American University of Armenia | Հայաստանի Ամերիկյան Համալսարան

School of Public Health
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Akhtala Pilot Project on Community Empowerment Final Report

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Prepared for

Blacksmith Institute

Armenia
2014

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ACKNOWLEDGEMENTS

The research team is grateful to the Blacksmith Institute for supporting the implementation of the Akhtala Pilot Project. We want to express our gratitude to the Prime Minister's Office of the Republic of Armenia, the Ministry of Health of the Republic of Armenia, Governor's office of Lori Marz, and Mayors' office of Akhtala town for supporting the implementation of this project. We also acknowledge all the participants of the focus group discussions and in-depth interviews for contributing to the development of the local needs/capacity assessment.

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EXECUTIVE SUMMARY

The pilot project for Akhtala town in Lori Marz of Armenia started in August 2013. This report covers the period from August 2013 to July 2014 and includes four components of the pilot project: 1) Thorough Risk Assessment, 2) Blood Lead Level Assessment, 3) Community Education and Empowerment, and 4) Local Action Plan.

The research team of the American University of Armenia School of Public Health (AUA SPH) conducted a thorough risk assessment in Akhtala following a standard protocol developed by the investigators. The collected soil samples were transported to the AUA Acopian Environmental Laboratory. The team developed a protocol for laboratory soil processing and analysis, and laboratory technicians processed all collected soil samples and analyzed them ex-situ with an XRF analyzer at the laboratory of the AUA Acopian Center for the Environment. The Blacksmith Institute gave the XRF analyzer to the team for testing the soil samples; AUA SPH team returned the analyzer to the Blacksmith Institute in April 2014. The AUA SPH team identified the churchyard in Akhtala as the most polluted area in the town that requires immediate remediation.

Blood lead levels among children have never been investigated in Armenia. The Blacksmith Institute generously provided the LeadCare Analyzer II to the research team making it possible to test blood lead levels of young children in communities contaminated by lead, such as Akhtala and Alaverdi. The research team prepared protocols and received ethical and government approvals and support letters to implement testing of blood lead levels (BLL) among children 4-6 years old. The assessment included testing for blood lead levels and survey of mothers or legal guardians of children to better understand the risk factors associated with higher blood lead levels. Currently the AUA SPH team is working on a manuscript for publication based on the BLL findings.

During the project the research team of the AUA SPH conducted thorough literature review and based on that developed training materials (manuals, presentations, and brochures), and conducted trainings with various groups of the population (parents of schoolchildren, healthcare specialists, school and kindergarten teaching staff, municipality staff, NGO representatives, active community members and high school students from two schools in Akhtala). Overall, 122 people received trainings in Akhtala community. In addition, the research team prepared an application for ethical approval before the fieldwork, as well as pre- and post- training self-administered questionnaires to evaluate the effectiveness of the trainings. The team entered the survey results in SPSS database and conducted analysis. The pre – and post- training evaluation results showed that the trainings were effective.

In addition to the trainings, meetings with community members were organized through focus group discussions and individual in-depth interviews to get their input in the development of the local needs/capacity assessment and development of the local action plan. Based on the results, the team developed a Local Action Plan for addressing the environmental and health problems in Akhtala. It was presented and discussed with the community and local authorities during the concluding community stakeholder meeting.

For effective implementation of different components of the project the team actively and effectively communicated with the National and Local government authorities through official letters, phone calls, and face-to-face meetings to inform them and gain their support for the Pilot project, to clarify certain issues and to report our project findings.

INTRODUCTION

Akhtala Mining Company is located in Akhtala town in Lori marz/province in the north of the country. Because of the economic crisis, the activities were stopped during 1990s and then restarted in 2001. The mining ore processing company has been using three tailing ponds for toxic waste. Two of them are located outside Akhtala in Jojkan and Mets Ayrum communities, which are about 13 km far from Akhtala. One tailing pond is located inside Akhtala community. In the frame of rapid risk assessment project (Initial Site Screening) the investigators from the American University of Armenia visited Akhtala community in September 2012 to do observations and collect samples from the area. The research team observed a re-cultivated, old, yellow tailing pond that was not currently active; it was located next to Akhtala Monastery across the main street of the town. At the moment of the rapid assessment the tailings were discharged into the river. It was probably due to damaged pipes, as it was cascading down from where the factory pipes were. There were piles of yellow tailings around the river banks continuously contaminating the river water.

The investigators took the first targeted sample from the church yard directly next to the tailing pond. The second and third composite samples were taken from the back-yards and front-yards of houses in the "Transport" ("Turki") district of Akhtala. The fourth and fifth samples were taken from the back-gardens and front-yards of houses in the "Svinets" district of Akhtala. The sixth targeted sample was taken from the community kindergarten playground. The seventh sample was taken from the front of the entrance of multi-storied buildings in the "Sarahart" district. Overall, seven soil samples were collected from the community (Table 1). The samples have been analyzed at the Environmental Impact Monitoring Center laboratory of the Ministry of Nature Protection of Armenia. The laboratory analyzed the samples using inductively coupled plasma-mass spectrometry (ICP-MS); total dissolution was performed prior to the analysis. The results are compared with the recommended Maximum Allowable Concentrations (MAC) provided by the Blacksmith Institute.

Table 1: Soil sampling area and number of subsamples (rapid risk assessment in Akhtala)

Soil Sampling Area	The number of subsamples collected
Section 1 – Transport ("Turki") district	
Front yard soil	7
Garden soil	7
Section 2 – Svinets district	
Front yard soil	8
Garden soil	8
Section 3 – Sarahart district	
Entrance soil of buildings	10
Kindergarden playground soil	5
Section 4 – Monastery area	
Yard soil	10

According to the results from the laboratory, the soil concentrations of arsenic were above the international MAC level in all seven soil samples. The concentration of Chromium was above the MAC level in residential soil samples (front yards of houses), kindergarten soil and in the entrance soil of multi-storied buildings. The concentration of Lead was above the MAC in churchyard soil, in residential soil samples of "Transport" ("Turki") district (front yards of houses), as well as in garden soil samples of "Transport" ("Turki") and "Svinets" district (backyards of houses). The concentration of Cadmium was above the MAC level in churchyard soil, in residential soil samples of "Transport" ("Turki") and "Svinets" districts (backyards of houses). Table 2 provides the details of the laboratory analysis results for the soil samples.

Table 2: Laboratory analysis results of soil samples (rapid risk assessment in Akhtala)

	Residential soil	Kindergarten playground soil	Agricultural soil
Arsenic			
MAC (mg/kg)	12	12	12
Percentage of samples above MAC levels (n/N)	100% (4/4)	100% (1/1)	100% (2/2)
Analytical result range for samples (mg/kg)	31.1-138.8	46.1	44.6 – 56.6

Samples above MAC level	Soil from front yard of houses (Section 1) Soil from front yard of houses (Section 2) Entrance soil of buildings (Section 3) Church yard soil (Section 4)	Playground soil (Section 3)	Garden soil (Section 1) Garden soil (Section 2)
Total Chromium			
MAC (mg/kg)	64	64	64
Percentage of samples above MAC levels (n/N)	50% (2/4)	100% (1/1)	0% (0/2)
Analytical result range for samples (mg/kg)	31.3 – 100.1	81.1	29.9 – 60.5
Samples above MAC level	Soil from front yard of houses (Section 2) Entrance soil of buildings (Section 3)	Playground soil (Section 3)	----------
Lead			
MAC (mg/kg)	400	400	400
Percentage of samples above MAC levels (n/N)	50% (2/4)	0% (0/1)	100% (2/2)
Analytical result range for samples (mg/kg)	95.1 – 4582.7	64.2	480-644
Samples above MAC level	Church yard soil (Section 4) Soil from front yard of houses (Section 1)	----------	Garden soil (Section 1) Garden soil (Section 2)
Cadmium			
MAC (mg/kg)	14	14	1.4
Percentage of samples above MAC levels (n/N)	25 (1/4)	0 (0/1)	100 (2/2)
Analytical result range for samples (mg/kg)	4.1-16	2.0	7.2 – 15.5
Samples above MAC level	Church yard soil (Section 4)	----------	Garden soil (Section 1) Garden soil (Section 2)

The level of arsenic was high in all samples and the levels of lead, chromium and cadmium were high in most of the samples. Particularly the yard of the Akhtala Church was greatly polluted with heavy metals (the level of As was 12 times exceeding the MAC and the level of Pb 11 times). Given the residential area in Akhtala was polluted with mining waste the research team conducted 1) Thorough Risk Assessment, 2) Blood Lead Level Testing and 3) community trainings to empower the community members and 4) assessed the local needs and capacities and developed a local action plan.

GRANT FUNDED ACTIVITIES

Thorough Risk Assessment

The American University of Armenia School of Public Health (AUA SPH) team developed a protocol for a thorough risk assessment in Akhtala. During this period we have purchased the necessary supplies before the field work in Akhtala for the soil sampling (thorough risk assessment, soil samples bagged and transported to the lab). The field work for the thorough risk assessment took place in October 2013. The town was divided into 4 sectors and church-yard was considered as a separate testing area; the investigators collected 202 soil samples (111 from yards, 37 from gardens (agricultural use), 20 from schools and kindergartens, 9 for background purpose from soil at depth of 10cm and 20cm inside and outside of the community, 20 from the church yard and 5 from the surface of the recultivated tailing pound. The team developed a special form for registering collected soil samples, where the investigators entered the IDs, GPS coordinates, and other necessary details about the samples. The collected soil samples were transported to the Acopian Environmental Laboratory at AUA, where they were processed. The research team carefully looked at the equipment needed for processing the collected soil samples in the lab and purchased the necessary supplies/equipment and disposables for soil homogenization, drying, and sieving to make them ready for ex-situ XRF testing.

The lab technicians prepared the soil samples in the laboratory following the protocol that AUA SPH researchers developed based on the review of international guidelines. The preparation process included soil samples' drying, homogenization and sieving. The activities took place from November 2013 to January 2014. The AUA SPH team tested the prepared soil samples by the XRF analyzer (INNOV-X α-2000) based on the protocol developed for soil testing. The testing process took place from December 2013 to January

2014. The duration of testing time was 90 seconds. The research team tested again the samples having test results below the Limit of Detection (LOD) and above the Maximum Allowable Concentration (MAC); this time the testing time was 240 seconds. The team compared the testing results with three reference levels: Maximum Allowable Concentrations (MAC), Clean up Levels (CL) and Identified Highest Background Level (HBL) (Table 3).

Table 3. Reference levels for comparison

Heavy Metals	MAC mg/kg	CL mg/kg	HBL (10, 20 cm depth) mg/kg
	Residential/ Agricultural		
As	12	100	40
Pb	400	400	59
Cr	64	-*	147
Cd	14/1.4	-*	Not Detected

* Not identified

Some measurements of the community soil samples (in yard, schools and kindergartens) were below the Limit of Detection (LOD) of the XRF analyzer. Table 4 presents the results of not detected measurements. If after the testing the analyzer could not detect the metal of interest it provided calculated limit of detection which is counted as three times the error of counting statistics of each measurement. The calculated LOD differed for each measurement. Table 4 presents not detected measurements for which the calculated LOD was above the MAC. Table 4 shows that for arsenic and cadmium calculated LOD of all not detected measurements exceeded the MAC, therefore not detected measurements are not a sign of low concentration of a specific metal of interest but rather the physical matrix of the soil that intercept with the detection ability of the instrument. For Chromium 5% out of total non-detected measurements only 0.5% exceeded the MAC.

Table 4. Not detected measurements below the LOD

Heavy Metals	MAC mg/kg	% of not detected measurements out of total n/N Range of LOD's mg/kg	% out of total above MAC n/N Range of LOD's above MAC mg/kg
	Residential/ Agricultural		
As	12	13.4% 27/202 17-146	13.4% 27/202 17-146
Pb	400	0% 0/202 -	0% 0/202 -
Cr	64	5.0% 10/202 50-66	0.5% 1/202 66
Cd	14/1.4	91.6% 185/202 17-38	91.6% 185/202 17-38

All not detected measurements were excluded from further analysis. Table 5 presents percent of total testing exceeding three reference levels - MAC, Highest Background level (HBL) (depth 10cm, 20 cm), Cleanup level (CL) as well as the geometric mean (GM) and the range of all detected measurements.

According to the results 93.6% of all detected measurements exceeded the MAC for Arsenic, 26.7% for Lead, 97.9% for Chromium and 100% for Cadmium. The geometric mean of detected measurements for Arsenic exceeded MAC by 3.1 times. For Arsenic 2.9% of soil samples and for Lead 26.7% of samples exceeded the clean-up level. Cleanup level for Chromium and Cadmium were not identified during the literature review and standards were substantially different across different countries. According to the results 44.0% of Arsenic, 90.1% of Lead and 49.5% of Chromium test results exceeded the highest background measurements (Cadmium was not detected in the soil) indicating that even in comparison with the highest background measurements the surface levels of heavy metals were higher suggesting external pollution and significant exposure risk for the population.

Table 5. Results compared to Maximum Allowable Concentration (MAC), Highest Background level (HBL) (depth 10cm, 20 cm) and Clean-up level (CL)

Heavy Metals	MAC mg/kg Residential/ Agricultural	% above MAC out of detected n/N GM and Range of all detected mg/kg	Clean-up level (CL) mg/kg	% above CL level out of detected n/N GM and Range of all detected mg/kg	Highest background level (HBL) (depth 10, 20 cm)	% above HBL out of detected n/N GM and Range of all detected mg/kg
As	12	93.6% 169/175 37. 6 9-276	100	2.9% 5/175 37. 6 9-276	40	44.0% 77/175 37. 6 9-276
Pb	400	26.7% 54/202 293.8 15-30,083	400	26.7% 54/202 293.8 15-30,083	59	90.1% 182/202 293.8 15-30,083
Cr	64	97.9% 188/192 147.4 55-525	---*	---	147	49.5% 95/192 147.4 55-525
Cd	14/1.4	100% 17/17 53.6 21-281	---*	---	Not Detected	---

* Not identified

Table 6 presents the results exceeding the MAC by sample type and geometric mean and range of all detected measurements. The most significant finding is that 95% of samples from the church yard exceeded the MAC for Lead. Table 7 present the results by sections suggesting that the most contaminated districts of the town are those located near the tailing pond and the church yard – 40.5% and 27.0% of samples in "Transport" and "Svinets" districts respectively exceeded the MAC for Lead, whereas only 4.0% and 10.6% of testing in "Sarahart" and "Barit" districts exceeded the MAC for Lead. Appendixes 1 and 2 demonstrate lead and arsenic contamination on the map of Akhtala community.

The AUA SPH research team is working on a manuscript based on the thorough risk assessment results for publication in an international peer-reviewed journal.

Table 6. Results above Maximum Allowable Concentration (MAC) by sample type

Heavy metals	MAC Mg/kg	Soil sample type									
		Yard		Garden		School & Kindergarten		Churchyard		Tailing pound	
	Residential/ Agricultural	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg
As	12	97.2%	36.9	94.3%	36.1	95.0%	49.4	100.0%	58.7	100.0%	21.5
		104/107	9-177	33/35	10-92	19/20	12-276	2/2	46-75	5/5	17-36
Pb	400	18.9%	230.1	27.0%	264.3	5.0%	130.5	95.0%	4841.1	0.0%	37.7
		21/111	15-12,562	10/37	76-8,174	1/20	19-592	19/20	263-30,083	0/5	26-110
Cr	64	98.1%	152.0	97.1%	136.3	95.0%	149.5	100.0%	157.3	100.0%	88.5
		103/105	62-525	33/34	59-253	19/20	55-280	20/20	80-378	4/4	70-114
Cd	14/1.4	100.0%	55.3	100.0%	100.3	-	-	100.0%	45.2	-	-
		4/4	23-106	3/3	37-182	-	-	9/9	21-281	-	-

Table 7. Results above Maximum Allowable Concentration (MAC) by sections

Heavy metals	MAC mg/kg	Sections							
		1-"Transport" District		2- "Svinets" District		3- "Sarahart" District		4- "Barit" District	
	Residential/ Agricultural	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg	% ↑ MAC n/N	GM and Range of all detected mg/kg
As	12	93.9% 31/33	28.2 11-92	100.0% 37/37	41.3 17-129	98.0% 48/49	38.6 11-177	93.5% 43/46	43.0 9-276
Pb	400	40.5% 15/37	326.5 25-12,562	27.0% 10/37	56-2,565 279.5	4.0% 2/50	129.0 15-705	10.6% 5/47	221.9 19-2,731
Cr	64	90.3% 28/31	116.2 59-165	100.0% 36/36	161.2 82-525	100.0% 49/49	154.1 65-393	97.8% 45/46	154.1 55-280
Cd	14/1.4	100.0% 3/3	71.5 23-150	100.0% 3/3	88.8 52-182	-	-	100.0% 1/1	37* -

* Not the geometric mean but the measurement of just one sample

Table 8 and 9 show results above Clean-up level (CL) by sample type and by sections. In all yard samples 2.8% exceeded the clean-up level for Arsenic and 18.9% for Lead; in garden samples 27.0% exceeded the clean-up level for Lead, in kindergarten and school samples 10.0% exceeded the clean-up level for Arsenic and 5.0% for Lead, in church yard samples 95.0% of samples exceeded the clean-up level for Lead. According to Table 9, 40.5% and 27.0% of samples in "Transport" and "Svinets" districts respectively exceeded the clean-up level for Lead, whereas only 4.0% and 10.6% of samples in "Sarahart" and "Barit" districts exceeded the MAC for Lead.

Table 8. Results above Cleanup level (CL) by sample type

Heavy Metals	Cleanup level mg|kg	Sample type									
		Yard		Garden		School & Kindergarten		Church yard		Tailing pond	
		% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg
As	100	2.8% 3/107	36.9 9-177	0.0% 0/35	36.1 10-92	10.0% 2/20	49.4 12-276	0.0% 0/2	58.7 46-75	0.0% 0/5	21.5 17-36
Pb	400	18.9% 21/111	230.1 15-12,562	27.0% 10/37	264.3 76-8,174	5.0% 1/20	130.5 19-592	95.0% 19/20	4841.1 263-30,083	0.0% 0/5	37.7 26-110

Table 9. Results above Clean-up level (CL) by sections

Heavy Metals	Cleanup level mg|kg	Sections									
		1-"Transport" District		2- "Svinets" District		3- "Sarahart" District		4- "Barit" District		Church yard	
		% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg	% ↑ CL n/N	GM and Range of all detected mg/kg
As	100	0,0% 0/33	28.2 11-92	2,7% 1/37	41.3 17-129	2,0% 1/49	38.6 11-177	6,5% 3/46	43.0 9-276	0.0% 0/2	58.7 46-75
Pb	400	40.5% 15/37	326.5 25-12,562	27.0% 10/37	56-2,565 279.5	4.0% 2/50	129.0 15-705	10.6% 5/47	221.9 19-2,731	95.0% 19/20	4841.1 263-30,083

Blood Lead Level Testing among Children

The study on blood lead levels among children has never been conducted in Armenia. The research team conducted a cross-sectional study among children living in polluted residential areas (Akhtala and Alverdi) and children living in less polluted residential areas (Erebuni district of Yerevan). The blood lead levels (BLL) of children 4-6 years old were measured.

The Blacksmith Institute generously provided the portable LeadCare II analyzer (ESA Biosciences, Inc., USA) to the research team making it possible to assess blood lead levels of young children in communities contaminated by lead. The team developed the protocol for using the LeadCare Analyzer based on the official guidelines and trained the health personnel who would conduct the fieldwork (the investigator and experienced nurse). The team received all the necessary permissions, approvals, and support letters before starting the field work and purchased all the needed supplies.

The research team identified 74 children 4-6 years old through the review of medical cards in the only primary healthcare facility in Akhtala. The research team and the local health care providers contacted the families of these children to recruit them for the BLL study. The trained pediatric nurse collected the blood samples. The capillary blood collection was done by a finger stick method following the *Center for Disease Control guidelines for Collecting and Handling Blood Lead Samples (*http://www.cdc.gov/nceh/lead/training/blood_lead_samples.htm*)* to assure high quality of the blood samples. The equipment was calibrated for every new test kit. For the purposes of quality control two standard control samples (level 1 and level 2) were tested for every change in the test kit lot number.

After the blood sample collection, the mother or legal guardian of the child was asked to respond to a questionnaire administered by a trained interviewer from the research team. The team developed a questionnaire for the mothers or legal guardians. The research team translated the questionnaire into Armenian and pre-tested it before the fieldwork on three women and finalized based on their feedback. The questionnaire included a set of questions on socio-demographic characteristics of the respondent and the household, the knowledge of respondents regarding

health risks of heavy metals and preventive measures to minimize those risks, tobacco and alcohol use by the family members, the conditions of the house (floor, number of windows, the ventilation practices, availability of carpets, etc), number of family members working in the mines, the smelter, tailing ponds and other toxic sites, house cleaning habits, child's health status, child's playing habits with soil or dust, hygiene and nutrition of the child. After completing the BLL testing and completing the questionnaire, the parents received information about their child's BLL test results and received counseling on evidence-based methods to reduce the BLL and prevent further exposure to heavy metals. Additionally, the research team provided special brochures on lead and arsenic prepared for this purpose to the parents (Appendixes 3 and 4).

The research team developed an SPSS database for the BLL results and the mothers' survey. Two data entry officers received training and performed the data entry. After double entry of the data, the research team merged the two datasets and performed data cleaning. The research team is working on a manuscript about BLL for publication in an international peer-reviewed journal. The research team has already analyzed the BLL results and prepared summary letters with specific tables (Table 10). The team sent the official letters with BLL results to the Prime Minister of the Republic of Armenia, the Ministers of Health, Nature Protection, and the Yerevan Mayor's office.

There is no safe level of lead in blood. Even very low concentration of lead in blood might be harmful for health of children. Nevertheless, a reference level is used for comparisons. The reference level calculated for the US is 5mcg/dl. This means that 2.5% of children from 1-5 years old in the US had blood lead level above 5 mcg/dl. The geometric means of blood lead levels in children of Akhtala and Yerevan are statistically significantly different ($p=0.035$), the means are also different between Alaverdi and Yerevan ($p=0.031$). No statistically significant difference was found between Alaverdi and Akhtala. This means that the health risks related to blood lead levels in children are much higher in Akhtala and Alaverdi compared to Erebuni district of Yerevan. In Akhtala the proportion of children with BLL exceeding the reference level for the US was statistically significantly higher compared with Yerevan ($p=0.005$). A similar difference was detected between Alaverdi and Yerevan ($p=0.035$). No statistically

significant difference was found between Alaverdi and Akhtala. This also indicates that the health risks related to blood lead levels in children are much higher in Akhtala and Alaverdi compared to Erebuni district of Yerevan.

Table 10. Blood Lead Levels of Children 4-6 years old in Akhtala, Alaverdi and Yerevan

Community	Number of children	Geometric Mean Range (mcg/dl)	The percent of samples above reference level[i]
Akhtala	39	6.8 3.6-15.5	84.6[iv]
Alaverdi	69	6.4 3.5-24.0	75.4
Yerevan	54	5.2[i] 0.1- 11.7 (52.8)	57.4

[i]In Yerevan the blood lead level was very high for one child – 52 mcg/dl. The geometric mean in Yerevan excluding this child was 4.9mcg/dl.

Overall, the main caregivers of 159 children were available to complete the interviewer administered questionnaire; among them 144 were mothers (90.6%), 13 grandmothers (8.2%), one father and one grandmother's sister (0.6%). All caregivers, except one, were women; their mean age was 32.3 years old ranging 22-66. Most participants (96.2%) were married; 3.8% were widowed. Almost one forth (25.8%) had university education (more than 13 years), 27.7% had college education (10-13 years), 39.0% high school (10 year) and 7.5% incomplete school education. Around three quarter (76.1%) of care-givers were unemployed and 23.9% employed. Table 11 provides details of characteristics of children and their households.

Table 11: Characteristics of children, households, hygiene and exposures

Child demographic characteristics	**Value**
Community % (n/N)	
Alaverdi	43.4% (69/159)
Yerevan	33.3% (53/159)
Akhtala	23.3% (37/159)
Marzes % (n/N)	
Lori (Akhtala and Alaverdi)	66.7 (106/159)
Yerevan	33.3% (53/159)
Child's gender % (n/N)	
male	52.5% (83/158)
female	47.5% (75/158)
Child's age in years	
N	159
Mean (SD)	5.3 (0.9)
Range	3.9 – 6.9
Child health status	
Blood lead level	
N	159
Geometric Mean (SD)	6.0 (1.5)
Range	1.6 – 24.0
Child nutrition % score	
N	154
Mean (SD=15.1)	50.0
Range	17.8 – 93.3
Stunting % (n/N)	
no	87.8% (129/147)
yes	12.2% (18/147)
Household characteristics	
Household living standard % score	
N	150
Mean (SD)	36.3 (14.3)
Range	0 - 72
Household size	
N	159
Mean (SD)	5.2 (1.3)
Range	2 - 10
Type of housing % (n/N)	
house*	29.6% (47/159)
flat	70.4% (112/159)
Duration of occupying the current flat/house (years)	
N	159
Mean (SD)	8.8 (8.3)
Range	0.15 – 40

Living on the first-floor or higher-floors	
first floor	47.8% (76/159)
higher floors	52.2% (82/159)
Windows % (n/N)	
Euro windows	23.9% (38/159)
Partial Euro windows or older	76.1 (121/159)
Mean duration of opening the window in a usual hot day in summer	
N	159
Mean (SD)	16.9 (7.1)
Range	0.5 – 24
Having carpet on the floor % (n/N)	
always	54.1% (86/159)
seasonal	33.3% (53/159)
never	12.6% (20/159)
Number of current smokers in the family	
N	158
Mean (SD)	1.1 (0.7)
Range	0 - 4
Smoking in the presence of child % (n/N)	
no	30.8% (41/133)
yes	69.2% (92/133)
Having family member working in a mine, processing factory, or smelter % (n/N)	
no	74.1% (117/158)
yes	25.9% (41/158)
Number of family members working in a mine, processing factory, or smelter	
N	158
Mean (SD)	0.3 (0.5)
Range	0 – 2
Total knowledge % score of the main care-giver	
N	152
Mean (SD)	52.3 (18.6)
Range	7 - 86
Household and child hygiene	
Child washes his/her hands after coming back home from outside % (n/N)	
always	84.7% (133/157)
not always	15.3% (24/157)
Child washes his/her hands before eating % (n/N)	
always	63.7% (100/157)
not always	36.3% (57/157)
Child bites nails % (n/N)	
no	82.9% (131/158)
yes	17.1% (27/158)

Child's protective hygiene score		
	N	156
	Mean (SD)	1.7 (0.7)
	Range	0 - 3
Parents changing working clothes and shoes before coming home from a mine, processing factory, or smelter % (n/N)		
	always	78.0% (32/41)
	sometimes	2.4% (1/41)
	never	19.5% (8/41)
Household protective hygiene % score		
	N	115
	Mean (SD)	70.4 (13.5)
	Range	33.3 – 91.7
Dusting the furniture % (n/N)		
	Every day	92.4% (146/158)
	Less often	7.6% (12/158)
Child exposure in the yard		
Yard composition % (n/N)		
	non-soil (asphalt, cement)	40.1% (63/157)
	partially or totally soil	59.8% (94/157)
Child soil exposure in yards, play grounds or gardens in warm seasons % (n/N)		
	no	25.0% (39/156)
	yes	75.0% (117/156)
Daily time (in hours) spent in yards, play grounds or gardens where the child was exposed to soil in warm seasons		
	N	156
	Mean (SD)	3.3 (2.8)
	Range	0 - 14

* House is defined as a stand-alone building that consists of one or two floors. A total of 12 out of 47 houses had two floors. Flats are apartments in multi-storey buildings. When calculating the variable of *living on the first floor or higher floor* the houses with second storey were included in the category of *first floor*.

Community Trainings

Training Materials and Survey Instruments

The AUA SPH team have conducted thorough literature review on heavy metals that pollute particularly the residential soil of Akhtala Community and developed a training manual for conducing trainings with community members in Akhtala in English. The team translated the training manual into Armenian. The team started adapting the training manual to the needs of

each training group: mothers, teachers of schools and kindergartens, workers of the Mayor's office, NGOs and active community members, healthcare providers and high school children.

The team has prepared presentations for the community trainings in Akhtala for the groups of parents, teachers, mayor's office/NGO/community members, healthcare providers, and high school students. The team first prepared the presentations in English then translated them into Armenian. The team has also developed and designed brochures on lead and arsenic in Armenian, based on a comprehensive literature review. The brochures cover brief information on hazardous effects of those heavy metals on the health of adults and children and how to prevent lead/arsenic and other heavy metal poisoning. The team adapted the information to the local needs/context and pre-tested them with mothers of young children to make sure the provided information was in a language that was clear and understandable for the local community members. The team made changes based on feedback from the pre-test and finalized the brochures.

The AUA SPH team conducted the trainings during the period December 2013 to July 2014. The trainings with the members of the general population (specifically parents of the children in the community) were conducted the first. Then the AUA SPH team contacted kindergarten and school principals, health providers and municipality workers in an effort to organize the trainings for different stakeholder groups. Despite the challenges the AUA SPH team organized about ten training sessions with 78 adult participants. Among the participants were 19 people from kindergarten and school teaching staffs, five health professionals working in school community, and five staff members of the mayor's office. During the discussions with the teachers and NGO representatives, we learned that high school students in Akhtala have been showing growing interest in environmental issues, specifically those related to the tailing pond. For this reason two additional training sessions were organized for 44 high school students. The content of the training materials were adapted for high school students.
During the Pilot Project 122 members of Akhtala community participated in the trainings.

Community Trainings and Evaluation

The first step, before starting the community trainings, was development of an application for the Institutional Review Board (ethical approval), as it was planned to evaluate the results of community trainings through baseline and follow-up surveys. The research team developed a questionnaire to assess the effectiveness of the community trainings; the team pre-tested it and finalized based on feedback from participants of the pre-test. Each training session began by providing participants with self-administered questionnaires for baseline knowledge assessment; the trainings were concluded with a follow-up self-administered questionnaire to evaluate the effectiveness of the trainings.

The AUA SPH Team has contacted the Akhtala mayor's office, the principals of two schools and three kindergartens, the World Vision Alaverdi Area Development Program (ADP) office, and the Armenian Young Women's Association NGO to effectively organize the community trainings. The AUA SPH team organized some of the trainings in the conference hall of the Akhtala mayor's office; other training sessions took place in the schools and the healthcare facility in Akhtala.

For conducting the evaluation of the training sessions in Akhtala, the research team developed an SPPS database. A trained researcher received an additional training on database and data entry and entered the baseline and follow-up survey results into the database. After the date entry was over, the research team cleaned the database. The database cleaning included the following steps:

1. All single cases of respondents entered into SPSS database were reviewed in comparison with the written questionnaires and corrections were made where needed.
2. Running frequency tests and looking at the ranges (min, max) for each variable. Errors were corrected in the database.

Data from 78 adult participants were used for evaluating the effectiveness of the community trainings. Data from high school student trainings were not included in this evaluation.

Parents and grandparents made up 57.1% of the sample population followed by school and kindergarten teachers - 28.6%; 7.8% of the participants were from the municipality, NGOs, or active groups and 6.5% were health providers. The majority of participants (87.2%) were women and the average age for the participants was 37.3 years old. The married participants made up 69.7% of the sample followed by single participants with 17.1%. Only 9.2% of the participants were widowed and 3.9% indicated a divorced status. Majority of the sample population came from an educated background with 32.0% having received higher (14 years and more) education and 24% from middle to professional (10-13 years) educational background. Moreover, 37.3% reported that they had received 10 years of schooling and only 6.7% had less than 10 years of education. Approximately 48.7% of the sample population indicated that they were employed at the time of the survey (for further details, see Table 12).

The average family size was 4.6 members. The smallest family was composed of only 1 member and the largest family had 8 members. The average number of family members less than 18 years of age was 1.8. Only 67 participants informed the research team that they had minors living in their family. The largest portion of participants (69.7%) came from an average socioeconomic background and 13.2% indicated less than the average status. Much less than the average and higher than the average category each included only 7.9% of the sample; 1.3% belonged to the much higher than the average category (Table 12).

Majority of the participants (51.9%) indicated that their monthly family spending was between 50,000AMD and 100,000AMD. About 22.1% reported that their family spent less than 50,000AMD and 20.8% between 101,000AMD and 200,000AMD per month. Very small percentage of families had higher monthly spending - 2.6% of the sample reported spending between 201,000AMD and 300,000AMD and another 2.6% spending above 300,000AMD. Approximately 53.2% had family members that worked in either the mine, the mining factory, or the smelter in Alaverdi. On average 1.2 members per family worked in mining related job sites. More than two thirds of the participants (80.8%) indicated that they did not participate in the Blood Lead Level (BLL) trainings; only 13.7% were involved and approximately 5.5% did not know if they participated in the training (Table 12).

Table 12. Characteristics of training participants

Characteristics	Value
Gender % (n/N)	
Male	87.2% (10/78)
Female	12.8% (68/78)
Age (N=70)	
Mean (SD)	37.3 (11.3)
Range	21.0 – 62.0
Marital Status% (n/N)	
Single	17.1% (13/76)
Married	69.7% (53/76)
Divorced	3.9% (3/76)
Widowed	9.2% (7/76)
Education % (n/N)	
Less than 10 years	6.7% (5/75)
School (10 years)	37.3% (28/75)
Middle-professional (10-13 years)	24.0% (18/75)
Higher (14 years and more)	32.0% (24/75)
Employment Status % (n/N)	
Yes	48.7% (37/76)
No	51.3% (39/76)
Groups Participating in the training % (n/N)	
Main Caregiver (parent and grandmother)	57.1% (44/77)
Worker of School or KG	28.6% (22/77)
Worker of Municipality, NGO, active groups	7.8% (6/77)
Health provider	6.5% (5/77)
Perceived socio-economic status % (n/N)	
Much less than the average	7.9% (6/76)
A little bit less than the average	13.2% (10/76)
Average	69.7% (53/76)
A little bit higher than the average	7.9% (6/76)
Much higher than the average	1.3% (1/76)
Family size (N=76)	
Mean (SD)	4.6 (1.5)
Range	1 - 8
Family members less than 18 years of age (N=67)	
Mean (SD)	1.8 (1.3)
Range	0 - 6
Monthly spending of the family % (n/N)	
Less than 50,000AMD	22.1% (17/77)
50,001-100,000AMD	51.9% (40/77)
100,001-200,000AMD	20.8% (16/77)
200,001-300,000AMD	2.6% (2/77)

More than 300,000AMD	2.6% (2/77)
Family members working in the mine, mining factory or copper smelter % (n/N)	
Yes	53.2% (41/77)
No	46.8% (36/77)
Number of family members working in the mine, mining factory or smelter (N=37)	
Mean (SD)	1.2 (0.5)
Range	1 - 3

The data analyst recoded all the knowledge variables by assigning 1 to correct answers and 0 to wrong or don't know answers. Then, the knowledge % score was calculated by adding all the correct answers, multiplying by 100 and dividing by 40 (the maximum possible knowledge score). The paired t-test was used to compare the baseline and follow-up knowledge scores. The assumption of normal distribution of data for paired t-test was checked by looking at measures of central tendency, QQ-Plot as well as the results of Shapiro-Wilk test. The paired t-test identified that there was a statistically significant difference between the baseline knowledge % score of 59.6 and follow-up score of 83.0 (39.3% improvement) (Table 13).

Table 13. Comparison of baseline and follow-up knowledge scores

Mean knowledge % score	**Baseline N=38**	**Follow-up N=38**	**p-value**
Mean (SD)	59.6 (14.0)	83.0 (11.1)	0.000
Range	25.0 – 87.5	55.0 – 97.5	
CI	55.8, 63.4	80.1, 86.0	

The research team also carefully examined the effect of BLL training on the mean knowledge % score. The participants of the BLL counseling were the main caregivers of children who were tested for their blood lead level and they received leaflets and counseling. The results indicate that those who had received BLL counseling had a 22.8% higher baseline mean knowledge % score than those who did not receive BLL training ($p<0.05$) (Table 14). However, independent of the baseline knowledge they all improved their follow-up knowledge level, and both groups reached the maximum level of 84 and 83 (Table 14).

Table 14. The influence of BLL training on baseline mean knowledge % score

	BLL Training: mean knowledge % Score (N)	No BLL Training: mean % knowledge Score (N)	% change of mean knowledge % score	p-value
Baseline	70 (7)	57 (44)	22.8%	p<0.05*
Follow-up	84 (9)	83 (43)	1.2%	P=0.643*

*Independent Samples t-test

Local Action Plan

Communication with the National and Local Government Authorities

The research team wrote official letters to the Mayor of Akhtala and Governor of Lori (the marz/province where Akhtala is located) and arranged meetings with them before starting the fieldwork in the community particularly before the assessment of blood lead levels among children 4-6 years old and thorough risk assessment in Akhtala. During the initial meetings the team informed about the thorough risk assessment and the testing of BLL among children 4-6 years old and the community educational component. The team also wrote letters to the Ministry of Health and had meetings with experts from the Ministry of Health to get ready for the assessments.

In addition, the team sent an official letter to the Minister of Culture of the Republic of Armenia to clarify why the Akhtala Monastery, that is surrounded by old tailing ponds, was not included in the UNESCO World Heritage List and received an answer clarifying the process for including historical buildings in this list and stating that Akhtala Monastery was never included in the list.

The AUA SPH team provided introductory letters about the results of the Thorough Risk Assessment and Blood Lead Level assessment among children to the Ministries of Health, Nature Protection and Emergency Situations, and the Prime Minister's office of the Republic of Armenia. Tables with detailed reporting of the study findings have been attached to the letters provided to each of the ministries. The AUA SPH team has also prepared and send to the Lori Governor the results of the Thorough Risk Assessment conducted in mining communities in Lori region and Blood Lead Level assessment among children in Akhtala and Alaverdi.

Assessment of Local Needs and Capacity

- The research team conducted assessment of Local Needs and Capacity to be able to develop a Local Action Plan for Akhtala community. For this purpose the research team developed a guide for in-depth interviews and focus group discussions. It included questions regarding priority problems and needs identified by the community, as well as about existing local capacities and external resources that could be used for solving environmental and public health problems. This guide was used to conduct Focus Group Discussions (FGD) with willing participants, as well as six in-depth interviews with active community members. In addition to the in-depth interviews, the team conducted two focus group discussions with 10 participants and five in-depth interviews. During these meetings the AUA SPH team has also shared the findings from the thorough risk assessment and BLL testing with different stakeholders.

The analysis of the FGDs and In Depth Interviews revealed several issues that are important for the community members. The summary findings are presented below:

1. **There are a few international organizations and local NGOs working in the community that focus on environmental and health issues:**
    - World Vision Armenia
    - Counterpart International (project ended in March 2014)
    - Armenian "AARHUS" centre (Alaverdi office)
    - "Center for Community Mobilization and Support" NGO (CCMS).
    - Young Women's Association NGO
    - SOS Cultural Centre (environmental/cultural education program which ended recently)

2. **There are very limited community resources:**
    - Both financial and technical resources were considered to be very limited in Akhtala.

3. **Previously conducted environmental activities:**

- Part of the old tailing pond had been covered with clean soil and trees were planted.

4. **Potential for changes in the community:**
    - Some residents of Akhtala have started to raise environmental issues
    - Active young students are trying to get the tailing pond fenced properly

5. **Participants highlighted the following problems of the community:**
    - Absence of necessary resources to conduct environmental and health monitoring, which could help them to take measures to decrease public health risks. Moreover, the Government has substantially reduced the community budget for 2015.
    - Environmental fees paid by the mining factory are very low
    - Low salaries of community members working in the factory. The community members are scared to raise their concerns not to lose their jobs.
    - Cooperation between the mine and community does not address environmental and health issues
    - Absence of Health Insurance for mine employees
    - Absence of civic society; residents are not ready to raise their voice about the problems the community is facing.
    - Inappropriate fencing of the tailing pond
    - Continuous pollution of the river and irrigation water with waste water and tailings being dumped to the river
    - Absence of strict rules and fines for trucks which carry an open cargo of overburden and toxic waste through the main community roads (especially during the weekends).

Based on the results of a thorough risk assessment, local needs/capacity assessment and consultations with an international environmental expert, the following actions are recommended for the Akhtala community:

- Write a proposal for a clean-up project for the Akhtala church yard. Conduct a thorough assessment for remediation in the church yard to obtain a clear and comprehensive picture of the shape, depth, and expansion of the pollution in the church yard. Use the

results of this assessment to design a clean-up project with technical support from engineers.

- Use the results of the Thorough Risk Assessment and Blood Lead Level Assessments in Akhtala to increase the amount the community receives from environmental fees paid by the mining companies.
- Cover with grass the bare soil areas and cover with asphalt the roads in Akhtala to reduce the level of dust that contains heavy metals.
- Set stricter rules within the community concerning the handling of toxic waste and management of mining activities. In case of noncompliance set appropriate fines.
- Continuously work with the young active civil groups and NGOs in the community to have more public monitoring over environmental and health issues.
- Continuously organize awareness-raising campaigns and events in the community about reduction of heavy metal poisoning through proper nutrition and hygiene practices.
- Encourage the residents of Akhtala to use only heavy metal-free areas in the community as crop cultivation and animal grazing land.
- Provide healthy nutrition to school and kindergarten children in Akhtala to reduce heavy metal poisoning.
- Stop the Mining Industry from dumping wastewater into the river.
- Stop the Mining Industry to have open cargo transportation of mining ore and waste through the town by setting appropriate fines (including on the weekends) to reduce the dust level in the community contaminated with heavy metals.
- Compel the Mining Industry to remove the existing tailings from the riverbank.
- Compel the Mining Industry to properly fence-off the tailing pond.
- Compel the Mining Industry to conduct health assessments among workers, provide them with daily nutrition and assure proper hygiene.

The AUA SPH team organized a final stakeholders meeting for Akhtala community to bring 12 representatives from the Mayor's office, NGOs, active citizens, health providers and other interested parties together. During this stakeholders' meeting the AUA SPH team presented the overall findings from the work in Akhtala and the proposed local action plan that has been

developed after in-depth interviews and focus group discussions with different stakeholders with specific recommendations on further reduction of pollution in the community and prevention of heavy metal poisoning. In addition to the presentation, the AUA SPH investigators distributed the copies of the local action plan among the participants of the meeting and received the feedback from community representatives.

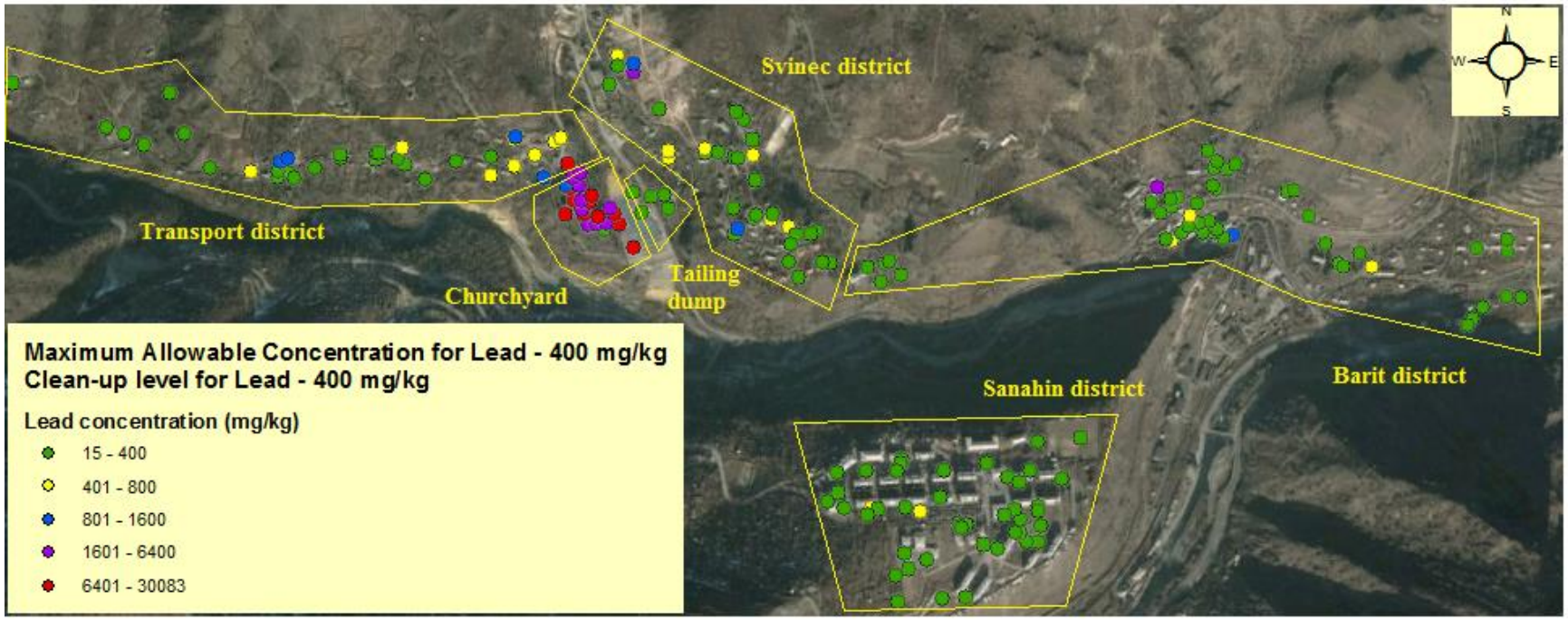
Overall, the concluding meeting with community stakeholders was the most effective and valuable meeting where the participants showed interest, enthusiasm and trust toward the project team from AUA SPH. They suggested that any future clean-up project in the church yard should consider collaboration with the Ministry of Culture and the Armenian Church (the Catholicosate of All Armenians, the Mother See of Holy Etchmiadzin) that are officially in charge of Akhtala Church and the adjacent area. In addition, they had explored the reasons for high contamination with heavy metals of the church yard and learned that according to some historical sources, in the 10th century Kurikians' royal dynasty had a fortress in this area and a smelter that was preparing copper coins[1]. Later the monastery was built in the area of this fortress. Moreover, one of the participants suggested that mining related waste has been widely used for construction purposes in the community and it could have been used also in the territory of the church yard.

The participants of the concluding stakeholder meeting suggested that the American University of Armenia could organize a symposium on the topic of environmental fees paid to affected communities where they could use the results of the studies to advocate for higher reimbursement to affected communities for environmental contamination.

[1] Center for Cultural Initiative "Var" and Institute of Archeology and Ethnography of National Academy of Science of the Republic of Armenia, *Akhtala. History and Reality,* 2010.

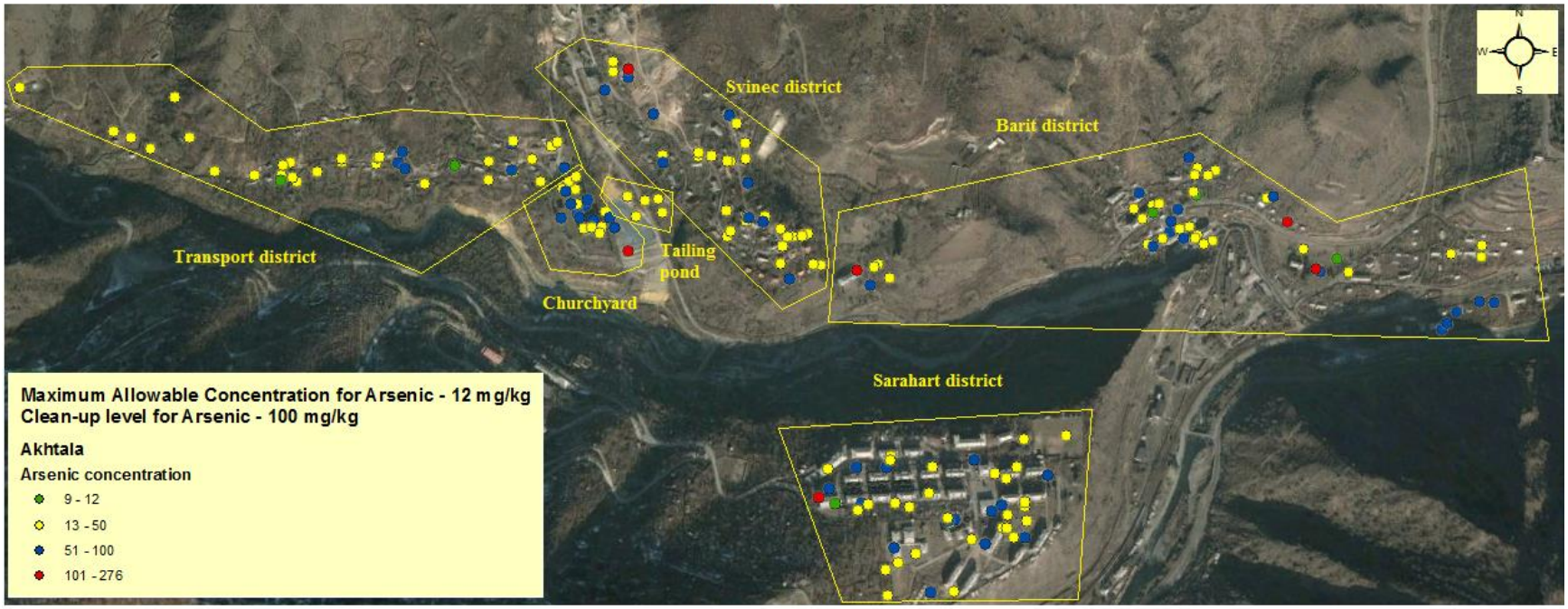
APPENDIX 1

Akhtala Community
Map of Lead Concentration



APPENDIX 2

Akhtala Community
Map of Arsenic Concentration



APPENDIX 3

Ինչպե՞ս պաշտպանել երեխային կապարի թունավորումից

- Հանքերում, ձուլարաններում, արհեստանոցներում և կապարի բարձր քանակ պարունակող այլ վայրերում աշխատող ծնողները պետք է տուն վերադառնալուց առաջ փոխեն հագուստը, կոշիկները և հնարավորության դեպքում ցնցուղ ընդունեն:

- Հատակն ու տան այլ մակերեսները շաբաթը 2-3 անգամ պետք է լվանալ ջրով և օճառով կամ լվացքի փոշով:
- Պետք է հաճախակի լվանալ երեխաների խաղալիքները
- Պետք է համոզվել, որ երեխաները դրսում խաղալուց հետո և ուտելուց առաջ լվանում են ձեռքերը:

- Պետք է դրսի կոշիկները տանը փոխել կապարով աղտոտված փոշին տուն չբերելու նպատակով:

Երեխաների առողջությունն ապահովելու միակ ճանապարհը կապարով թունավորման կանխարգելումն է:

Առողջ սնունդ

Երեխայի սննդակարգում երկաթով և կալցիումով հարուստ սննդի տեսակներ ներառելով կարող եք պաշտպանել երեխային կապարով թունավորումից:

<u>Կալցիումի համար օգտագործել՝</u>

✓ Կաթ և այլ կաթնամթերք, օրինակ պանիր ու մածուն:

<u>Երկաթի համար օգտագործել՝</u>

✓ Մաքուր վայրերում աճեցված մուգ կանաչ տերևներով բանջարեղեններ (բանջար, կանաչի և այլն)՝ սպանախից բացի
✓ Լոբի, սիսեռ, ոլոռ և նմանատիպ այլ ընդեղեն
✓ Նշեղեն և սերմեր (պոպոք, պնդուկ, նուշ, դդմի սերմեր, գետնանուշ, արևածաղիկ)
✓ Չորացրած մրգեր, օրինակ՝ ծիրանի չիր
✓ Կարմիր միս (ներքին օրգաններից՝ լյարդ)
✓ Ձուկ
✓ Սև շոկոլադ և կակաո

Վերոնշյալ սնունդը վիտամին C պարունակող մթերքների հետ միաժամանակ օգտագործելը (նարինջ, ելակ, քաղցր պղպեղ, մաղադանոս, ծաղկակաղամբ, և այլն) հեշտացնում է դրանց ներծծման արդյունավետությունը:

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ԱՌՈՂՋ ՄԻՋԱՎԱՅՐ ԱՌՈՂՋ ԸՆՏԱՆԻՔ ԱՌՈՂՋ ԵՐԵԽԱ

ԿԱՊԱՐ

Ինչպե՞ս պաշտպանել ձեզ և ձեր երեխային

Ի՞նչ է կապարը

Կապարը բնության մեջ հանդիպող ծանր մետաղ է, որը կուլ տալու կամ շնչելու միջոցով անցնում է օրգանիզմ և վնասում մարդու առողջությանը: Այն հատկապես վնասակար է մինչև վեց տարեկան երեխաների համար, քանի որ նրանք շարունակ բերանն են տանում իրենց ձեռքերը և այլ իրեր: Բացի դրանից կապարը հեշտ է ներծծվում և պահեստավորվում երեխայի աճող օրգանիզմում:

Որտե՞ղ է հանդիպում կապարը

Կապարի բարձր կոնցենտրացիաներ կան այնպիսի վայրերում, որտեղ իրականացվում են հանքարդյունաբերական կամ ձուլման աշխատանքներ: Կապարի քանակությունը բարձր է նաև ռադիատորների և մարտկոցների (ակումլյատորների) վերանորոգման արհեստանոցներում: Նաև այնպիսի վայրերում, որտեղ աշխատանքի ընթացքում շփվում են արճիճի հետ:

Ինչպե՞ս կարող է կապարը հայտնվել ձեր օրգանիզմում

Կապարը կարող է մտնել երեխայի օրգանիզմ ուտելու, խմելու և շնչելու միջոցով:

Քանի որ երեխաները հաճախ բերանն են տանում ձեռքերը և այլ իրեր, նրանք կարող են կուլ տալ կապարով աղտոտված հողը կամ փոշին:

Օրգանիզմ անցնելուց հետո կապարը արյան միջոցով տարածվում և պահեստավորվում է ոսկորներում: Ինչքան երկարատև լինի կապարի ազդեցությունը օրգանիզմի վրա, այնքան դրա քանակությունը բարձր կլինի ատամներում և ոսկորներում:

Կապարը կարող է օրգանիզմ մտնել հետևյալ ուղիներով՝

Փոշի և հող

✓ Հանքարդյունաբերության, շինարարական և արդյունաբերական աշխատանքների արդյունքում առաջացած փոշին կարող է աղտոտել բակերն ու խաղահրապարակները, որտեղ խաղում են երեխաները: Ավելին, փոշին կարող է նստել նաև տնային պարագաների վրա և երեխաների օրգանիզմ մտնել ուտելու կամ խաղալու ընթացքում սպասքի կամ խաղալիքների միջոցով:

✓Կապարով աղտոտված փոշին կարող է շնչելու միջոցով մտնել օրգանիզմ:

✓Կապարի բարձր քանակություն պարունակող վայրերում աշխատող ծնողները կարող են կապարով աղտոտված փոշին իրենց աշխատանքային հագուստի և կոշիկների միջոցով բերել տուն:

Սնունդ և ջուր

✓ Աղտոտված տարածքներում աճեցված, ոչ մաքուր վայրերում պատրաստված սնունդը կարող է աղտոտված լինել կապարով:

✓Ոռոգման համար օգտագործվող ջուրը կարող է աղտոտված լինել կապարով՝ հանքարդյունաբերական և ձուլման թափոնները գետերը լցնելու հետևանքով:

Ինչպե՞ս է կապարն ազդում Ձեր երեխայի առողջության վրա

Կապարը կարող է ազդել տարբեր օրգանների, հատկապես կենտրոնական նյարդային համակարգի վրա, առաջացնելով՝

- Վարքագծային փոփոխություններ, սովորելու և կենտրոնանալու հետ կապված խնդիրներ, զարգացման դանդաղեցում, գերակտիվություն, լսողության կորուստ և այլն: Մեծ դոզայով թունավորումը կարող է հանգեցնել կոմայի և ցնցումների:
- Անեմիա (սակավարյունություն). սա ավելի ծանր է դրսևորվում երեխաների մոտ, քանի որ նրանք ավելի հաճախ են ունենում երկաթի պակաս, որն էլ իր հերթին մեծացնում է կապարով թունավորման հետևանքները:
- Կարող է առաջացնել նաև լյարդի և երիկամների հիվանդություններ:

Արյան մեջ անգամ փոքր քանակի կապարը կարող է բացասաբար ազդել երեխաների մտավոր ունակությունների և ընդհանուր ուսումնական առաջադիմության վրա:

APPENDIX 4

2. Խմելու և լվացվելու համար օգտագործե՛ք մաքուր ջուր :

- Օճառով լվացե՛ք ձեռքերը ուտելուց առաջ և այգում գործ անելուց հետո:
- Հետևե՛ք, որ Ձեր երեխաները օճառով լվացվեն դրսում խաղալուց հետո և ուտելուց առաջ:

3. Լավ լվացե՛ք բոլոր մրգերն ու բանջարեղենները մինչև ուտելը:

- Եթե ձեր այգին գտնվում է փողոցի մոտ, ապա ուտելուց առաջ հեռացրե՛ք բանջարեղենների և մրգերի արտաքին տերևներն ու թերթիկները և լավ լվացե՛ք 1%-ոց քացախաջրով:
- Պահե՛ք սնունդը փակ դարակներում:

Արգելե՛ք Ձեր երեխաներին խաղալ արդյունաբերական թափոնների կույտերի հետ. դրանք կարող են պարունակել մեծ քանակությամբ մկնդեղ և այլ ծանր մետաղներ:

Առողջ սնունդ

Նշված սննդամթերքի կիրառումը կօգնի նվազեցնել մկնդեղի վնասակար ազդեցությունները և կպաշտպանի ձեր և ձեր երեխայի առողջությունը:

- ✓ Սխտոր, սոխ
- ✓ Ձու
- ✓ Բանջարեղեն՝ կաղամբ, ծաղկակաղամբ, գազար, լոլիկ, քաղցր բիբար
- ✓ Լոբի, ոլոռ, եգիպտացորեն, ոսպ
- ✓ Նշեղեն և սերմեր (պոպոք, պնդուկ, նուշ, դդմի սերմեր, գետնանուշ, արևածաղիկ)
- ✓ Մրգեր՝ նարինջ, ելակ, ազնվամորի
- ✓ Խոտաբույսերով թեյ

Այս քայլերը կօգնեն Ձեզ պաշտպանվել թե՛ մկնդեղի, թե՛ այլ ծանր մետաղների (օրինակ կապար, կադմիում) վնասակար ազդեցությունից :

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ՄԿՆԴԵՂ

Ինչպես պաշտպանել ձեզ և ձեր երեխային

Ի՞նչ է մկնդեղը

Մկնդեղը (արսեն) ծանր մետաղ է, որը բնական ձևով կարող է հանդիպել միջավայրում: Սակայն արդյունաբերական գործունեության հետևանքով (օր. հանքարդյունաբերություն և ձուլում) այն կարող է մեծ քանակությամբ արտանետվել շրջակա միջավայր:

Ինչպիսի՞ ազդեցություն ունի մկնդեղը Ձեր առողջության վրա:

Եթե մկնդեղը մտնի Ձեր օրգանիզմ, այն կարող է վնասել Ձեր առողջությանը՝ ազդելով բոլոր օրգան-համակարգերի վրա:

Հայտնի է, որ մկնդեղը մարդկանց օրգանիզմում առաջացնում է քաղցկեղ:

Ապացուցված է, որ

✓ Մկնդեղը կարող է առաջացնել թոքերի, մաշկի, միզապարկի, կրծքագեղձի, երիկամների, լյարդի և շագանակագեղձի քաղցկեղ:
✓ Մկնդեղը կարող է առաջացնել սրտի, արյունատար, մարսողական, շնչառական համակարգերի հիվանդություններ:
✓Կարող է վնասել պտղին՝ դեռևս մոր արգանդում և առաջացնել, վիժում, վաղաժամ ծնունդ կամ բնածին արատ:
✓ Կարճ ժամանակահատվածում մեծ քանակությամբ մկնդեղ օրգանիզմ անցնելու դեպքում կարող է առաջանալ սուր թունավորում, որն ուղեկցվում է գլխապտույտով, թմրածությամբ, գլխացավով, սրտխառնոցով և մազաթափությամբ:

Ինչպե՞ս կարող է մկնդեղը հայտնվել Ձեր օրգանիզմում

Մկնդեղը հիմնականում անցնում է օրգանիզմ ուտելու, խմելու, շնչելու և մաշկի միջոցով:

Մկնդեղը կարող է անցնել ձեր օրգանիզմ հետևյալ ուղիներով.

Փոշի և հող

✓ Դրսի փոշին ու հողը, որոնք արդյունաբերական աշխատանքների հետևանքով պարունակում են մեծ քանակությամբ մկնդեղ կարող են ներթափանցել տուն, նստել սպասքեղենի, երեխաների խաղալիքների, սննդի և այլ պարագաների վրա, որտեղից էլ անցնել օրգանիզմ՝ աղտոտված տան օդը շնչելու և աղտոտված իրերը բերանը դնելու և ուտելու միջոցով:
✓ Երեխաները, դրսում խաղալով աղտոտված հողի և ավազի հետ, կարող են կուլ տալ և շնչել մեծ քանակությամբ մկնդեղ պարունակող հող և փոշի:

Սնունդ

✓ Չլվացված կամ վատ լվացված մրգերն ու բանջարեղենը կարող են աղտոտված լինել մկնդեղ պարունակող փոշով և հողով:

Ինչպե՞ս պաշտպանվել մկնդեղից:

1. Աշխատե՛ք հնարավորինս մաքուր պահել Ձեր բնակարանը:

- Շաբաթական առնվազն 2-3 անգամ թաց շորով և մաքուր օճառաջրով մաքրե՛ք Ձեր բնակարանի հատակը:
- Աշխատե՛ք ոչ թե ավլել բնակարանը, այլ մաքրել թաց շորով՝ օդում փոշու քանակությունը հնարավորինս քչացնելու նպատակով: Հնարավորության դեպքում օգտագործե՛ք փոշեծծիչ (пылесос):

- Տան մուտքի առջև միշտ ունեցե՛ք թաց շոր՝ կոշիկները հողից և փոշուց մաքրելու համար:
- Հնարավորինս հաճախ օճառով լվացե՛ք պատուհանի գոգերը, լուսամուտների փեղկերն ու ապակիները:
- Ամեն օր խոնավ շորով սրբե՛ք տան փոշին, լվացեք և մաքրեք երեխաների խաղալիքները:
- Դրսում փոշի բարձրանալու դեպքում փակե՛ք տան դռներն ու պատուհանները:
- Ամեն օր մաքրե՛ք Ձեր և Ձեր երեխաների դրսի կոշիկները և տանը դրսի կոշիկներով մի՛ շրջեք: