# ETHIOPIA

# A. Regulation on sources

| Source of lead | Relevant legislation/regulation | Government agencies | Data source |
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| 1. Used lead-acid battery recycling | 1. As of 2019, the Ethiopian Environment, Forestry and Climate Change Commission (EFCCC) along with the GIZ was working on a 'road map' detailing short, mid and long-term plans in recycling ULABs.<br>2. The detailed implementation of the road map will be developed under three pillars, which are an economic incentive for used lead-acid battery handlers, as well as capacity development for the private sector and the public sector. | a. Environment, Forestry and Climate Change Commission | 1. Wilson, Brian. 2019. “Improving Battery Recycling in Ethiopia- ILA Blog.”<br>2. Mengesaha, Selamawit. 2002. “Commission Writes Strategy to Recycle Car Batteries.” |
| 3. Standards for lead in food | 1. The Ministry of Agriculture and Livestock Resources is responsible for establishing maximum residue limits (MRLs) and conducting pesticide residue analysis on primary agricultural products.<br>2. Applicable MRLs as well as limits for other contaminants including lead are listed in the individual product standards.<br>3. Detailed documents on particular standards currently not publicly available, can be accessed after putting in a special request with the Ethiopian Standards Agency. In the absence of a particular national standard, the Ethiopian Government is likely to defer to the Codex recommendations of the FAO/WHO. | a. Ministry of Agriculture and Livestock Resources | 1. USDA FAS. 2020. Food and Agricultural Import Regulations and Standards Country Report. |
| 4. Standards for lead in cookware | 1. No specific set of regulations around cookware found so far | | |

| Source of lead | Relevant legislation/regulation | Government agencies | Data source |
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| 5. Standards for occupational exposure | 1. According to the 2015 report on safety practices and awareness of lead acid battery recyclers in Addis Ababa by the Lead Recycling Africa Project (Oeko-Institut, PAN-Ethiopia, CREPD-Cameroon, CJGEA-Kenya and AGENDA-Tanzania) employers are responsible to provide the necessary Personal Protective Equipment (PPEs), undertake proper supervision in workplaces and provide proper washing facilities.<br>2. The government is authorized to ensure the implementation of provisions under national legislations related to safety and health at work. | a. Ministry of Labour and Social Affairs | 1. Belay, Mehari, Atalo Belay, and Zemenu Genet. 2015. Safety Practices and Awareness of Lead Acid Battery Recyclers in Addis Ababa, Ethiopia. Pesticide Action Nexus Association, Ethiopia.<br>2. Proclamation No 377/2003 of the Federal Democratic Republic of Ethiopia |
| 6. Lead in paint | 1. 90 ppm lead limit for manufacture, import and sale of all paint | a. Environment, Forestry and Climate Change Commission | 1. UNEP. 2019. Update on the Global Status of Legal Limits on Lead in Paint September 2019. |
| 7. Waste generated from smelting or mining | 1. No specific set of regulations around waste generated from smelting or mining found so far | | |

## B. International Agreements

| Agreement | Year Ratified |
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| 1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal | 2000 (accession), 2003 |
| 2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade (Accession) | 2000 (accession) |
| 3. Stockholm Convention on Persistent Organic Pollutants | 2003 |
| 4. Common Market for Eastern and Southern Africa | 1981 |

## C. Blood lead-level monitoring programs

No details of a national or regional level structured program for blood lead level testing found.

## D. Inventory of toxic sites (Toxic Sites Identification Program (TSIP), Pure Earth)

No sites identified yet

## E. Scientific papers on lead exposure (Please contact info@gahp.net for information on studies not in the public domain)

| Topic | Authors | Year | Title | Abstract/ description |
|---|---|---|---|---|
| Childhood exposure | Eticha, Tadele, Melat Afrasa, Getu Kahsay, and Hailekiros Gebretsadik | 2018 | Infant Exposure to Metals through Consumption of Formula Feeding in Mekelle, Ethiopia | **Background:** This study aimed at determination of heavy metals (cadmium, lead, and zinc) in milk-based infant formulas collected from Mekelle, Ethiopia, and their associated health risks to the infants through consumption of these products. **Methods:** The infant feeding samples were dry-ashed in a muffle furnace followed by digestion in nitric acid and the resulting solutions were analyzed by flame atomic absorption spectrophotometer. **Results:** Cadmium was not detected in the samples while the levels of lead and zinc ranged from not detected value to 0.103 mg/kg and from 27.888 to 71.553 mg/kg, respectively. The estimated daily intake values and the health risk indices of both metals were below their respective safety limits and the threshold of 1, respectively. These findings show low infant health risk of these metals through consumption of these products. Nevertheless, regular monitoring of infant formula for toxic metals is required since infants are potentially more susceptible to metals. |
| Environmental exposure | Dawit Debebe; Fiseha Behulu; | 2020 | Predicting children's blood lead levels from exposure to school drinking water in | **Background:** Human beings could be exposed to impacts associated with heavy metals such as lead (Pb) through drinking water. The objective of this study was to evaluate quality of water consumed by kindergarten school children in Addis Ababa city, who are highly susceptible to issues related to heavy metals in water. |

| Topic | Authors | Year | Title | Abstract/ description |
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| | Zerihun Getaneh | | Addis Ababa, Ethiopia | **Methods:** Through conducting chemical analysis, using microwave plasma atomic emission spectrophotometry (MP-AES), the level of lead (Pb) was measured at 38 selected schools in the city. Drinking water samples were taken from three water supply sub-systems: Akaki, Legedadi, and Gefersa. Results revealed the average Pb concentration in the city was 62.37 µg/L which is significantly higher than the World Health Organization (WHO) recommended threshold value of 10 µg/L. The children's blood lead levels and exposure to Pb were also calculated using the integrated exposure uptake bio-kinetic (IEUBK) model as per USEPA guidelines.<br>**Results:** Estimated geometric mean blood lead levels (BLLs) for each school ranged from 4.4 to 13.2 µg/dL. On average, the model predicted that 20% of children in the city will have blood lead levels above the WHO recommended 10 µg/dL. The study can be considered as an unprecedented piece of work as it addresses critical issues and methods to mitigate problems caused by high concentration of Pb in water supply distribution infrastructure. |
| Environmental exposure | Zerihun Getaneh, Seblework Mekonen & Argaw Ambelu | 2014 | Exposure and Health Risk Assessment of Lead in Communities of Jimma Town, Southwestern Ethiopia | **Background:** Human beings could be exposed to lead arising from different environmental sources, such as air, water and soil. Tap water, air and soil samples were collected from four quadrants of Jimma town in southwestern Ethiopia.<br>**Methods**: Eighty samples from each environmental source: water, air and soil samples were collected and analyzed for lead concentration. Prediction of the blood lead level and risk characterization was made using integrated exposure uptake biokinetic model and lead risk was calculated using USEPA guideline.<br>**Result**s: Average concentration of lead in water, air and soils were 24.55 ± 10.01, 1.01 ± 0.41 µg/m3, and 220.08 ± 135.95 µg/g respectively. Uptake of lead by children is significantly higher than the adults. The total risk value was 1.41 for children and 0.37 for adults. The finding revealed that children are more at risk than adults. |

| Topic | Authors | Year | Title | Abstract/ description |
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| Occupational Exposure | Ataro, Zerihun, Abraham Geremew, and Fekadu Urgessa | 2019 | Chemical exposure in garage workers and related health risks on the biochemical levels: A comparative study in Harar town, eastern Ethiopia | **Objectives:** Occupational exposure to chemicals causes a wide range of biological effects depending on the level and duration of exposure. The current study is intended to determine the differences in biochemical levels among garage workers compared with occupationally nonexposed participants in Harar town, eastern Ethiopia.<br>**Methods**: A comparative cross-sectional study was conducted in Harar town, eastern Ethiopia. Thirty (30) garage workers were selected and compared with 30 age- and sex-matched control group of teachers and students. Demographic and occupational data were collected using a structured questionnaire by trained data collector. Biochemical levels were measured by automated clinical chemistry analyzer (Autolab 18, Boehringer-Mannheim Diagnostics, the United States). Data were analyzed using STATA Version 13.<br>**Results**: All of the included garage workers were male. A statistically significant increase were found in alanine aminotransferase (35.60 ± 7.93 vs 19.17 ± 0.91 U/L; P value = 0.0440), aspartate aminotransferase (47.23 ± 4.89 vs 27.03 ± 1.13 U/L; P value = 0.0002), total protein (85.83 ± 1.16 vs 76.40 ± 0.86 g/l; P value < 0.0001), uric acid (7.34 ± 0.29 vs 5.19 ± 0.21 mg/dl; P value < 0.0001), glucose (85.13 ± 3.92 vs 75.60 ± 2.40 mg/dl; P value = 0.0425); total cholesterol (199.40 ± 13.11 vs 140.37 ± 3.81 mg/dl; P value = 0.0001) and triglyceride (143.40 ± 5.79 vs 110.60 ± 8.98 mg/dl; P value = 0.0033) in garage workers compared with control group. On the contrary, a statistically significant decrease were found in albumin (39.37 ± 1.78 vs 46.37 ± 0.56 g/l; P value = 0.0004) and urea (21.63 ± 1.04 vs 27.60 ± 1.69 mg/dl; P value = 0.0039) among garage workers compared with the control group. |

| Topic | Authors | Year | Title | Abstract/ description |
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| Occupational Exposure | Higemengist A Gebrie, Dejene A Tessema & Argaw Ambelu | 2014 | Elevated blood lead levels among unskilled construction workers in Jimma, Ethiopia | **Background:** No study has been carried out to assess the blood lead levels of workers or the contribution of common workplace practices to lead exposure in Ethiopia. This study was carried out to assess the blood lead levels of female and male laborers in the construction sector in Jimma town, Ethiopia. **Method:** A cross-sectional study on the blood lead levels of 45 construction workers was carried out in the town of Jimma. The t-test, analysis of variance, the Kruskal-Wallis, Mann–Whitney and odds ratio tests were used to compare mean blood lead levels and to investigate the associations between specific job type, use of self-protection device, sex, service years and occurrence of non-specific symptoms with BLLs. **Results:** The mean blood lead level of the exposed group (40.03 ± 10.41 μg/dL) was found to be significantly greater than that of the unexposed group (29.81 ± 10.21 μg/dL), p = 0.05. Among the exposed group female workers were found to have higher mean blood lead level (42.04 ± 4.11 μg/dL) than their male colleagues (33.99 ± 3.28 μg/dL). Laborers who were regularly using self-protection devices were found to have significantly lower blood lead levels than those who were not using. |
| Occupational Exposure | Yalemsew Adela, Argaw Ambelu & Dejene A Tessema | 2012 | Occupational lead exposure among automotive garage workers – a case study for Jimma town, Ethiopia | **Background:** In Ethiopia, although there are numerous small-scale and medium industries which use lead-based raw materials that may pose health risks to workers, there are no workplace regulations for lead exposure. Moreover, there are no studies carried out on the blood lead levels (BLLs) of workers or on the contribution of common workplace practices to lead poisoning. **Method**: A cross-sectional study on the BLLs of 45 automotive garage workers and 40 non-garage workers was carried out in the town of Jimma, Ethiopia. In addition to BLL analysis, data on some risk factors such as smoking, and chewing 'khat' (the leaves of Catha adulis) were gathered through structured questionnaires and interviews and data analysis was performed using SPSS (version 16). The t-test was used to compare mean BLLs of study groups. The analysis of variance (ANOVA), Kruskal-Wallis, Pearson chi-square and odds ratio tests were used to investigate the associations between specific job type, smoking and/or 'khat' chewing, service years and occurrence of non-specific symptoms with BLLs. |

| Topic | Authors | Year | Title | Abstract/ description |
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| | | | | **Results:** The mean BLL of the automotive-garage workers was found to be significantly greater than that of the controls. The BLLs of all the lead-exposed individuals were found to be over 10 µg/dL, and 53% of them had BLLs ranging 12 – 20 µg/dL, with the remaining 47% having over 20 µg/dL. The BLL of the workers increased with the duration of working in an automotive garage. Individuals involved in manual car painting comprise a larger percentage (58%) of those with the highest BLLs (≥ 20 µg/dL). Lead accumulation in individuals who chew 'khat' in the work place was found to be faster than in those who are not used to chewing 'khat'. 'Khat' is an evergreen shrub native to tropical East Africa, with dark green opposite leaves which are chewed when fresh for their stimulating effects. |
| Occupational Exposure | Kemal Ahmed, Gonfa Ayana & Ephrem Engidawork | 2008 | Lead exposure study among workers in lead acid battery repair units of transport service enterprises, Addis Ababa, Ethiopia: a cross-sectional study | **Background**: Lead exposure is common in automobile battery manufacture and repair, radiator repair, secondary smelters and welding units. Urinary Aminolevulinic acid has validity as a surrogate measure of blood lead level among workers occupationally exposed to lead. This study had therefore assessed the magnitude of lead exposure in battery repair workers of three transport service enterprises.<br>**Methods**: To this effect, a cross-sectional study was carried out on lead exposure among storage battery repair workers between November 2004 and May 2005 from Anbasa, Comet and Walia transport service enterprises, Addis Ababa, Ethiopia. Subjective information from the workers was obtained by making use of structured questionnaire. Other information was obtained from walkthrough evaluation of the repair units. Aminolevulinic acid levels in urine were used as an index of the exposure. This was coupled to measurements of other relevant parameters in blood and urine collected from adult subjects working in the repair units as well as age matched control subjects that were not occupationally exposed to lead. Aminolevulinic acid was determined by spectrophotometry, while creatinine clearance, serum creatinine, urea and uric acid levels were determined using AMS Autolab analyzer.<br>**Results:**<br>Urinary aminolevulinic acid levels were found to be significantly higher in exposed group (16 µg/ml ± 2.0) compared to the non-exposed ones (7 µg/ml ± 1.0) ($p < 0.001$). Alcohol taking exposed subjects exhibited a |

| Topic | Authors | Year | Title | Abstract/ description |
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| | | | | significant increase in urinary aminolevulinic acid levels than non-alcohol taking ones ($p < 0.05$). Moreover, urinary aminolevulinic acid levels of exposed subjects increased with age ($p < 0.001$) as well as duration of employment ($p < 0.001$). Whereas serum uric acid levels of exposed subjects was significantly higher than non-exposed ones ($p < 0.05$), no statistically significant difference had been found in renal indices and other measured parameters between exposed and non-exposed subjects. From the questionnaire responses and walkthrough observations, it was also known that all the repair units did not implement effective preventive and control measures for workplace lead exposure. |

# F. Blood testing in National Health Surveys

| National Health Survey | Ethiopia Demographic and Health Survey (EDHS) | Source |
|---|---|---|
| Purpose | The EDHS 2016 provides a comprehensive overview of population, maternal, and child health issues in Ethiopia, specifically key demographic indicators (particularly fertility and under-5 and adult mortality rates), levels and trends of fertility and child mortality, contraceptive knowledge and practice, immunisation coverage, maternity care indicators, child feeding practices, nutritional status, haemoglobin testing, knowledge and attitudes about sexually transmitted diseases and HIV/AIDS, HIV testing of dried blood spot (DBS) samples, injuries and accidents, prevalence of fistula and female genital mutilation, and women's experience of violence. (A Mini Demographic and Health Survey was conducted in 2019 to provide up-to-date estimates of key indicators of maternal and child health). | Central Statistical Agency/CSA/Ethiopia and ICF. 2016. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF. |
| Sample size | The nationally representative sample for EDHS 2016 consisted of 16,650 households, 15,683 women age 15-49 years and 12,688 men age 15-59 years. | |
| Blood sample testing | Blood specimens for anaemia testing were collected from women age 15-49, men age 15-59 and children age 6-59 months in the 2016 survey | |
| Latest round | 2016, 2019 | |
| Next round | Unknown | |