory testing data for products reference values below XRF detection limits (e.g., staple food products like flour).

# Methodology

- Over 1,000 samples shipped to New York
- Over 1,100 XRF readings made, often multiple readings on same item
  - Comparison to field XRFs – used range of 70% to 130% of NY XRF (and lab)
  - Anomalous results required more in depth look as to why...
  - Submission of selected samples to lab
- 354 samples submitted for laboratory testing for total lead
  - Majority at CET in Connecticut, in addition to labs in Georgia and the Philippines due to import/export issues with perishables



# What Does This Look like?

Tunisia	Spices	Cumin	5/21/2023	23TAT094	ND<2/sq. rt. of 2	1.4	2.73	submitted to lab (Multitest, Georgia) for total lead
Bangladesh	Spices	Turmeric	7/19/2022	08KHU067	Average of all XRF readings	3	2.8	submitted to lab (CET) for total lead
Armenia	Spices	Paprika	7/10/22	15VAG018	singular reading	4	2.80	tested by Georgian lab for total lead
Nigeria	Spices	Anise Seed (Powder)	11/14/2022	24LAG051	ND<3/sq. rt. of 2	2.1	3.1	submitted to lab (CET) for total lead
Nigeria	Spices	Ginger (Powder)	11/14/2022	24LAG003	ND<4/sq. rt. of 2	2.8	4.1	submitted to lab (CET) for total lead
Kenya	Spices	Chili powder	11/21/2022	22NBI002	lowest ND = ND<4/sq. rt. of 2	2.8	5.1	sent to CET for total lead analysis
Vietnam	Spices	Ginger powder	7/24/2022	29NAD010	average of all readings	9	9.8	submitted to lab (CET) for total lead
Armenia	Spices	Coriander	7/10/22	15VAG009	singular reading	12	10.95	tested by Georgian lab for total lead
Pakistan	Spices	Pakistani spices blend (Garam Masala)	12/15/2022	26KAR032	single XRF reading	160	13.04	submitted to lab (Multitest, Georgia) for total lead
Tajikistan	Spices	Spice "Turmeric"	8/12/2022	11KHU069	average of all XRF readings	72	66	submitted to lab (CET) for total lead
Tajikistan	Spices	Spice "Turmeric No. 1"	8/11/2022	11KUL005	average of all XRF readings	262	220	submitted to lab (CET) for total lead
Tajikistan	Spices	Spice "Turmeric"	8/25/2022	11BOK136	average of all XRF readings	393	320	submitted to lab (CET) for total lead

# Key Findings

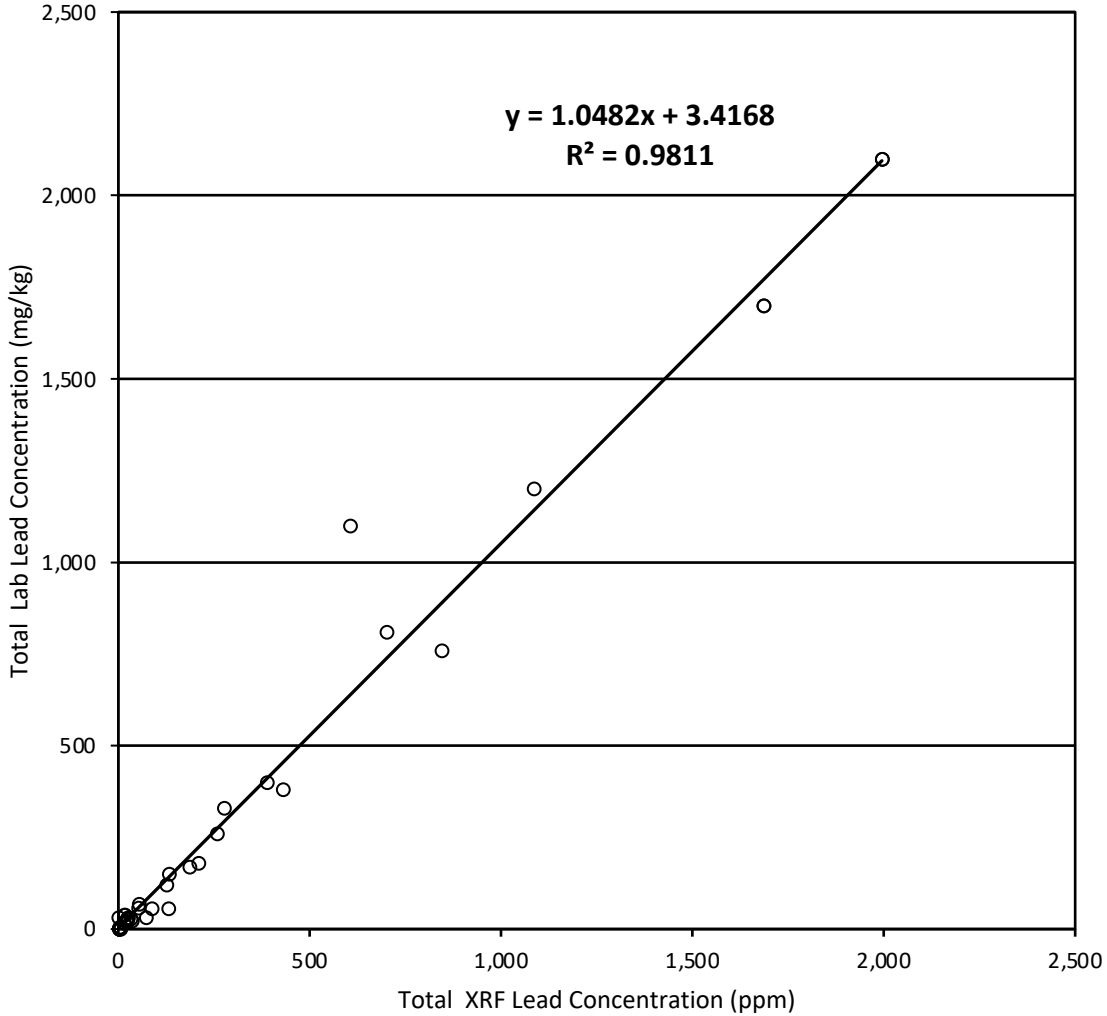
- Lead concentrations measured with a portable XRF were very comparable to lead concentrations determined by laboratory analysis across all screened items with lead concentrations in the low to high range (e.g., >5 to <30,000 ppm) based on a comparison of 354 samples submitted for laboratory testing for comparison to corresponding XRF readings. See graphs in following slides...
- Detection limits of the XRF (generally <3 or 4 ppm) and the reporting limit for laboratories (0.2 to 0.5 ppm) made comparison at the <5 ppm range difficult.
- In the limited number of samples with lead concentrations in the very high (e.g., >30,000 ppm or 3%), the XRF significantly overestimated the lead concentration in those samples, although there were only a limited number of samples in this range; e.g., pure lead on XRF vs. 30% in lab...

# Key Findings

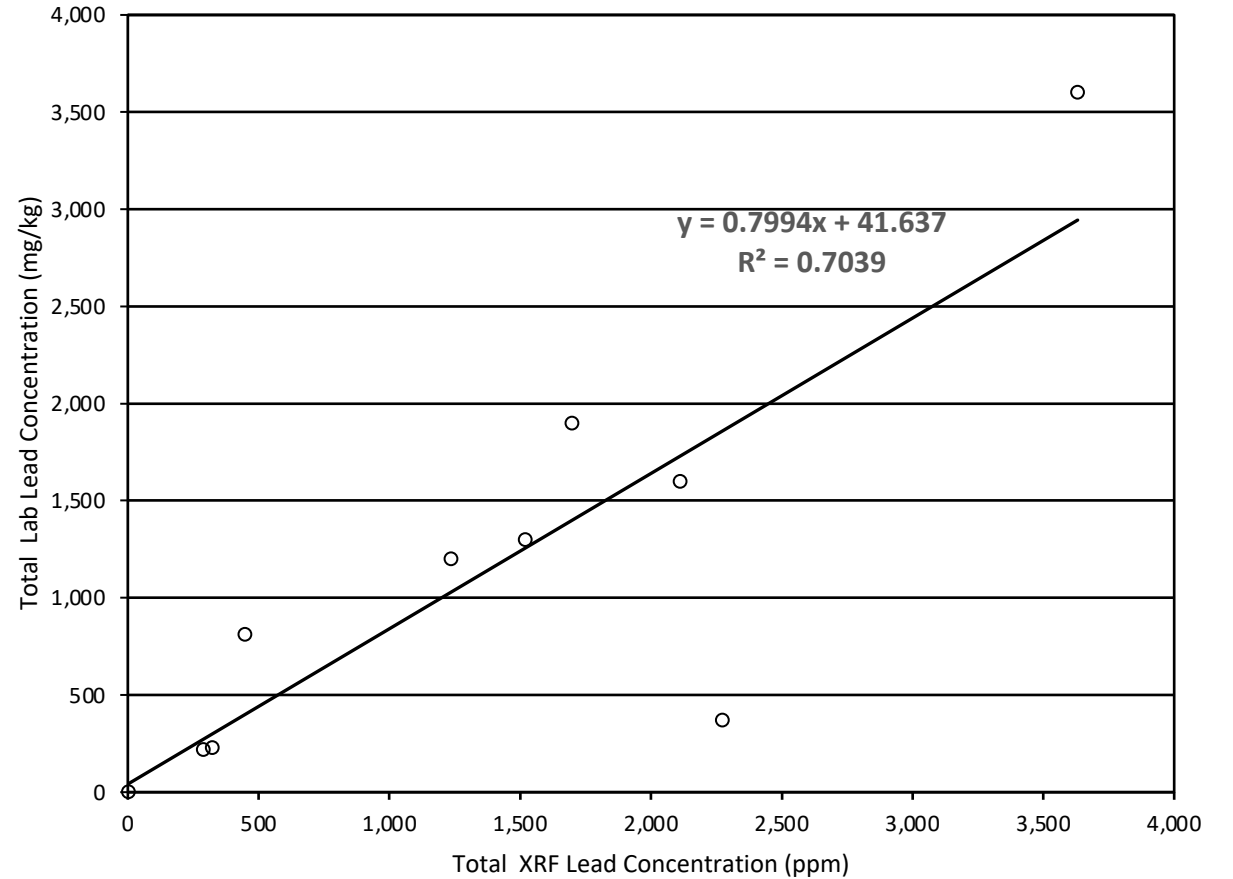
- Heterogeneous samples (e.g., with multiple colors or materials) or items containing internal metal parts (e.g., gear boxes, batteries, wires in toys; decorative portions on ceramics) proved a challenge to screen with an XRF.
- Lastly, the XRF underestimated the concentration of lead in thinly painted toys relative to scraped samples of paint submitted for laboratory testing.
  - In one case, it was the plastic beneath the paint that contained lead by XRF (not the paint)
- XRF used for Tajikistan and Kazakhstan samples had issue causing most of the data to be expunged...
- **Overall, the XRF results proved to be an excellent screening tool for elevated total lead in products ranging from spices to plastics, and at levels at or below the majority of reference standards (e.g., >5 ppm) with the exception of foods and cosmetics.**

# XRF vs. Lab

XRF vs. Laboratory Comparison  
Total Lead in Plastic Toys



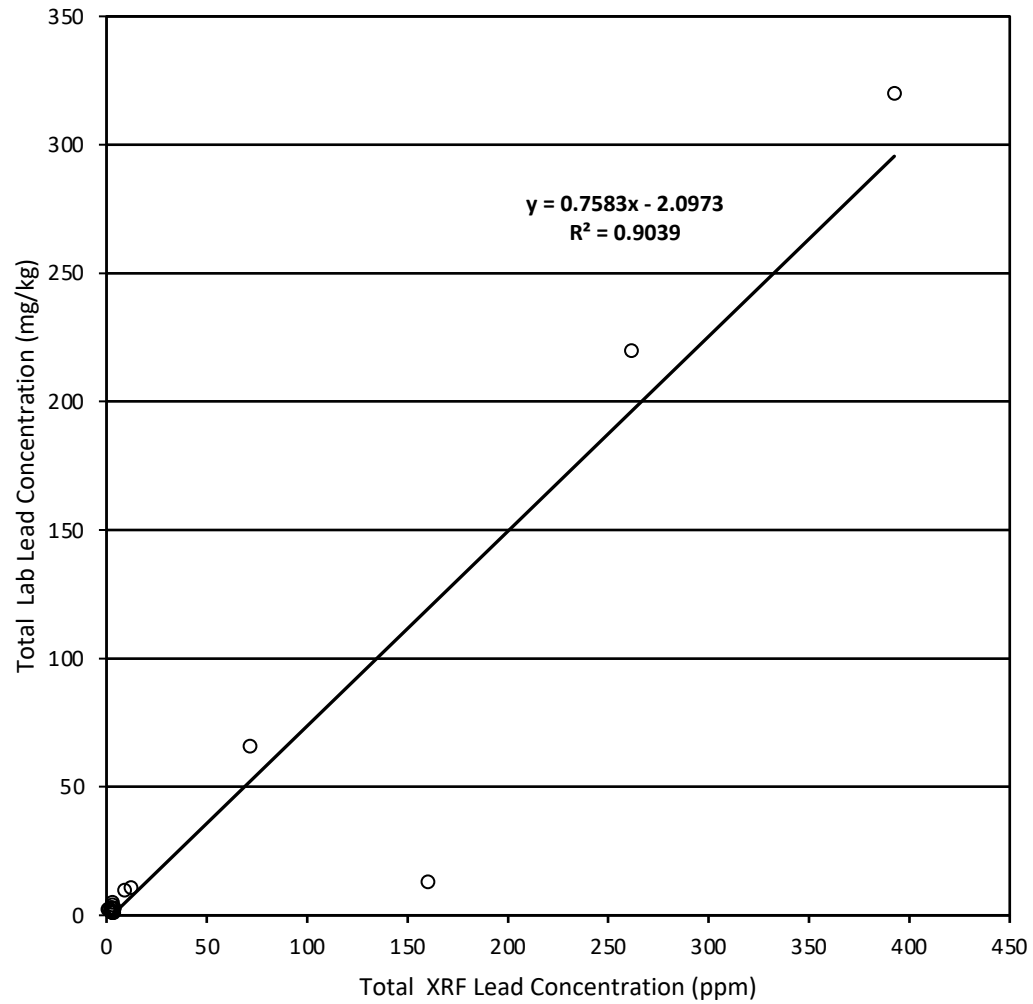
XRF vs. Laboratory Comparison  
Total Lead in Plastic Foodware



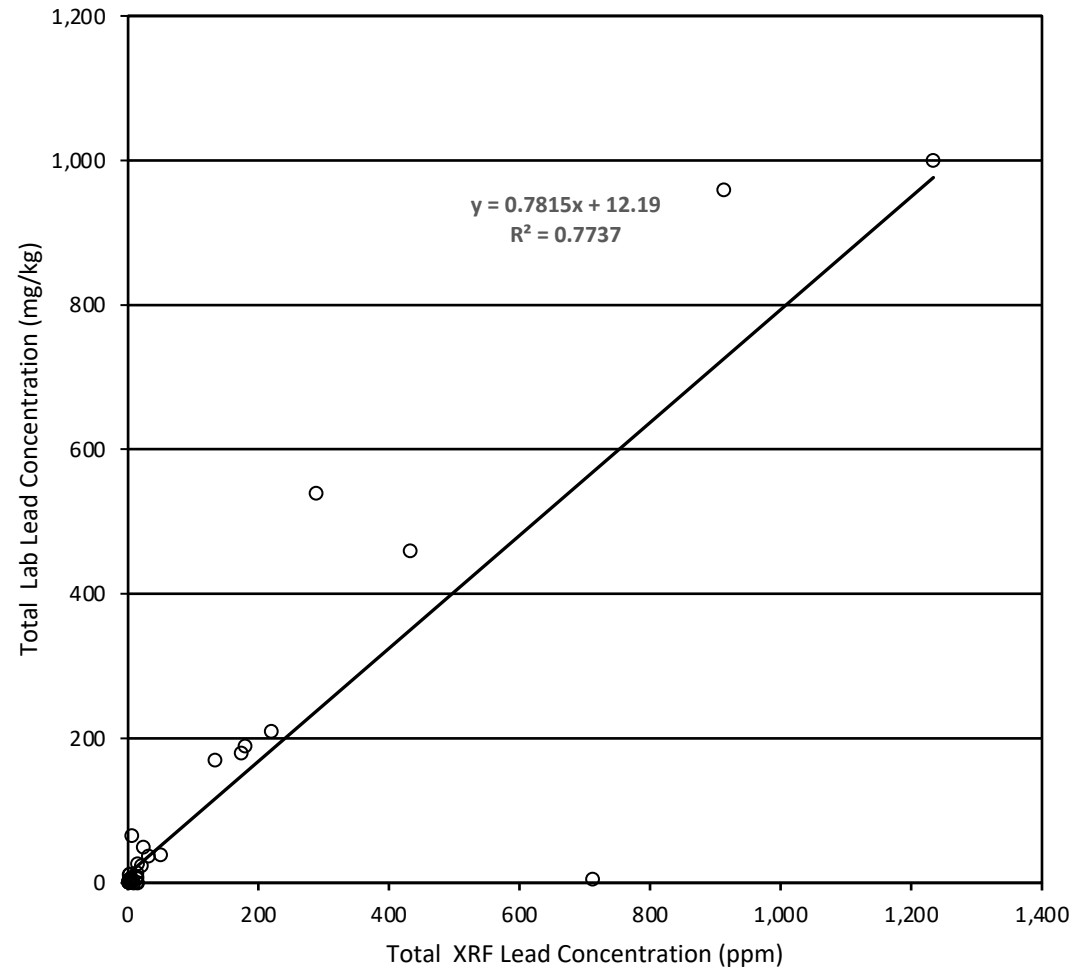


# XRF vs. Lab

XRF vs. Laboratory Comparison  
Total Lead in Spices



XRF vs. Laboratory Comparison  
Total Lead in Cosmetics





Heterogeneous toy samples from Kyrgyzstan.



Metal interior to a plastic toy from Azerbaijan.