SOUTH DAKOTA DEPARTMENT OF HEALTH

South Dakota Childhood Lead Poisoning Prevention Program (SDCLPP)
Lead Advisory Group Meeting
January 30th, 2024

Welcome and Introductions

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Lead Testing Methods in Human Specimens and Environmental Samples

Rea Riggle

Lead Testing Methods in Human and Environmental Samples

Rea Riggle
Environmental Coordinator, Senior Chemist

Lead toxicity is reported to be a major public health problem in the US today

- Harmful effects have been known for thousands of years
- Injurious effects at low levels have been the subject of increasing concern

Where is lead?

- Small amounts are naturally found in the earth’s crust.
- Contaminated soil
- Paint
- Ceramics
- Pipes and plumbing fixtures
- Solders
- Batteries
- Ammunition
- Cosmetics
- Foods and spices

Lead is commonly monitored by measuring levels in blood

Analytical Methods

- Anodic Stripping Voltammetry (ASV) (Lead Care II System)
- Atomic Absorption Spectrometry (Graphite Furnace Atomic Absorption (GFAA))
- Inductively Coupled Plasma Mass Spectrometry (ICP/MS)
- Inductively Coupled Plasma-Atomic (or Optical) Emission Spectrometry (ICP/AES or ICP/OES)

Anodic Stripping Voltammetry (ASV)

- Electrochemical technique
- Blood sample is first treated to release lead in ionic form from red blood cells and proteins
- Reference electrode and a thin-film Hg-graphite electrode
- A negative potential is applied to the Hg electrode
- The direction of the potential is reversed to give an increasingly larger potential over several minutes
- As the voltage reaches the voltage characteristic for lead, the lead ions are stripped from the electrode

ASV, continued

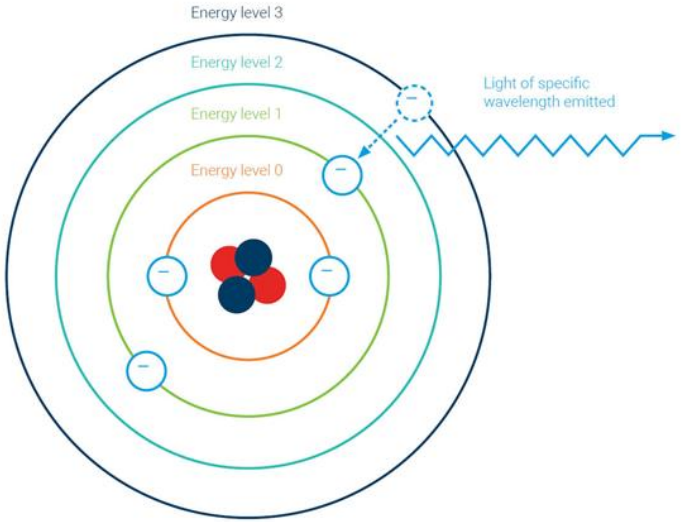
- The release or stripping of lead ions produces a current that can be measured
- The current produced is proportional to the number of lead ions released which can be compared to calibration solutions to determine the concentration of lead in the sample
- Lab-based ASV is no longer commonly used

Lead Care II System

- Portable ASV device
- Uses disposable screen-printed electrodes
- The single-use sensor, sample container, reagents and calibration equipment are provided as disposable units and are pre-calibrated by the manufacturer
- The reportable range is 3.3-65ug/dL, elevated results should be confirmed
- Studies have shown good correlation between the Lead Care II device and GFAA analysis

Atomic Absorption Spectrometry (AAS)

- Principle of Atomic Absorption Spectrometry: the interaction between outer-shell electrons of free, gaseous, uncharged atoms and ultraviolet or visible light generated from the element to be measured



Atomic Absorption Spectrometry, cont.

- The sample is atomized by either a flame or electrothermal device
- A hollow cathode lamp coated with lead emits a light in a characteristic wavelength that can be absorbed by lead atoms in the sample
- Light passes through the atomized sample and some energy is absorbed by the lead atoms, reducing the amount of light transmitted to the detector
- The amount of light absorbed is related linearly to the concentration of the analyte in the sample

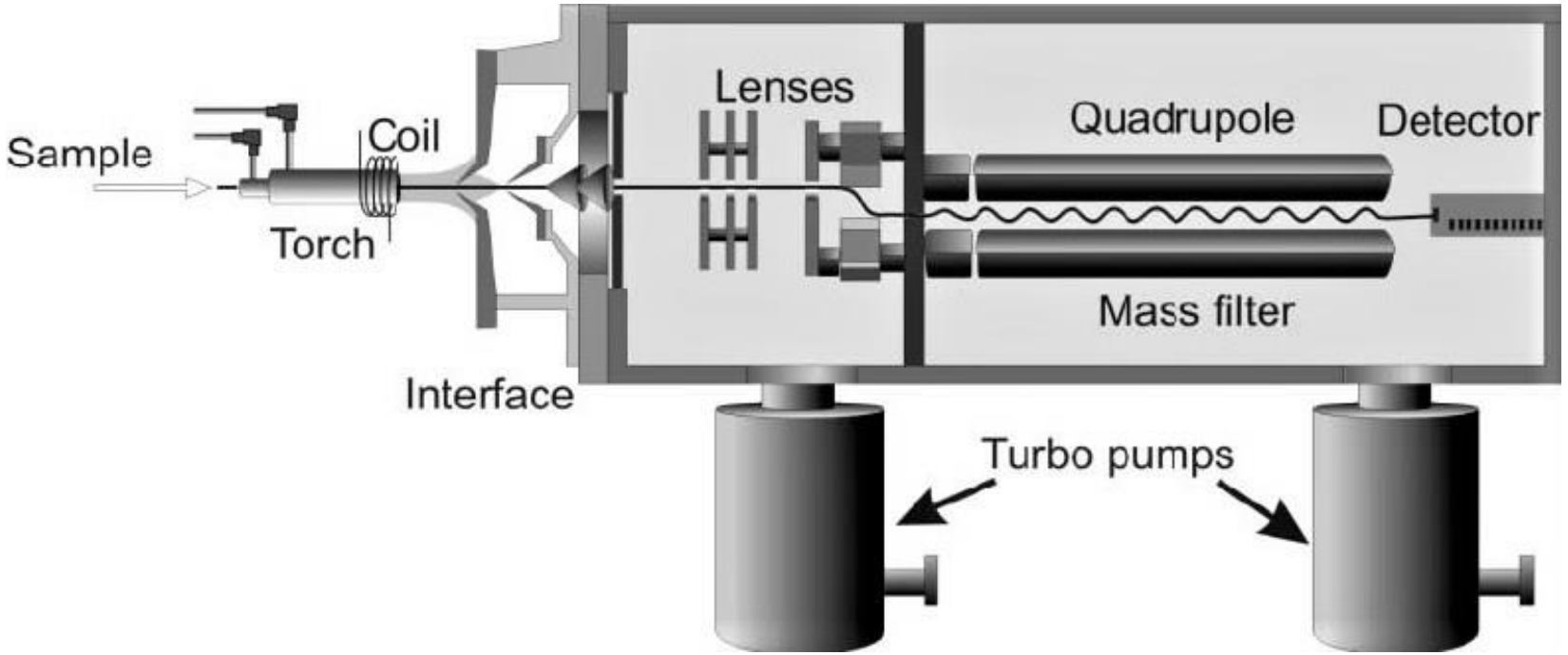
Electrothermal Atomic Absorption Spectrometry (ETAAS) aka, Graphite Furnace Atomic Absorption (GFAA)

- Most ETAAS systems use an electrically heated graphite tube to pyrolyse the blood matrix and atomize the lead
- Must be operated by trained lab analysts
- Widely available
- Sample volume 50-100uL
- Low detection limit
- Autosampler
- Intermediate cost, but maintenance and consumable cost is high
- Biological and Environmental samples
- Single element analysis

Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)

- Uses plasma to dissociate the sample into constituent ions
- Ions are extracted and passed into a mass spectrometer where they’re separated and measured based on mass-to-charge ratio
- Biological and Environmental samples

Inductively Coupled Plasma-Mass Spectrometry (ICP/MS)



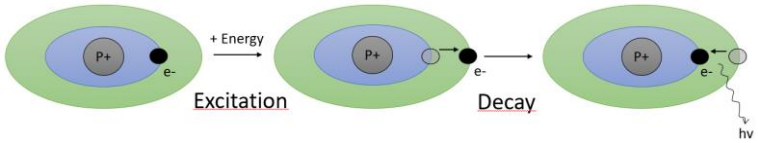
ICP/MS, cont.

- Very low detection limits
- Sample volume 50-100uL (blood), environmental sample size varies
- Minimal sample preparation
- Multi-element technique
- Limited to samples with low dissolved solids
- Cost
- Require highly skilled lab analysts


PerkinElmer
NexION 350D

Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP/AES or ICP/OES)

- Analysis of environmental samples
- Uses plasma to excite atoms to a higher energy state
- Atoms release photons at specific wavelengths as they return to a lower energy state
- The amount of light emitted at each wavelength is used to calculate the concentration of the elements in the sample

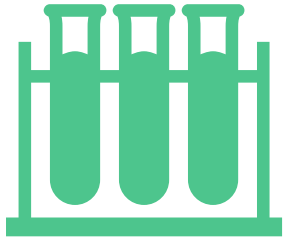


ICP/OES, cont.

- Multi-element
- Cost is lower than ICP/MS
- LOD in the ppb range
- Can analyze samples with higher dissolved solids
- Require highly skilled lab analysts

Summary

Choice of analytical instrumentation depends on several factors



Lab-based methods require trained staff

Point-of-care methods are simple to use and don’t require trained lab staff

Pros & Cons- Lead Care II (ASV)

- Portable
- Easy to operate
- Fast
- Low Cost
- On-site testing

- High results must be confirmed
- Important to avoid sample contamination

Pros & Cons- GFAA

- Low detection limit
- Lower initial cost
- Fewer interferences
- Simple sample prep
- Both environmental and biological samples
- Low sample volume

- Lab setting
- Skilled analysts
- Single element technique
- High cost of consumables

Pros & Cons – ICP/MS

- Multi-element technique
- Large analytical range
- Low detection limit
- High sample throughput
- Low sample volume
- Both environmental and biological samples

- Equipment cost
- Operating cost
- Highly skilled lab analysts
- Must control interferences

Pros & Cons – ICP/OES

- Multi-element technique
- Large analytical range
- High sample throughput
- Low sample volume
- Simple sample prep
- Environmental samples

- Higher detection limit than ICP/MS
- Equipment cost-initial and ongoing
- Highly skilled analysts

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Child Medical Management 'Quick Guide' for Lead Testing and Treatment

Summary of Recommended Follow-up Actions for Children Based on a Venous Blood Lead Level

< 3.5 µg/dL	3.5 - 9 µg/dL	10- 44 µg/dL	45 - 69 µg/dL	≥ 70 µg/dL
-Repeat blood lead level in 6-12 months if the child is at high risk or risk changes during the timeframe -Ensure levels are done at 1 and 2 years of age. -For children screened at age < 12 months, consider retesting in 3-6 months as lead exposure may increase as mobility increases. -Routine assessment of developmental milestones and nutritional status with a focus on iron and calcium intake. -Anticipatory guidance about common sources of lead exposure and how to prevent exposure.	Refer child < 6 years old to SD DOH CLPPP for case management services, referrals, and health education. Schedule retest of the lead level based on confirmatory venous result	Perform steps as described for levels at 3.5 – 9 µg/dL. Consider: -Testing siblings or other children in the household - Ensuring iron sufficiency with adequate laboratory testing (CBC, Ferritin, CRP) and treatment per AAP guidelines Pediatric Environmental Health Specialty Unit (PEHSU) and American Academy of Pediatrics guidelines. (QR Code) -Performing structured developmental screening evaluations at periodic health visits to ensure appropriate developmental milestones are being met -Assessing nutritional status (especially iron, calcium, and zinc) -Checking and following neurologic and developmental status	Perform steps as described for levels at 10 – 44 µg/dL. Consider: -Testing: Iron status, Neurodevelopmental monitoring, Abdominal X-ray (if particulate lead ingestion is suspected), Chelation therapy, Consultation with South Dakota Poison Center (800-222-1222) or Rocky Mountain Pediatric Environmental Health Line (877-800-5554)	Perform steps as described for levels at 45– 69 µg/dL. Consider: Hospitalize child and begins chelation therapy (following confirmatory venous blood lead test)

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Lead Advisory Group Approval Requested

South Dakota health care providers to follow the American Academy of Pediatrics Bright Future screening guidelines: assess all children for the risk of lead exposure at 6, 9, 12, 18, & 24 months, and at 3, 4, 5, and 6 years at well child visit. If a known or possible risk is identified, conduct a blood lead level testing.

If the Capillary Blood Lead Level is ≥ 3.5 µg/dL follow the Recommended Schedule for a confirmatory Venous Sample	
Capillary BLL	Confirm test with venous within*
3.5 - 9 µg/dL	3 months
10- 44 µg/dL	1 month
45 - 59 µg/dL	48 hours
60 - 69 µg/dL	24 hours
≥ 70 µg/dL	Immediately as an emergency test
The higher the BLL on the screening test, the more urgent the need for confirmatory venous test	

If the Confirmatory Venous Sample is ≥ 3.5 µg/dL follow the Recommended Schedule for Follow-Up Testing		
Venous BLL	Follow-up Venous Test Schedule	Long-Term Follow-Up**
3.5 - 9 µg/dL	3 months	6-9 months
10- 19 µg/dL	Within 3 months	3-6 months
20 - 44 µg/dL	2 weeks–1 month	1-3 months
≥ 45 µg/dL	Repeat venous blood test Immediately	Based on chelation protocol

Questions to ask to determine if testing is needed.
If answer is Yes or I don't know proceed with testing:

Does this child Live in a high-risk ZIP code area for lead exposure?

Does this child live or spend time in a house built before 1978?

Does this child live or spend time in house built before 1978 with recent or ongoing remodeling within the past year?

Is this child eligible for or enrolled in Medicaid, Head Start, or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)?

Is this child a recent immigrant, refugee, or foreign adoptee?

Does this child live with parent or caregiver who has a job that causes them to have frequent contact with lead? (e.g., plumbers, construction, auto repair, metal/battery recycling, welders)?

Does this child have developmental disabilities and persistent pica habits?
Does this child have a sibling or playmate with a blood lead level (≥3.5 µg/dL), or parent expresses a concern about or asks for their child to be tested for lead?

High-Risk Zip Codes: 57001, 57006, 57024, 57043, 57048, 57066,57069,57078, 57103, 57104, 57105, 57107, 57201, 57212, 57221, 57248,57262, 57266,57273, 57274, 57301, 57315, 57335, 57350, 57356, 57369, 57380, 57401, 57501, 57533, 57538, 57551, 57555,57579, 57601,57638, 57660, 57701, 57702, 57717, 57754

Interventions to Help Limit Exposure

- Educate caregivers on sources of lead exposure.
- Wash hands with soap and water…after play, before meals, and before bed.
- Clean child's toys, bottles & pacifiers often
- Feed child foods with Calcium, Iron & Vitamin C daily
- Block areas with lead hazards.
- Wet wipe windowsill, door jams, & door frames
- Wet mop floors and stairs once a week or more
- Use HEPA filter vacuum to clean up dust and paints.

Break

Program Updates

Media Campaign

Radio
- Live by 12/15/23
Printing, as needed
- Rack Card
- Poster
Social Media
- Start by 12/15/23
Facebook page
- Cross posting DANR messages
-Billboard


RADIO
ADVERTISEMENT


RADIO
ADVERTISEMENT

Social Media

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Social Media

Display Ads

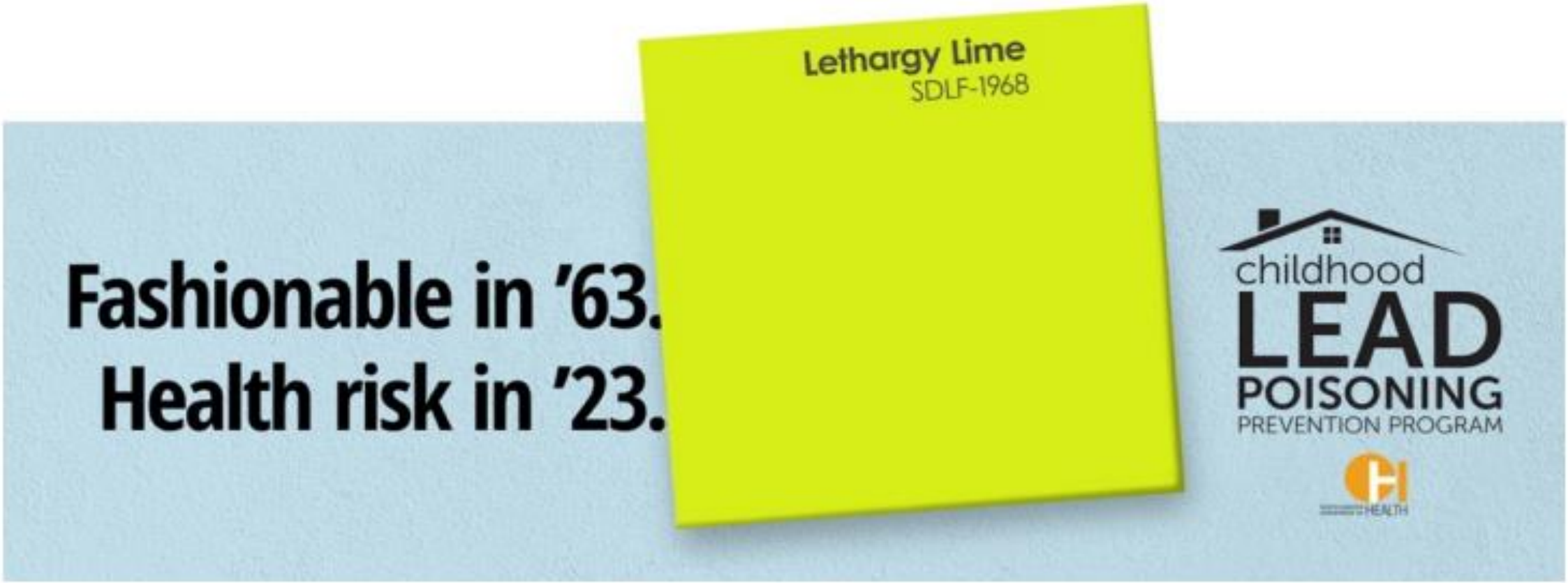

childhood
LEAD
POISONING
PREVENTION PROGRAM
The ugly paint with an uglier truth.
Learn more.


LEAD
POISONING
The ugly paint with an uglier truth.
Learn more.

Newspaper Ad

Billboard Design

I-90 2mi west of I-29 – Mile Marker 394 - West Facing



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Billboard Placement

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Billboard Design

I-90 Mile Marker 269 - East Facing (4 miles West of Chamberlain exit)

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Billboard Placement

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United States Department of Housing and Urban Development(HUD)

- Request for data from HUD
  - Individual residing in South Dakota with a confirmed EBLL
  - Data from Jan 1,2018 through Present.
  - SD DOH working on analysis to match HUD housing to Individual with EBLL

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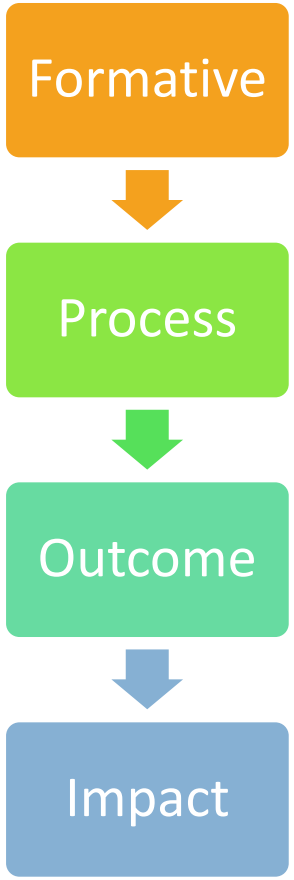
Evaluation Report for 2022

Brief Introduction to Evaluation

- Type of program assessment
- What is working well?
  - Is everything working as intended?
  - What processes can be improved?
- Is the program meeting its goals?
  - Are activities being carried out as described?
  - What are the barriers/facilitators for the program to meet its goals?
- What is the overall impact of the program?
  - Who benefited from the program?
  - What were the program results?

Types of Evaluation



- Formative
  - Usually pre work to determine what is needed
  - Needs assessment
- Process
  - Start of a program
  - How is the program working?
  - Are processes working the way they were intended?
- Outcome
  - Did the program meet its goals?
  - What does the data show?
- Impact
  - What is the overall impact of the program?

Implementing Evaluation

- Based on logic model
  - Model includes resources, activities, outputs, and outcomes to map out how the program will meet the overall outcomes
- Operationalize information in the logic model to understand how the program is doing
  - Indicators
  - Performance measures
- Collect data and information on your measures and assess
  - Continuous process
  - Not just a one time assessment, but throughout the course of the program

Project Logic Model

Strategies and Activities	Short-Term Outcomes	Intermediate Outcomes	Long-Term Outcomes
Strategy #1: Ensure Blood Lead Testing and Reporting	Increased collaboration and coordination between appropriate stakeholders Increased awareness of pediatric health care providers and clinical laboratories of state blood lead testing recommendations and reporting requirements	Improved blood lead testing and reporting rates for children less than 6 years of age at risk for lead exposure	Decreased disparities in blood lead levels by race/ethnicity and socioeconomic status Decrease adverse health effects of lead exposure in children Decreased societal costs associated with childhood lead exposure (e.g., healthcare, special education, criminal justice system) Decreased number of children living in environments at high risk of lead exposure
Develop and sustain a statewide Lead Advisory Committee			
Develop or update and implement an appropriate statewide screening plan based on local data			
Strategy #2: Enhance Blood Lead Surveillance	Increased linkages between complementary data systems (e.g., Medicaid, immunization, adult blood lead, vital statistics) Increased identification of geographic areas risk for lead exposure using enhanced data linkages	Improved use of surveillance system data to capture missing data on child demographic and follow-up information	
Develop, update, or maintain a blood lead surveillance system that collects and tracks all blood lead test results and follow-up data on children with elevated blood lead levels including environmental source investigations and referrals to recommended services			
Develop and implement plans for surveillance data collection, data quality, and data dissemination with a focus on interoperability			
Conduct analyses of surveillance data to identify lead-exposed children, high-risk populations, and geographic areas			
Strategy #3: Improve Linkages of Lead-Exposed Children to Recommended Services	Increased identification, tracking, and recommended services for children with elevated blood lead levels Increased ability for public health agencies, health care professionals, and other stakeholders to provide linkages to services and reduce loss to follow-up	Improved rates of children less than 6 years of age with elevated blood lead levels linked to recommended services	
Identify children with elevated blood lead levels requiring follow-up			
Partner with programs and organizations that provide services to mitigate the effects of elevated blood lead levels			
Connect children with elevated blood lead levels to recommended medical, environmental, and social services			

Strategy 1: Ensure Blood Lead Testing and Reporting

Description	Baseline	Value Year 2 2022	Value Year 3 2023	Value Year 4 2024
# LAG members represented by geography	7	7		
% of members in attendance	70%	81%		
# of tests for children under 6 below the BLRV received	-	4,409		
% of children with blood lead testing	-	7.67%		
# of media spots created	-	6		

***Note: data is provisional**

Strategy 2: Enhance Blood Lead Surveillance

Description	Baseline	Value Year 2 2022	Value Year 3 2023	Value Year 4 2024
# of blood lead tests reported to SD DOH	-	4,662		
# of all tests with a BLL ≥ BLRV	-	253		
% of all tests with a BLL ≥ BLRV	-	5.42		
# of tests ≥ BLRV with appropriate follow-up	-	253		
# of families with contact initiated with children with BLL ≥ to the BLRV	-	66		
# of families with complete interviews with children with BLL ≥ BLRV	-	134		
# of cases with missing child demographic information	-	387		
# of high-risk zips codes identified	-	41		
# of surveillance reports	1	1		
# of on-time CDC submissions for surveillance data	4	4		
# of interactions with labs submitting BLL to educate on submission of results	-	30		

***Note: data is provisional**

Strategy 3: Improve Linkages of Lead-Exposed Children to Recommended Services

DESCRIPTION	BASELINE	VALUE YEAR 2 2022	VALUE YEAR 3 2023	VALUE YEAR 4 2024
# of families with a BLL ≥ BLRV that receiving education on follow-up testing and timing	-	37		
# of children with BLL of 20 mcg/dl or greater with a follow-up visit to their medical professional within 2 weeks of initial notification from SD DOH	-	119		
# of referral sources identified and additional partnerships	-	5		
# of families referred	-	2		
# of MOUs	-	1		
# of reports with shared data	-	1		
Submission of Awardee Lead Profile Assessment	-	1		
Submission of a Success Story	1	1		

***Note: data is provisional**

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Lead-contaminated Cinnamon-applesauce pouches

Lead-contaminated Cinnamon-applesauce pouches

In November 2023 FDA published that WanaBana USA was voluntarily recalling all lots of WanaBana Apple Cinnamon Fruit Purée pouches due to reports of elevated levels of lead found in certain units of the product.

- Company Name: Wanabana LLC
- Brand Name: Wanabana, Schnucks, Weis
- Product Description: Apple Cinnamon Fruit Puree/Cinnamon Apple Sauce

Lead-contaminated Cinnamon-applesauce pouches

FDA product testing has also identified high levels of chromium, in addition to lead, in cinnamon samples and recalled applesauce pouch products.

- Chromium is a naturally occurring element with trace levels normally found in the diet
- The most common forms of chromium found in chromium compounds are trivalent chromium [chromium (III)] and hexavalent chromium [chromium (VI)].

- Chromium (III) is considered an essential nutrient and can be found in a normal diet and in some dietary supplements

- Chronic, prolonged exposure to chromium (VI) in occupational settings through inhalation and skin exposure has also been associated with chronic lung disease and ulceration of skin and mucous membranes. Chromium (VI) is a known carcinogen.

- The exact form of chromium in the recalled applesauce products is unclear. However, lead chromate has previously been reported as a contaminant in spices and foods.

Lead-contaminated Cinnamon-applesauce pouches

As of January 16, 2024, FDA has received 89 confirmed complaints

- People for whom a complaint or adverse event was submitted and met FDA's complainant definition, are between zero and 53 years of age and the median age is one-year old are between zero and 53 years of age and the median age is one year old

As of January 12, 2024. CDC has received the following reports from state and local health departments:

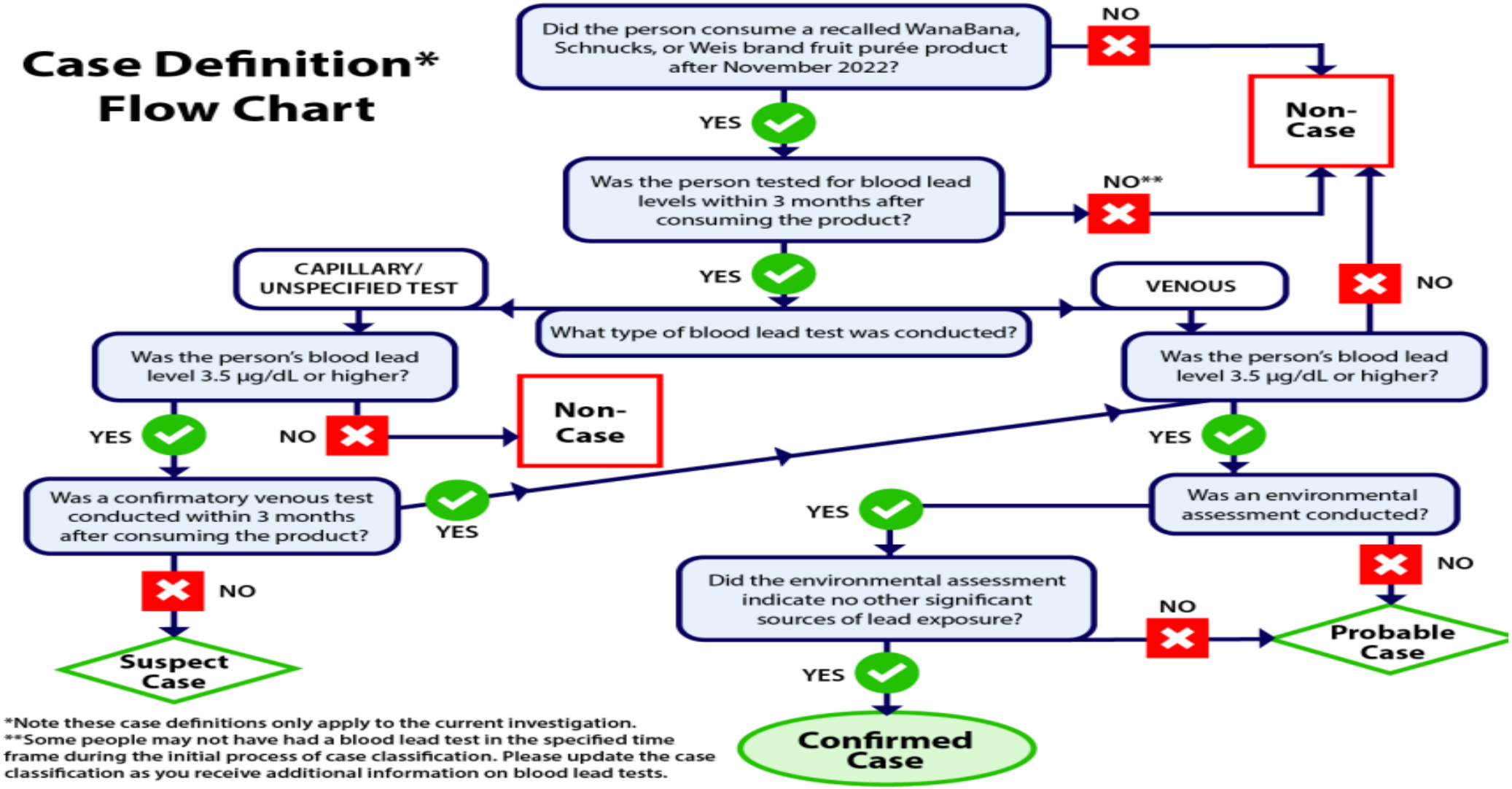
•Total Cases: 354

- Confirmed Cases: 93
- Probable Cases: 233
- Suspect Cases: 28

States: (41 total) AL, AR, CA, CO, CT, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, OR, PA, RI, TN, TX, UT, VA, VT, WA, WI, WV

- The person must have had a blood lead level of 3.5 ug/dL or higher measured within 3 months after consuming a recalled WanaBana, Schnucks, or Weis brand fruit purée product after November 2022.

Lead-contaminated Cinnamon-applesauce pouches



*Note these case definitions only apply to the current investigation.
**Some people may not have had a blood lead test in the specified time frame during the initial process of case classification. Please update the case classification as you receive additional information on blood lead tests.

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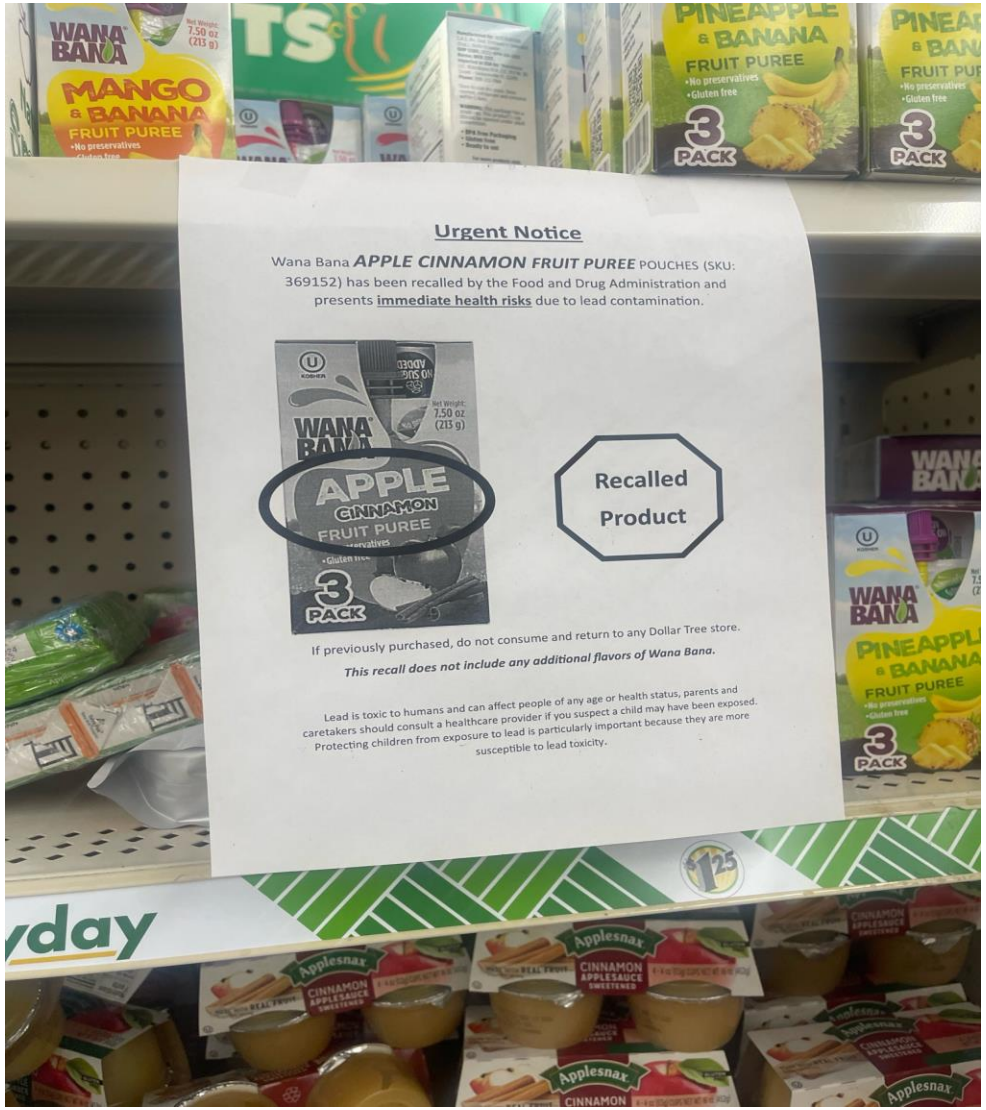
Lead-contaminated Cinnamon-applesauce pouches In South Dakota



Picture at Dollar Tree in Sioux Falls

- Monitoring during investigation
- No reported cases
- South Dakota Alert Network sent on Nov 13, 2023

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Nurse Educator

- Develop relationships with nursing, physician assistant, physician, and other medical professional student training programs at colleges and technical colleges.
- Incorporate information on the importance of lead-free development into existing curriculum at student training programs.
- Identifying existing training avenues for clinicians, nurses, and allied health professionals (e.g., Grand Rounds, organization-specific training opportunities, and professional organization [e.g., AAP, AAFP, SDAHO]).
- Incorporate information on lead poisoning prevention into existing training avenues (e.g. CEU).
- Coordinating the development and distribution of webinars for clinician education, mini clips for clinician and general public education, and CDC's asynchronous computer training to raise awareness of the following:
  - Hazards of lead in blood (sources, routes of exposure, physiologic effects),
  - How to screen children to determine if testing is needed,
  - How to test and interpret results, and
  - Follow-up actions that are recommended based on test results
- Creating clinical educational and outreach materials such as clinical reference guides, medical provider 60-second clips on counseling/follow-up, and other program materials as needed.
- Attend and support the Lead Advisory Group quarterly meetings.
- Conducting initial in-person survey for children with lead in the blood at or above 20 ug/dL who are unable to be reached by phone.

Next Steps

- Additional LAG Members
- Next meeting
- Qualtrics survey
- Closing

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END

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