



AMERICAN UNIVERSITY OF ARMENIA

Center for  
Responsible Mining



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In 2013, the American University of Armenia School of Public Health (1) conducted a study to determine if there was an association between exposure to heavy metals and sulfur dioxide pollution and reproductive health problems in women. The SPH team chose Alaverdi as the site to conduct the study because of the copper smelter in that town. The researchers were interested in reproductive health problems such as infertility, miscarriages, induced abortions due to medical issues, stillbirths, prenatal mortality and birth defects. According to the Centers for Disease Control and Prevention (CDC) of the United States of America many factors can alter the reproductive health of a woman and her ability to give birth to a healthy child. One such factor is exposure to sulfur dioxide, which can lead to fetal death, preterm birth, miscarriage and stillbirth. Exposure to heavy metals, such as arsenic, lead, cadmium, can also affect female reproductive functions leading to reproductive problems.

Metal processing plants and smelters are facilities that extract various metals from ore to create more refined metal products. Smelting specifically involves heating the ore with a reducing agent such as coke, charcoal or other purifying agents. Metals may be released as fine particles or volatile compounds, either via a chimney or as “fugitive” emissions from general operations. Humans typically become exposed to smelter contaminants through inhalation and ingestion. Inhalation of pollutants occurs as a consequence of gaseous emissions and fine particulate matter such as dust. Layers of dust can also settle onto nearby agricultural fields, causing crop intake of pollutants that are later consumed by people.

Armenia is a country with significant reserves of polymetallic ores. Armenia’s largest smelter is located in Alaverdi, with a population of approximately 16,500 people. The smelter operated in low capacity from 1990 to 2000, producing only 535 tons of copper in 1999 and in its full capacity since 2001, producing 4955 tons of copper in that year. The emissions released into the air from the stack of the smelter contain sulfur dioxide, with a concentration 10.4 times higher than the maximum allowable concentration (MAC).

In 2001 a study was conducted by Petrosyan et al (2) to analyze heavy metal pollution in residential soil and dust in Alaverdi. The study revealed that the lead levels in 44% of yard soil and 77% of exterior loose dust samples exceeded the United States Environmental Protection Agency standard of 400mg/kg. The levels of arsenic in 50% of yard soil and 70% of loose dust samples exceeded the remediation level of 80 mg/kg.

The SPH reproductive health study involved 370 participants from Alaverdi and 370 from Artik, the town that was picked for comparative purposes. The target population of the survey included adult women of reproductive age, 18 to 49 years of age, living near the smelter in Alaverdi. The same target population in terms of gender and age was surveyed from Artik, a town in the Shirak region that was chosen as the comparison town because of the fact that there are no metal mining or smelting activities there. Another factor in picking Artik as the comparison town was that Lori and Shirak regions were found to be similar in several aspects such as basic sources of livelihood, level of education and age and gender distribution of the population. The data for the study was gathered through a self-administered questionnaire, which was developed based on the Reproductive Health Survey Instrument of the United States Institute for Health Metrics and Evaluation.

The School of Public Health study found significant differences in the reproductive health of women living in Alaverdi, the smelter town, and Artik, the comparison town. The research team eventually found that the odds of having a stillbirth was 2.38 times higher, the odds of having an induced abortion due to medical indications 2.67 times higher, and the odds of having early prenatal mortality 2.67 times higher for women living in Alaverdi compared with women living in Artik. From the data collected and analyzed, it is reasonable to suggest that the differences in the reproductive health of women from Alaverdi and Artik could be associated with women in Alaverdi being exposed to heavy metals and sulfur dioxide pollution being emitted by the copper smelter.

[*Aelita Sargsyan, Reproductive Health Problems among Women of Childbearing Age in Alaverdi (Lori marz) and Artik (Shirak marz) Cities: a Cross-sectional Survey, School of Public Health, American University of Armenia, Yerevan, 2013 - at: [http://auachs.com/UserFiles/File/Aelita%20Sargsyan\\_2013.pdf](http://auachs.com/UserFiles/File/Aelita%20Sargsyan_2013.pdf)*]

[Petrosyan, V., Orlova, A., Dunlap, C. E., Babayan, E., Farfel, M., & Von Braun, M. (2004). Lead in residential soil and dust in a mining and smelting district in northern Armenia: a pilot study. *Environmental research*, 94(3), 297–308. doi:10.1016/S0013-9351(03)00113-0]